Idaho High-Level Waste & Facilities Disposition

DRAFT ENVIRONMENTAL IMPACT STATEMENT

DECEMBER 1999 DOE/EIS-0287D

Cover Sheet

Responsible Agency: Lead Federal Agency: U.S. Department of Energy (DOE)
Cooperating Agency: The State of Idaho

Title: Idaho High-Level Waste and Facilities Disposition Draft Environmental Impact Statement (DOE/EIS-0287D)

Contact: For additional information on this Draft Environmental Impact Statement (EIS) and its related public hearings and meetings, write or call:

T.L. Wichmann, Document Manager
U.S. Department of Energy,
Idaho Operations Office
850 Energy Drive, MS 1108
Idaho Falls, ID 83401-1563
Attention: Idaho HLW & FD EIS
Telephone: (208) 526-0535

Ann Dold, Project Lead
State of Idaho INEEL Oversight Program
900 N. Skyline, Suite C
Idaho Falls, ID 83706
Telephone: (208) 526-2600

This Draft EIS is also available on the Internet at:
http://tis.eh.doe.gov/nepa/docs/docs.htm

For general information on the process that DOE follows in complying with the National Environmental Policy Act process, write or call:

Ms. Carol M. Borgstrom, Director, Office of NEPA Policy and Assistance, EH-42
U.S. Department of Energy
1000 Independence Avenue, S.W.
Washington, D.C. 20585
Telephone: (202) 586-4600, or leave message at (800) 472-2756

Abstract:

This Idaho High-Level Waste and Facilities Disposition Draft EIS analyzes the potential environmental consequences of managing two waste types at the Idaho National Engineering and Environmental Laboratory, namely, high-level waste in a calcine form and liquid mixed transuranic waste (historically known as sodium bearing waste and newly generated liquid waste). It also analyzes the disposition of existing and proposed high-level waste facilities after their missions have been completed. The waste processing alternatives are No Action, Continued Current Operations, Separations, Non-Separations, and Minimum INEEL Processing. The facilities disposition alternatives are No Action, Clean Closure, Performance-Based Closure, Closure to Landfill Standards, Performance-Based Closure with Class A Grout Disposal, and Performance-Based Closure with Class C Grout Disposal. The period of analysis for actions considered in this EIS is from 2000 through 2095. For residual contamination and waste disposal, DOE analyzed potential impacts over 10,000 years.

Public Comments:

In preparing this Draft EIS, DOE considered comments received by letter and voice mail, and formal statements made at public scoping meetings in Idaho Falls, Idaho, on October 16, 1997, and Boise, Idaho, on October 23, 1997.

A 60-day comment period on the Idaho High-Level Waste and Facilities Disposition Draft EIS begins with the publication of the U.S. Environmental Protection Agency Notice of Availability in the Federal Register. Public hearings to discuss and receive comments on the Draft EIS will be held at times and locations to be announced in the DOE Notice of Availability. Comments may also be submitted by mail to T.L. Wichmann at the address above or electronically at http://www.jason.com/hlwfdeis. The comments received during the comment period will be considered in the preparation of the Final EIS. Late comments will be considered to the extent practicable.

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DECEMBER 1999 DOE/EIS-0287D

SUMMARY

Department of Energy
Washington, DC 20585

December 1999

This is the Summary of the *Idaho High-Level Waste and Facilities Disposition Draft Environmental Impact Statement* (Draft EIS). The Department of Energy (DOE) has prepared this draft EIS in compliance with the National Environmental Policy Act and its implementing regulations. The State of Idaho is a Cooperating Agency in the preparation of this EIS. DOE will consider the analyses developed in this EIS before making decisions regarding:

1) Construction and operation of facilities to treat high-level waste and associated liquid mixed transuranic waste, currently managed at the Idaho National Engineering and Environmental Laboratory, in order to prepare the wastes for disposal; and

2) Disposition of associated high-level waste management facilities upon mission completion.

You are invited to comment on this Draft EIS. Copies of the Draft EIS are available in the public reading rooms and information locations identified in the Summary. Copies of the Summary and the full, four-volume Draft EIS are also available by calling 1-888-918-5100 or on the Internet at http://tis.eh.doe.gov/nepa/docs/docs.htm. A 60-day comment period on this Draft EIS begins with the publication of the U. S. Environmental Protection Agency Notice of Availability in the *Federal Register*. All comments submitted during the public comment period will be considered in preparing the Final EIS; comments submitted after the comment period closes will be considered to the extent practicable. Comments may be submitted as follows:

- Written comments may be sent to:

  Thomas L. Wichmann, Document Manager
  U. S. Department of Energy, Idaho Operations Office
  850 Energy Drive, MS 1108
  Idaho Falls, Idaho 83401-1563
  Attention: Public Comment: Idaho HLW & FD EIS

- Comments may be submitted by fax to 1-208-526-1184.
- Comments may be submitted electronically at: http://www.jason.com/hlwfdeis.
- Oral comments will be accepted only at public hearings. DOE will announce the dates, times, and locations of the hearings in the near future.

The Final EIS is expected to be completed in mid-2000. No decisions will be made until at least 30 days after publication in the *Federal Register* of the Notice of Availability of the Final EIS.

Carolyn L. Huntoon
Assistant Secretary for
Environmental Management

Responsible Agency: Lead Federal Agency: U.S. Department of Energy (DOE)
Cooperating Agency: The State of Idaho

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CONTENTS

Acronyms and Abbreviations

DOE limited the use of acronyms and abbreviations in this Summary to provide a more reader friendly document. These acronyms and abbreviations are listed below.

CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
DOE	U.S. Department of Energy
EIS	environmental impact statement
EPA	U.S. Environmental Protection Agency
HEPA	high-efficiency particulate air
HLW	high-level waste
INEEL	**Idaho National Engineering and Environmental Laboratory** (formerly known as the Idaho National Engineering Laboratory or INEL)
INTEC	**Idaho Nuclear Technology and Engineering Center** (formerly known as the Idaho Chemical Processing Plant or ICCP)
LCF	latent cancer fatality
LLW	low-level waste
MEI	maximally exposed individual
MTHM	metric tons of heavy metal
NEPA	National Environmental Policy Act
NRC	U.S. Nuclear Regulatory Commission
PSD	Prevention of Significant Deterioration
RCRA	Resource Conservation and Recovery Act
ROD	Record of Decision
SBW	sodium-bearing waste
SNF and INEL EIS	U.S. Department of Energy Programmatic Spent Nuclear Fuel Management and Idaho National Engineering Laboratory Environmental Restoration and Waste Management Programs EIS
TRU	transuranic waste
WIPP	Waste Isolation Pilot Plant

What is..

High-level Waste?

High-level waste (HLW) is the highly radioactive material resulting from reprocessing spent nuclear fuel, including liquid waste produced directly in reprocessing and any solid material derived from the liquid waste that contains fission products in sufficient concentrations, and other highly radioactive material that is determined, consistent with existing law, to require permanent isolation. HLW stored at INTEC contains a combination of:

- Highly radioactive, but relatively short-lived (approximately 30 year half-life) fission products (primarily cesium-137 and strontium-90)
- Long-lived radionuclides - technetium-99, carbon-14, and iodine-129 as well as transuranics (elements with atomic numbers greater than uranium).

At the INEEL, all liquid HLW has been converted to a granular solid called calcine, which is stored in bin sets. HLW calcine is considered mixed HLW because it contains hazardous constituents.

Spent nuclear fuel?

Spent nuclear fuel is fuel that has been withdrawn from a nuclear reactor following irradiation. When it is taken out of a reactor, spent nuclear fuel contains some unused enriched uranium, radioactive fission products, and activation products. Because of its high radioactivity (including gamma-ray emitters) it must be properly shielded.

Transuranic waste?

Transuranic waste (TRU) is radioactive waste that contains isotopes with 93 or greater protons (atomic number) in the nucleus of each atom (such as neptunium or plutonium), a half-life greater than 20 years, and an alpha-emitting radionuclide concentration of greater than 100 nanocuries per gram of waste.

Mixed waste?

Mixed waste is waste that contains both radioactive and hazardous constituents. RCRA identifies wastes as hazardous either because they appear on lists of hazardous materials developed by EPA or because they have certain hazardous characteristics (they are ignitable, corrosive, reactive, or toxic).

Sodium-bearing liquid waste?

Sodium-bearing waste (SBW) is a liquid radioactive waste produced from the second and third cycles of spent nuclear fuel reprocessing, waste calcination, and decontamination of HLW facilities. SBW contains large quantities of sodium and potassium nitrates. Typically, SBW is processed through an evaporator to reduce the volume, then stored in the HLW tanks. It has historically been managed within the HLW program because of the existing plant configuration and some physical and chemical properties that are similar to HLW. Radionuclide concentrations for liquid SBW are generally 10 to 1,000 times less than for liquid HLW. SBW contains hazardous and radioactive materials and is classified as mixed transuranic waste. The EIS refers to SBW as mixed transuranic waste/SBW.

Newly generated liquid waste?

Newly generated liquid waste refers to liquid waste from a variety of other sources that has been added to the liquid HLW and mixed transuranic waste/SBW in the below-grade tanks at INTEC. Sources include leachates from treating contaminated HEPA filters, decontamination liquids from INTEC operations that are not associated with HLW management activities, and liquid wastes from other INEEL facilities. This term is used in this EIS because INTEC has historically used this term to refer to waste streams that were not part of spent fuel reprocessing.

Summary

1.0 Purpose and Need for Agency Action

1.1 Background

From 1952 to 1991, DOE and its predecessor agencies reprocessed spent nuclear reactor fuel at the Idaho Chemical Processing Plant, located on the Snake River Plain in the desert of southeast Idaho (Figure S-1). This facility, now known as INTEC, is part of the INEEL, a nuclear research complex that has served the nation through both peaceful and defense-related missions.

Regional Setting

The INEEL occupies approximately 890 square miles (570,000 acres) of high desert sagebrush steppe in Bingham, Bonneville, Butte, Clark, and Jefferson counties in southeastern Idaho. Approximately 2 percent of this land (11,400 acres) has been developed to support INEEL facility and program operations associated with energy research, defense missions, and waste management activities.

Smaller communities and towns near the INEEL include Mud Lake and Terreton to the east; Arco, Butte City, and Howe to the west; and Atomic City to the south. Larger communities and towns near the INEEL include Idaho Falls, Rexburg, Rigby, Blackfoot, Pocatello and the Fort Hall Indian Reservation to the east and southeast.

Reprocessing operations at INTEC used solvent extraction systems to remove mostly uranium-235 from spent nuclear reactor fuel and, in the process, generated HLW mixed with hazardous materials (mixed HLW). Mixed HLW is the product of the first extraction cycle of the reprocessing operation. Subsequent extraction cycles, treatment processes, and follow-up decontamination activities generated additional liquids that were combined to form SBW, which is much less radioactive than the mixed HLW and is best characterized as mixed transuranic waste/SBW. At INTEC, all of these liquid wastes were stored in eleven 300,000-gallon underground tanks.

Over several years, much of the liquid waste was fed to a pretreatment facility and converted to a dry granular substance called calcine. The calcine, which is stored in large, robust bin sets, is a more stable waste form that poses less environmental risk than storing liquid radioactive waste in underground tanks. However, the calcine does not meet current working assumptions for waste acceptance criteria for acceptance at a disposal repository. Further treatment would be necessary to convert the mixed HLW into a waste form acceptable for disposal in a repository.

Spent nuclear fuel processing was discontinued at INTEC in 1991, so liquid HLW ceased to be generated. However, since that time, liquid mixed transuranic waste/SBW has continued to accumulate in the tanks from calcine operations, decontamination, and other activities. In 1995, DOE and the State of Idaho reached an agreement, called the Idaho Settlement Agreement/Consent Order, as to when the liquid waste would be removed from the tanks and set a target date of 2035 for all of the mixed HLW and mixed transuranic waste/SBW to have been treated and made road-ready for shipment out of Idaho.

Consistent with this agreement, DOE completed calcining all of the liquid mixed HLW in 1998. At present, approximately 4,200 cubic meters of mixed HLW calcine remain stored in bin sets, and 1.4 million gallons of liquid mixed transuranic waste/SBW remain in the underground tanks. DOE intends to manage these wastes according to regulatory requirements and commitments to the State of Idaho, and in a manner that helps to ensure the protection of human health and the environment.

Idaho Nuclear Technology and Engineering Center

INTEC occupies approximately 250 acres and consists of more than 150 buildings. Primary facilities include storage, treatment, and laboratory facilities for spent nuclear fuel, mixed HLW, and mixed transuranic waste/SBW.

In addition, the Minimum INEEL Processing Alternative would involve the treatment of INEEL mixed HLW at the Hanford Site near Richland, Washington. Chapter 3 and Appendix C.8 of this Draft EIS describes the Hanford Site, focusing on the 200-East Area, where INEEL mixed HLW would be treated under this alternative.

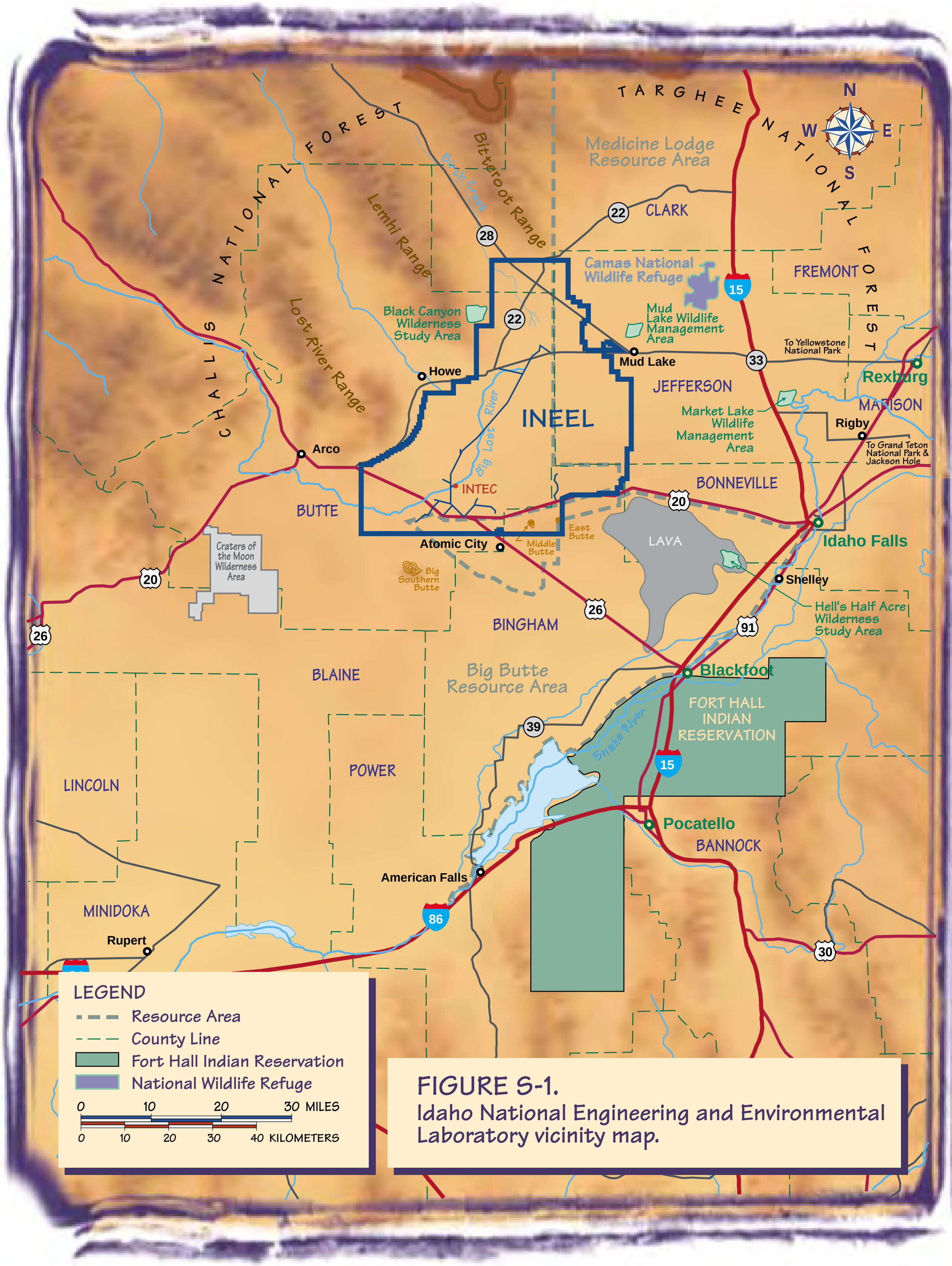


FIGURE S-1.
Idaho National Engineering and Environmental Laboratory vicinity map.

To achieve this, DOE proposes to:

- Develop appropriate technologies and construct facilities necessary to manage INTEC mixed HLW and mixed transuranic waste/SBW
- Treat the mixed HLW calcine so that it will be suitable for disposal in a repository
- Treat and dispose of associated radioactive wastes
- Provide safe storage for HLW destined for a repository
- Provide for the disposition of INTEC HLW management facilities when their missions are completed.

1.2 Purpose

To resolve waste management issues, DOE needs to decide:

- How to treat INTEC mixed HLW so that it can be transported out of Idaho to a storage facility or repository
- How to treat and where to dispose of other radioactive wastes that are associated with the HLW management program at INTEC
- How to manage treated INTEC wastes that are ready to be transported out of Idaho
- How to close HLW-related facilities at INTEC, including certain liquid waste

Elements of the 1995 Idaho Settlement Agreement/Consent Order Pertaining to HLW Management

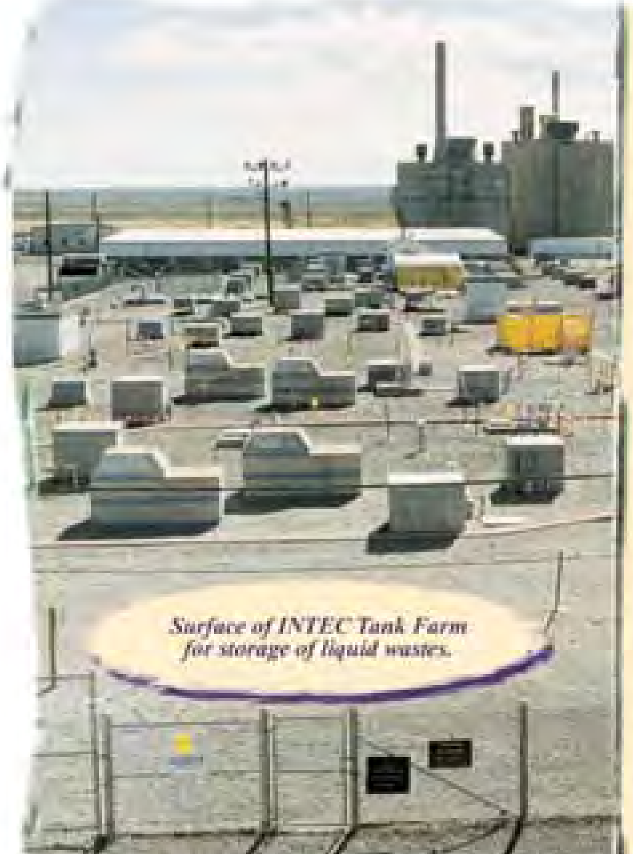
- Complete calcination of liquid mixed HLW by June 30, 1998 (done).
- Begin calcination of liquid mixed transuranic waste/SBW by June 2001 (started).
- Complete calcination of liquid mixed transuranic waste/SBW by December 2012.
- Start negotiations with the State of Idaho regarding a plan and schedule for treatment of calcined waste by December 31, 1999 (started).
- "DOE shall accelerate efforts to evaluate alternatives for the treatment of calcined waste so as to put it into a form suitable for transport to a permanent repository or interim storage facility outside of Idaho."
- "It is presently contemplated by DOE that the plan and schedule shall provide for the completion of the treatment of all calcined waste located at INEL by a target date of December 31, 2035."

storage tanks, bin sets, the New Waste Calcining Facility, facilities that would be constructed under the waste processing alternatives and treatment options, and associated laboratories and support facilities.

DOE, with the State of Idaho as a Cooperating Agency, has prepared this EIS to:

- Assess various treatment and disposal alternatives so that mixed HLW can be made ready for transport out of Idaho for ultimate disposal in a repository, and liquid mixed transuranic waste/SBW can be removed from the underground tanks and managed appropriately
- Assess various facility disposition alternatives so that the HLW management areas at INTEC can be closed
- Provide the necessary background, data, and analyses to help decision-makers and the public understand the potential environmental impacts of each alternative.

DOE will present its decision in one or more Record of Decision documents, which will be issued no sooner than 30 days after a Notice of Availability of the Final EIS is published in the Federal Register.

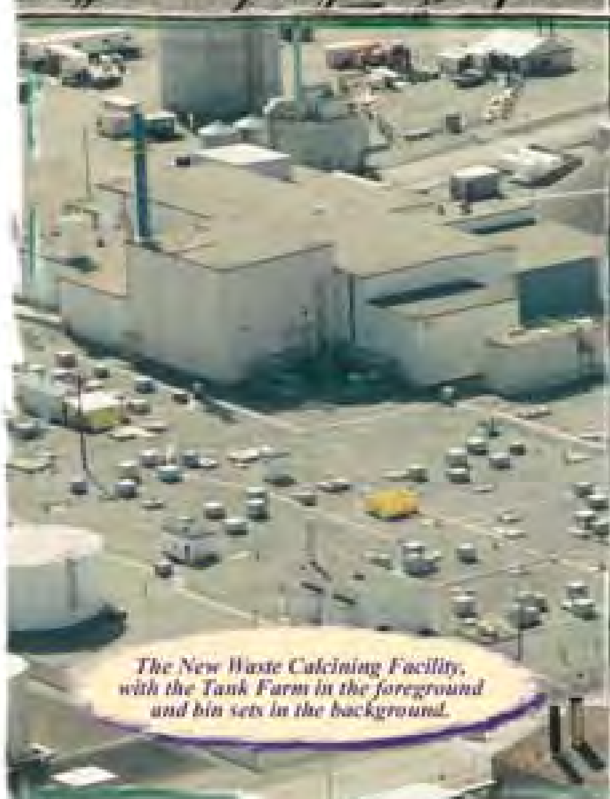


Surface of INTEC Tank Farm for storage of liquid wastes.

How and why did DOE calcine HLW?

Since 1963, DOE has operated a facility at the INEEL to convert liquid mixed HLW (and, more recently, liquid mixed transuranic waste/SBW) into a solid substance called calcine. Calcination reduces the liquid waste volume and places the liquid waste in a more stable form. The final waste form is a dense powder similar in consistency to dry laundry detergent.

During the calcine process, liquid waste is drawn from the Tank Farm (top left) and sprayed into a vessel containing an air-fluidized bed of granular solids. The bed is heated using kerosene and oxygen. During calcination at the New Waste Calcining Facility (bottom left), most liquids evaporate, and the radioactive fission products stick to the granular material in the vessel. The offgas is processed in the offgas cleanup system before release to the environment. Following calcination, the calcined product is pneumatically transferred to the Calcined Solids Storage Facilities for long-term storage in bin sets (bottom right).



The New Waste Calcining Facility, with the Tank Farm in the foreground and bin sets in the background.

Typical bin set storage units for calcined solids at INTEC (61 feet in diameter and 111 feet tall).

1.3 Timing and Regulatory Considerations for this EIS

Some INTEC wastes (mixed transuranic waste/SBW) are stored as liquids in eleven 300,000-gallon tanks that do not meet current hazardous waste management standards. DOE's objective is to cease use of and close these tanks in compliance with applicable regulations. Previously, DOE's plan was to cease use of the tanks by calcining all the liquid waste as described in the following documents:

- Amended ROD for the SNF and INEL EIS
- Idaho Settlement Agreement/Consent Order (October 1995)
- INEEL Site Treatment Plan/Consent Order (November 1995).

However, DOE is now reconsidering this plan because of the following factors:

- ***Technical constraints which have hindered DOE's efforts to sample offgas emissions for traces of hazardous materials from the New Waste Calcining Facility calciner.***

  The calciner has operated under RCRA interim status. In order to continue to run the calciner, DOE must submit to the State of Idaho an application for a RCRA Part B permit that includes emission and waste characterization data. In addition, by Consent Order, the State and DOE have agreed to cease calciner operations if such a permit has not been obtained by June 1, 2000, and until a permit is granted.

- ***New EPA air quality standards for hazardous waste combustion units.***

  Independent of the RCRA permitting discussed above, by June 1, 2000, DOE must decide whether or not to continue to operate the calciner under new requirements of the Clean Air Act. DOE must publicly announce whether it intends to upgrade the calciner to comply with the emissions standards or to cease use of the calciner by October 1, 2001. This declaration process, which includes public involvement, must begin no later than June 30, 2000, and be completed with a final Notice of Intent to Comply to the regulatory agencies by October 2, 2000.

Were DOE to decide, after completion of this EIS, to reconsider its plan to calcine the remaining liquid in the underground tanks and to implement other treatment options, some activities envisioned in the Idaho Settlement Agreement/Consent Order might need to be changed. This EIS provides a basis for discussions regarding potential modifications.

Other timing considerations important to the issuance of this EIS include the following:

- ***Data are needed on the cumulative impacts associated with cleanup activities at INTEC that are carried out under CERCLA.***

  CERCLA cleanup projects at INTEC are in process. These projects involve the cleanup and/or removal of contaminated soils and other environmental media, portions of which are within those areas or projects being evaluated in the various alternatives in this EIS. To avoid the possibility that CERCLA decisions may inappropriately preclude some waste processing or facility disposition alternatives, the CERCLA and NEPA processes at INTEC are being coordinated.

- ***The lead-time required for facility development and funding of alternative technologies means that a DOE ROD on a calcine treatment technology would be needed sooner than previously estimated.***

  This EIS is being prepared sooner than required by the Idaho Settlement Agreement/Consent Order in order to accommodate time estimates for facility design and funding acquisition. This should make it possible for DOE to meet the target date of December 31, 2035, for having the treated waste ready to leave Idaho.

Concerns and Issues Identified During the Scoping Process

The scoping process for this EIS began on September 19, 1997, when DOE published in the Federal Register its Notice of Intent to prepare an EIS to evaluate alternatives for managing HLW and associated radioactive wastes and facilities at the INEEL. The Notice of Intent included DOE's preliminary identification of EIS issues.

DOE held public scoping workshops and sponsored a number of activities to work with stakeholders to identify new alternatives and issues and allow for meaningful information exchange. For example, DOE held open houses; set up booths and displays at shopping malls throughout southern Idaho; made presentations to schools and civic groups; and provided individual briefings to key stakeholders who included government and Tribal officials, interest groups, site employees, and the INEEL Citizens Advisory Board.

During this process, stakeholders submitted over 900 comments, including agency comments, and identified many concerns and issues they wanted DOE to address. The Scoping Activity Report (January 1998) summarized these comments and identified the following categories of key issues:

- *Treatment criteria DOE would use as a basis for producing waste forms suitable for repository disposal*
- *A HLW disposal site outside of Idaho if the proposed repository at Yucca Mountain is not available*
- *Long-term storage or disposal of any treated waste over the Snake River Plain Aquifer*
- *Hazardous constituents in HLW that may preclude disposal in a repository*
- *Technical viability concerns that any alternative selected will not work as planned*
- *Cost/risk-benefit analyses that compare the cost and risk of treating waste to the benefits*
- *Funding sufficient to complete INEEL cleanup*
- *Compliance concerns that may conflict or require prioritization.*

In addition, DOE reviewed public comments on the proposed plan for the CERCLA cleanup of Operable Unit 3-13, Waste Area Group 3, at INTEC. Because this cleanup project involves contaminated soils and other environmental media associated with the waste processing and facility disposition alternatives evaluated in this EIS, DOE should coordinate both efforts. The comments submitted during the CERCLA process raised many of the same concerns identified during scoping for this EIS.

DOE used scoping comments to refine the alternatives and options being analyzed in this EIS, which are introduced in the next section. Section 6 of this Summary describes the alternatives in more detail.

2.0 Proposed Action and Alternatives at a Glance

To meet the purpose and need for agency action and considering the issues and concerns raised during scoping, DOE has identified five alternatives for waste processing and six alternatives for facility disposition. These alternatives can reasonably be expected to achieve the goals of:

- Treating all of the calcined HLW and liquid mixed transuranic waste/SBW to a form suitable for disposal
- Closing the associated waste management facilities.

For purposes of analysis, DOE used a modular approach in developing alternatives for this EIS. Under this approach, DOE identified a series of discrete projects, which, when implemented together under a given alternative, form a set of actions that will achieve the goals of the proposed action. Thus, some projects are included in more than one waste processing alternative. This modular approach provides DOE flexibility in analyzing waste processing alternatives and treatment options and in selecting a preferred alternative, which may be a hybrid made up of projects that have been analyzed in this EIS.

The analysis of the facility disposition alternatives considers all of the facilities that would be required to implement each waste processing alternative. Figures S-2 and S-3 show the waste processing and facility disposition alternatives at a glance.

2.1 Preferred Alternative

Neither DOE nor the State of Idaho has identified a preferred alternative. After considering information in this EIS and other factors, including any public comment received, DOE and the State will enter into discussions concerning the preferred alternative. If DOE and the State reach agreement, the Final EIS will identify the agreed-upon preferred alternative; if not, the Final EIS will set forth both the State's and DOE's respective choices for the preferred alternative.

Proposed Action

- *Develop appropriate technologies and construct facilities necessary to manage INTEC mixed HLW and mixed transuranic waste/SBW.*
- *Treat the mixed HLW calcine so that it will be suitable for disposal in a repository.*
- *Treat and dispose of associated radioactive wastes.*
- *Provide safe storage for HLW destined for a repository.*
- *Provide for the disposition of INTEC HLW management facilities when their missions are completed.*

2.2 Role of this EIS in Decision-making

DOE will consider the environmental impacts discussed in this EIS when making decisions about waste processing and facility disposition alternatives. Other factors that DOE will consider include public comments on the draft EIS and programmatic, policy, and cost considerations. The results of the cost evaluation will be made available to the public.

Waste Processing Alternatives at a Glance

- These alternatives offer DOE different ways to treat mixed HLW currently stored in calcine bin sets and liquid mixed transuranic waste/SBW currently stored in underground tanks so that these wastes can be safely stored and properly disposed of.
- These alternatives differ in the kinds of technology used to treat the waste, specifically, whether or not the calciner will be upgraded and permitted for pre-treating the liquid mixed transuranic waste/SBW and whether or not waste will be separated into fractions for different disposal destinations.
- These alternatives also differ in the kind of disposal options available for mixed low-level waste fractions produced as a result of treatment alternatives.
- The timeframe of the waste processing alternatives spans approximately the years 2000 to 2035. The year 2035 is the target date in the Settlement Agreement/Consent Order for DOE to have all the calcined mixed HLW treated and ready for shipment to a storage facility or repository outside of Idaho.
- Long-term impacts (beyond 2035) associated with waste processing alternatives that include onsite disposal of low-level waste (Class A type and Class C type) are carried over to the facility disposition alternatives, which evaluate impacts associated with the long term closure of HLW facilities at INTEC.
- Projects and facilities are identified individually and can be combined in a building block fashion to develop other waste processing alternatives.

NO ACTION ALTERNATIVE

Required by NEPA as a basis for comparison.

- Leave liquid mixed transuranic waste/SBW in tanks indefinitely.
- Leave mixed HLW calcine in bin sets indefinitely.

CONTINUED CURRENT OPERATIONS ALTERNATIVE

Calcine the liquid mixed transuranic waste/SBW, add to existing mixed HLW calcine in bin sets.

- Upgrade and permit calciner.
- Store calcine in bin sets indefinitely.
- Remove transuranics from tank heels and newly generated liquid waste and send to WIPP.
- Grout remaining low-level waste (Class A type) for disposal at INEEL.

SEPARATIONS ALTERNATIVE

Different ways to chemically separate waste into fractions that can be disposed of differently depending on the type and level of radioactivity.

FULL SEPARATIONS OPTION

The most highly radioactive and long-lived radionuclides removed for disposal in a HLW repository.

- Separate cesium, strontium, and transuranics from mixed HLW calcine and liquid mixed transuranic waste/SBW and treat (vitrify) for disposal in a HLW repository.
- Treat low-level waste (Class A type) fraction for disposal in empty underground tanks, bin sets, onsite landfill, or offsite landfill.

PLANNING BASIS OPTION

This option mirrors the previously announced DOE decisions and agreements regarding calcined mixed HLW and the liquid mixed transuranic waste/SBW.

- Upgrade and permit the calciner
- Calcine the liquid mixed transuranic waste/SBW and add to the bin sets.
- Proceed as for Full Separations Option above except that the low-level waste fraction would be disposed of at offsite landfill.
- Remove transuranics from tank heels and newly generated liquid waste and send to WIPP.

TRANSURANIC SEPARATIONS OPTION

Does not result in a HLW fraction.

- Remove transuranics from calcine and liquid mixed transuranic waste/SBW, solidify and send to WIPP.
- Grout low-level waste (Class C Type) fraction containing cesium and strontium; dispose in empty tanks, bin sets, onsite landfill, or offsite landfill.

NON-SEPARATIONS ALTERNATIVE

Different ways to immobilize the waste through solidification without separating waste fractions by type and level of radioactivity.

HOT ISOSTATIC PRESSED WASTE OPTION

Creates a non-leaching, glass-ceramic waste.

- Upgrade and permit the calciner
- Calcine the liquid mixed transuranic waste/SBW and add to bin sets.
- Blend calcine with silica and titanium powder and press into glass ceramic for disposal in HLW repository.
- Remove transuranics from tank heels and newly generated liquid waste and send to WIPP.

DIRECT CEMENT WASTE OPTION

Creates a cement-like solid.

- Upgrade and permit the calciner
- Calcine liquid mixed transuranic waste/SBW and add to bin sets.
- Blend calcine with slag, caustic soda, and water and cure at elevated temperature and pressure for disposal in a HLW repository.
- Remove transuranics from tank heels and newly generated liquid waste and send to WIPP.

EARLY VITRIFICATION OPTION

Creates a non-leaching, glass waste out of liquid mixed transuranic waste/SBW and HLW calcine.

- Blend liquid mixed transuranic waste/SBW and tank heels with glass frit, vitrify, and send to WIPP.
- Blend mixed HLW calcine with glass frit, and vitrify for disposal in a HLW repository.

MINIMUM INEEL PROCESSING ALTERNATIVE

Calcined mixed HLW would be sent to the Hanford site in Washington State for treatment and liquid mixed transuranic waste/SBW would be treated at INEEL.

- Place mixed HLW calcine and cesium ion exchange resin in shipping containers and transport to the Hanford Site.
- Separate calcine into high-level and low-level waste fractions and treat at Hanford.
- Return treated mixed HLW and low-level waste to INEEL.
- Dispose of low-level waste fraction at INEEL or offsite; store HLW fraction for disposal in a HLW repository.
- At INEEL, process liquid mixed transuranic waste/SBW and tank heels to remove cesium and grout remainder for shipment to WIPP.

FIGURE S-2.
Waste processing alternatives and treatment options at a glance.

Facility Disposition Alternatives at a Glance

- These alternatives offer DOE different ways to address the final risk component of the proposed action and close INEEL facilities used to treat and manage HLW when their missions are completed.
- These alternatives differ in the degree to which the land is considered "cleaned-up" and in the type of use that could be made of the land as a result.
- Two of the alternatives include onsite low-level waste disposal options (Class A or Class C type waste that are part of the waste processing alternatives).
- For purposes of analysis, DOE assumed that the timeframe spans the years 2035 to 2095. During this period, DOE would continue to maintain facilities and store treated waste ready for disposal. Beyond 2095, DOE would no longer maintain facilities or restrict access to the site. Where potential impacts to public health and the environment could occur well beyond 2095, the analysis is extended for 10,000 years.

CLOSURE TO LANDFILL STANDARDS ALTERNATIVE

Facilities closed in accordance with state and Federal requirements for landfills.

- Stabilize waste residuals in tanks, vaults, and piping with grout.
- Build an engineered cap over facilities.
- Install groundwater monitoring system
- Provide post-closure monitoring.

PERFORMANCE-BASED CLOSURE WITH CLASS A GROUT DISPOSAL

Closure methods similar to the Performance-Based Closure Alternative; however, Class A type grout from waste processing alternatives would be disposed of in the empty underground tanks or bin sets.

NO ACTION ALTERNATIVE

Required by NEPA as a basis for comparison.

- Similar to the No Action Alternative for Waste Processing.
- Remove bulk chemicals and de-energize facilities.
- Perform surveillance and maintenance until 2095.
- Leave existing facilities in place with no further consideration.

CLEAN CLOSURE ALTERNATIVE

Restore the land to a condition after closure that presents no risk to workers or the public from hazardous or radiological components.

- Remove or treat all wastes and contaminated items so that radiation is at background level.
- If necessary, remove buildings, vaults, and contaminated soil.
- Post-closure monitoring may be required.

PERFORMANCE-BASED CLOSURE ALTERNATIVE

Closure methods decided on a case-by-case basis, depending on risk.

- Raze above-grade facilities and decontaminate below - grade facilities as determined on a case-by-case basis.
- Decontaminate remaining facilities so as not to pose an unacceptable risk to workers or the public.
- Determine which facilities may require monitoring.
- Provide post-closure monitoring as necessary.

PERFORMANCE-BASED CLOSURE WITH CLASS C GROUT DISPOSAL

Closure methods similar to the Performance-Based Closure Alternative; however, Class C type grout from waste processing alternatives would be disposed of in the empty underground tanks or bin sets.

FIGURE S-3.
Facility disposition alternatives at a glance.

What is a rem?

A unit of radiation dose.

Waste processing activities analyzed in this EIS could result in radiation exposures to workers and the public during operations. Additional radiation exposures could result from facility accidents. Any radiation exposures from waste processing would be in addition to exposures that normally occur from natural sources such as cosmic radiation (involuntary exposure) and artificial sources such as chest x-rays (voluntary exposure).

The effects of radiation exposure on humans depend on the kind of radiation received, the total amount absorbed by the body, and the tissues involved. A rem is calculated by a formula that takes these three factors into account. The average individual in the United States receives a dose of about 0.36 rem or 360 millirem per year from natural and medical sources combined.

What is a latent cancer fatality (LCF)?

Normal operations and accidents that could result in a release of radioactivity pose a hazard to the population exposed to such a release. Latent cancer fatalities, or LCFs, measure the expected number of additional cancer deaths in a population (or people dying of cancer) as a result of a given exposure to radiation. Death from cancer as a result of exposure to radiation may occur at any time after the exposure takes place. However, latent cancers would be expected to occur in a population from one year to many years after the exposure takes place. Other health effects that could result from exposure to radiation include non-fatal cancers and genetic defects in the future population. This EIS focuses on LCFs as the primary health risk from radiation exposure and used the estimation of LCFs as the basis for comparing radiation-induced impacts among alternatives.

How is an LCF calculated?

Radiation Dose: Radioactivity from all sources combined, including natural background radiation and medical sources, produces about a 0.36 rem dose to the average individual per year.

Probability: The probability of receiving the above dose is essentially 100 percent.

Average lifetime: The average lifetime is considered to be 72 years .

Lifetime dose: Over 72 years, an individual would receive 72 years x 0.36 rem per year or approximately 26 rem.

Population dose: If 1,000 individuals each receive 26 rem, then the so-called collective dose or dose to the population is 1,000 persons x 26 rem or 26,000 person-rem.

Risk factor: The International Commission on Radiological Protection has determined that for every person-rem of collective dose, approximately 0.0005 individuals from the general public could ultimately develop a radiologically induced cancer.

Estimation of LCFs: For a population exposed to a release of radioactive material (such as from a facility accident), LCFs are estimated by multiplying the resulting dose to the population (in person-rem) by a factor of 0.0005 LCF per person-rem. For the example resident population of 1,000 individuals receiving a population dose of 26,000 person-rem from all anticipated sources, the number of resulting LCFs would be estimated as 26,000 person-rem X 0.0005 LCF per person-rem, or 13 LCFs. For a hypothetical facility accident that results in a population exposure of 5,000 person-rem, the number of resulting LCFs would be estimated as 5,000 person-rem X 0.0005 LCF per person-rem, or 2.5 LCFs. The total estimated health effects in a population as a result of a given exposure to radiation can be estimated by multiplying the estimated LCFs by 1.46. based on data also provided by the International Commission on Radiological Protection.

Per Capita Population Risk: Dividing the anticipated LCFs from a radioactive release by the affected population provides a perspective on the relative per capita increase in cancer risk to that population. For the example resident population of 1,000 individuals, the hypothetical facility accident that results in 1 LCF, poses an additional per capita risk to the resident population of 0.001, or one in a thousand.

Individual Risk: Although the radiation risk data presented above, strictly apply only to large populations of individuals, mathematically one can calculate the increase in risk of cancer to an individual by multiplying the dose to that individual as a result of an exposure to radiation by 0.0005.

Sometimes, calculations of the number of LCFs associated with radiation exposure do not yield whole numbers, and especially in environmental applications, may yield numbers less than 1.0. For example, if each individual in a population of 100,000 received a total dose of 0.001 rem, the collective dose would be 100 person-rem and the corresponding estimated number of LCFs would be 0.05 (100,000 persons x 0.001 rem x 0.0005 LCF per person-rem). How should one interpret a nonintegral number of LCFs, 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 result if the same exposure situation were applied to many different groups of 100,000 people. For most groups, no one would incur an LCF from the 0.001 rem dose each member would have received. In a small fraction of the groups, 1 LCF would result; in exceptionally few groups 2 or more LCFs would occur. The average number of deaths over all of the groups would be 0.05 LCF (just as the average of 0, 0, 0, and 1 is 1/4, or 0.25). The most likely outcome for any single group is 0 LCFs.

3.0 Major Results

DOE assessed environmental impacts on 14 areas of interest for the five waste processing and six facility disposition alternatives. In nine of the areas, little or no impact is indicated. The assessment results for the 14 areas of interest are presented in Section 7 of this Summary. The major results are summarized below.

Under normal operations through the foreseeable future (until 2095 for analysis purposes), none of the alternatives would result in health and safety impacts that exceed allowable regulatory limits of exposure to workers or the public.

This EIS analyzes the construction and operation of facilities needed to implement the various waste processing alternatives. These activities would normally occur from 2000 to 2035, depending on specific schedules for the alternatives. After 2035, DOE would begin to shut down the facilities in accordance with the facility disposition alternatives. Also, DOE would be disposing of various waste forms and performing post-closure management of the disposal facilities. DOE analyzed all these post-2035 activities through 2095. In the year 2095 it is assumed, for analysis purposes, that DOE would no longer maintain facilities or control site access. Neither the activities occurring during 2000 to 2035 nor those from 2035 to 2095 would result in health and safety impacts that would exceed allowable regulatory limits of exposure to workers, the public, or the environment.

Except under the No Action Alternative, long-term impacts (up to 10,000 years) from residual contamination or waste that has been disposed of would not exceed allowable limits to the environment or to members of the public.

Under facility disposition alternatives that result in facilities being closed with residual contamination and waste disposal on the INEEL, contaminants would migrate through the environment to the groundwater over long periods of time. DOE estimated

Accident

An unplanned, unexpected, and undesired series of events during facility operations that has the potential to harm workers, the public, and the environment.

Accident Scenario

A set of related events starting with an "initiating event" that leads to the release of radioactive or hazardous material with the potential to cause injury or death.

Reasonably Foreseeable Accident

An accident scenario that does not require extraordinary initiating events or unrealistic assumptions about the progression of events or the resulting releases.

Bounding Accident

The reasonably foreseeable accident that has the highest environmental impacts, particularly human health and safety impacts, among all reasonably foreseeable accidents identified for an alternative.

Bounding Accident Risk Estimation

Risks due to accidents are estimated very conservatively in this Draft EIS. In estimating the frequency and severity of bounding accidents, no credit was taken for engineered safety systems and design features that would be incorporated in an actual facility.

Likewise, human health impacts from releases of radioactivity were estimated using very pessimistic meteorological assumptions. Although this approach overstates the risk of accidents, it does provide a level of certainty that the estimated risks reported in this Draft EIS are not likely to be exceeded and it does provide a viable basis for comparing one alternative to another.

the impacts to groundwater and to humans who would use the groundwater over a 10,000-year period. These initial calculations indicate that, except for the No Action Alternative, groundwater concentrations would not exceed EPA drinking water standards and neither hazard quotients nor doses to humans would exceed accepted guidelines. However, alternatives that involve a disposal of low-level waste at INTEC are undergoing further evaluation to reduce the uncertainty in estimating long term impacts to groundwater.

The analyses of bounding accident scenarios indicate the potential for major impacts on human health and the environment.

DOE analyzed internal and external influences on a series of process elements (projects that would implement each alternative). The potential of these influences to result in an accident was then evaluated. In general, the No Action and Continued Current Operations Alternatives pose the greatest anticipated risk because liquid mixed transuranic waste/SBW and/or calcined mixed HLW would be left at INTEC indefinitely. In other words, the longer these waste forms are stored at INTEC, the greater the probability of a bounding accident, such as a flood causing a bin set to fail or an earthquake repturing a bin set or underground tank. Other accident scenarios evaluated for waste processing alternatives presented comparatively low anticipated risks because associated treatment operations would only occur for 35 years (2000-2035). The results of the accident analyses are discussed in more detail in Section 7 of this Summary.

Due to degradation of the mixed transuranic waste/SBW storage tanks and the calcine storage bin sets, the No Action and Continued Current Operations Alternatives involve an additional level of risk when compared to other waste processing alternatives.

The No Action Alternative would store liquid mixed transuranic waste/SBW in five underground 300,000 gallon storage tanks and 4,200 cubic meters of mixed HLW in the bin sets indefinitely. The Continued Current Operations Alternative would store approximately 6,000 cubic meters of mixed HLW in the bin sets indefinitely. There is the possibility that over an extended period of time, especially after the loss of institutional control, structural degradation of these storage facilities could occur. The probability of a structural failure increases when maintenance and monitoring is no longer routinely performed. It is assumed that a partial structural failure due to degradation in the tanks or bin sets could occur. The impacts of failure of the underground storage tanks or the bin sets have been analyzed and the results are provided below.

- *For the No Action Alternative, five in-service storage tanks filled with liquid mixed transuranic waste/SBW are assumed to fail and breach after 500 years, releasing their contents to the soil column and contaminating the groundwater.*

  After 500 years, the major contaminant of concern is iodine-129. For an individual on the INEEL site in the vicinity of the storage tanks and ingesting contaminated drinking water from the aquifer, the lifetime dose would be approximately 66 millirem. This accident is discussed in more detail in Section 7.3 of this Summary.

- *For either the No Action or Continued Current Operations Alternatives, long-term degradation is assumed to result in structural failure of a bin set with a subsequent release of mixed HLW contents.*

  Failure of a bin set could have major impacts to human health and the environment. Such an event becomes more probable after 500 years, which is the nominal design life of the calcine storage bins.

  After 500 years, it is estimated that calcine released from one bin set would result in an estimated total lifetime dose of 12 rem to a hypothetical maximally exposed individual residing in the vicinity of the bin sets. This would result in an estimated increased risk of developing a fatal latent cancer of 1 in 170. The maximally exposed individual at 3 miles from INTEC (the approximate current site boundary) would be exposed to an airborne dose of 170 millirem, or an estimated increased risk of developing a fatal latent cancer of 1 in 12,000. For the population within 50 miles of INTEC, the accident could result in 1,300 person-rem resulting in 0.65 LCF.

Some waste processing and facility disposition alternatives have greater potential environmental impacts at the INEEL than others.

Although environmental impacts identified for many of the waste processing and facility disposition alternatives are similar, there are some discriminating differences. Specifically, while all waste processing alternatives could result in some residual contamination, those that involve disposal of low-level waste in a landfill at INTEC or in the empty underground tanks or bin sets could eventually contribute additional contaminants, such as iodine-129, into the groundwater. Similarly, closure scenarios for the facility disposition alternatives differ in the amount of residual contamination that would remain, and these contaminants could eventually migrate to the groundwater.

Another potential difference is the amount of waste that would be produced under the various alternatives. Processing and treating the approximately 4,200 cubic meters of HLW calcine and the 1.4 million gallons of liquid mixed transuranic waste/SBW by different waste processing alternatives would result in significantly different estimated final waste volumes and waste types. Waste volumes for all alternatives are provided in Section 7 of this Summary.

Accidents and Anticipated Risk

Determination of Anticipated Risk - Bounding accidents do not provide a complete picture of health risks for a population from a proposed action. Overall health risk to a population is also related to the anticipated risk. The anticipated risk to public or worker health due to an accident is a function of both the severity of the accident (amount and type of contaminant released) and the frequency of the event. Therefore, anticipated risk associated with a facility's bounding accident takes into account that some large impact facility accidents may be much less likely to occur, hence they can result in low anticipated risk. Likewise, some low frequency or low consequence accidents can be associated with very long periods of vulnerability and can result in high anticipated risk.

Application of Anticipated Risk - Given the above alternatives that do not reduce the likelihood of a release or the quantity of releasable radioactive material and have a long period of vulnerability can result in high-anticipated risks. This is demonstrated by the bounding design basis accident for the No Action and Continued Current Operations Alternatives. These two alternatives would store mixed radioactive waste indefinitely and thus would result in a anticipated risk that is higher than the bounding design basis accident for the other alternatives. The other alternatives involve facility operations that extend for only thirty-five years (2000-2035) and which actively reduce the quantity of releasable radioactive material by putting waste into a form suitable for disposal. Further, waste processing facilities will employ appropriate safety and mitigation features that greatly reduce anticipated risk.

Under any alternative, there is some degree of risk.

All alternatives involve some level of risk. These risks include exposures to nuclear or hazardous materials, accidental releases of these substances, and injuries incurred by workers.

For normal operations, the highest radiological dose to the public from airborne emissions would occur for the Non-Separations Alternative and the Planning Basis Option (0.10 person-rem/yr to the population living within 50 miles of INTEC). Recent data indicate that the annual collective radiological dose to the population is about 0.24 person-rem, which is fairly representative of the population annual dose from existing INEEL operations. Therefore, the total annual dose to the population is estimated to be 0.34 person-rem for either the Non-Separations Alternative or the Planning Basis Option, resulting in 0.0002 LCF.

Worker exposure to radiation would be highest for clean closure of the Tank Farm and related HLW facilities. For clean closure of these facilities, the cumulative occupational dose to workers was estimated to be 7,600 person-rem, resulting in an estimated 3 LCFs. Worker exposures under other facility disposition alternatives would be much lower.

Not all of the waste processing alternatives meet key requirements of the Idaho Settlement Agreement/Consent Order.

DOE is committed to meeting regulatory requirements, as well as agreements with the State of Idaho. However, the agreement provides for a process whereby DOE may propose changes to specific requirements, provided they are based on an adequate environmental analysis under NEPA. In order to evaluate a reasonable range of waste processing alternatives, some of the alternatives analyzed in this EIS may not meet specific requirements of the Idaho Settlement Agreement/Consent Order.

Key elements in the Idaho Settlement Agreement/ Consent Order are commitments to have all the liquid mixed transuranic waste/SBW out of the underground storage tanks and cease using them by 2012, and have all HLW treated and ready for shipment out of Idaho by a target date of 2035. Based on the analysis in this EIS, DOE expects that all alternatives, except for No Action and Continued Current Operations, would meet the 2035 target date. However, the analysis also indicates that, except for the Minimum INEEL Processing Alternative, it would be difficult to stop using the Tank Farm by 2012. The Planning Basis Option does include the possibility of meeting the 2012 date if construction, testing, and operations can be performed under an accelerated schedule. All milestones for waste treatment under the Planning Basis Option would depend on timely funding and permitting.

Another key element in the Idaho Settlement Agreement/Consent Order is the use of the calciner as the pretreatment process for liquid transuranic waste/SBW in the tanks. Since there are several treatment technologies evaluated in this EIS that do not require a pretreatment calcine step, a decision to use a different process would require a modification of the agreement, as well as the Site Treatment Plan and related DOE decisions.

Finally, the State of Idaho has stated its position in the foreword to this EIS that one of the reasons Idaho agreed to the Settlement Agreement was DOE's commitment to convert all liquid waste in the INTEC Tank Farm to a solid form by 2012, and to treat this waste so that it is ready to be shipped out of Idaho by a target date of 2035. Wastes covered by the HLW requirements of the Idaho Settlement Agreement/ Consent Order include the current tank inventory of mixed transuranic waste/SBW liquids and any solids derived from liquids that have been stored in the tanks. Consequently, the State of Idaho considers that any alternative that leaves liquids in the INTEC Tank Farm (No-Action Alternative) or calcined waste in the bin sets (No Action and Continued Current Operations Alternatives) for an indefinite period of time is inconsistent with the agreement. Similarly, it is the State's position that alternatives that propose to dispose of low-level waste fractions separated from mixed HLW calcine or mixed transuranic waste/SBW at INTEC will not meet a requirement of the Settlement Agreement to have such waste treated and ready to be shipped out of Idaho.

4.0 Areas of Uncertainty

There are a number of issues outside the scope of this EIS whose resolution may not be complete when the final EIS is published. These issues, nevertheless, bear on the alternatives considered in this EIS, and their lack of resolution introduces some degree of uncertainty, as explained below. DOE will appropriately factor these uncertainties into decisions made pursuant to this EIS.

4.1 Waste Acceptance Criteria

Disposal facilities restrict the materials that can be received for disposal by establishing waste acceptance criteria. These criteria define such things as packaging requirements, waste form requirements, acceptable radiation levels, and limits on radionuclide content.

DOE has not yet identified final waste acceptance criteria for some wastes, including HLW, although EPA has identified immobilization in borosilicate glass as an acceptable waste form for HLW disposal. The lack of final criteria introduces some uncertainty that could affect process design and system operation of the treatment options for INEEL HLW.

4.2 Waste Type Definitions

WASTE INCIDENTAL TO REPROCESSING

Some waste streams associated with HLW generation, treatment, and storage may be more appropriately managed as a transuranic or low-level waste. Recently adopted DOE Order 435.1, Radioactive Waste Management, has established procedures for determining if a high-level waste stream can be considered a "waste incidental to reprocessing" and, therefore, can be properly treated and disposed of safely as either a transuranic or low-level waste.

Many of the waste processing alternatives in this EIS would involve application of the waste-incidental-to-reprocessing process. Specifically, some treatment activities would result in waste fractions that may be managed as transuranic waste or low-level waste, as appropriate. Because the determination process is newly established, there may be some unforeseen difficulties as DOE works through its formal application.

CLASSIFICATION OF TRANSURANIC WASTE FRACTION

Some of the waste processing alternatives and treatment options (e.g., Transuranic Separations Option) would produce transuranic waste for potential disposal in the Waste Isolation Pilot Plant near Carlsbad, New Mexico. The transuranic waste that would be produced by processing INTEC HLW may contain hazardous constituents currently not identified in the Waste Isolation Pilot Plant list of permitted wastes. The additional waste codes would need to be included in the Waste Isolation Pilot Plant permit before the transuranic waste fraction would be acceptable for disposal.

DETERMINATION OF EQUIVALENT TREATMENT AND DELISTING

Vitrification is the treatment process currently identified for mixed HLW that exhibits the RCRA characteristics of corrosivity or toxicity. This process seals the waste in a glass matrix. The mixed HLW at INTEC exhibits these characteristics. However, some of the waste processing alternatives and treatment options evaluated in this EIS, such as hot isostatic pressed waste, are not vitrification operations. Before these treated waste forms could be accepted at a HLW repository, DOE would have to obtain a determination of equivalent treatment from the EPA. Such a determination can be granted when it is demonstrated that the proposed treatment will create a waste form that protects human health and the environment, meets applicable treatment standards, and is in compliance with Federal, State, and local requirements. Alternatively, DOE could submit a variance request to EPA, asking to be exempted from the RCRA vitrification standard.

In addition to RCRA characteristic wastes, INTEC's mixed HLW and mixed transuranic waste/SBW contain hazardous constituents that are listed wastes under RCRA. Without delisting, the treated waste forms produced under the various alternatives in this EIS would continue to be regulated as mixed wastes under RCRA.

There are uncertainties associated with obtaining a delisting. These include difficulties associated with sampling and analyzing the waste due to its radioactive properties, quality of data for analyses of wastes with very low concentrations of listed hazardous constituents, and availability of data from treatability studies when some treatment technologies lack technical maturity. Sufficient data on the listed waste and the performance of the final waste form will be required to successfully demonstrate that the waste would not harm human health or the environment. Finally, difficulties associated with delisting may increase if states having sites proposed as locations for management of delisted waste are reluctant to allow delisting due to the resulting loss of regulatory control over the waste.

Not knowing whether a delisting petition will be approved for treated mixed HLW introduces another uncertainty. There is no proposal to accept mixed HLW at the Yucca Mountain site, which DOE is in the process of evaluating as a repository for HLW. It is unclear whether a geologic repository will ever be available to accept mixed HLW.

4.3 Technical Maturity of Alternative Treatment Processes

Production scale experience in the operation of mixed HLW treatment processes is extremely limited. Because of differences in waste characteristics among DOE sites, knowledge gained at one site does not always apply to others. Some proposed mixed HLW treatment processes are only in a preliminary stage of technology development; the viability of others has not been demonstrated beyond the bench scale or pilot stage. Implementation of any of the mixed HLW treatment technologies will require additional research and development work.

4.4 Costs

Although NEPA does not require agencies to address costs in an EIS, Federal agencies should identify the considerations, including factors not related to environmental quality, that are likely to be relevant and important to a decision.

To support the decision process for management of INEEL's HLW, DOE is analyzing costs associated with all treatment and disposal alternatives using several techniques, such as probabilistic cost estimating and establishment of cost ranges for each alternative. Although cost estimates are very useful to the decision-maker, current cost estimates, as analyzed, incorporate some uncertainties for the following reasons:

- The technical maturity of the proposed processes is assumed to be low. More precise construction and operations cost estimates will be developed as the technologies mature.

- Final waste form requirements are not all known for all wastes and could affect some treatment processes and related costs.

- The timeline for waste management extends beyond a target date of 2035, making cost estimates more difficult.

5.0 Areas of Controversy

There are areas relevant to alternatives considered in this EIS, where viewpoints may differ among members of the public, technical experts, the State of Idaho, or DOE. These controversies, described below, may not be resolved in the course of preparing this EIS and issuing a ROD.

5.1 Low-level Waste Disposal Locations

Future disposal locations for DOE's low-level waste have not yet been selected. DOE will specify disposal sites for low-level waste in a ROD that is being developed under the *Final Waste Management Programmatic Environmental Impact Statement* (DOE/EIS-0200). Because the low-level waste fractions resulting from separation of mixed HLW were not in the scope of the *Final Waste Management Programmatic Environmental Impact Statement*, however, DOE has analyzed both onsite and offsite disposal for comparison purposes in this Draft EIS.

Onsite disposal of low-level waste at the INEEL is an area of controversy, as evidenced by public input received on the proposed low-level waste landfill associated with CERCLA cleanup actions at INTEC. If the programmatic ROD for low-level waste specifies the INEEL as a disposal site, further site-specific NEPA analysis will be needed, and opportunities for public involvement will be provided.

5.2 Repository Capacity - Metric Tons of Heavy Metal

Space in the proposed spent nuclear fuel/HLW repository is allocated by MTHM, and DOE has allocated 4,667 MTHM for its HLW. Under DOE's current method of calculating the amount of MTHM in a canister of HLW, however, half of the DOE HLW inventory would not be accepted for disposal in the proposed repository and would have to remain in storage. DOE has not identified the order in which sites that currently manage DOE-owned HLW would send canisters to the repository.

There are other methods for calculating MTHM equivalency that would result in a calculated quantity of MTHM that would be within the current allocation. The State of Idaho has urged DOE not to use the current method for calculating MTHM because, in the State's view, the current method overestimates the MTHM in DOE HLW. Instead, the State advocates that DOE use one of two other approaches to calculating MTHM, either one of which, in the State's view, better reflects the relative risk and actual concentrations of radionuclides in DOE HLW. Under either of the two approaches advocated by the State, DOE would be within the current allocation of DOE HLW for the proposed repository.

DOE discusses the various methods for calculating MTHM equivalency in the *Draft Environmental Impact Statement for a Geologic Repository for the Disposal of Spent Nuclear Fuel and High-level Radioactive Waste at Yucca Mountain, Nye County, Nevada* (DOE/EIS-0250D).

5.3 Differences in Flood Studies

DOE and RCRA facility siting requirements usually restrict construction of waste management facilities within a floodplain. Two studies were completed to evaluate potential flood hazards at INTEC: one by the U.S. Geological Survey and the other by the U.S. Bureau of Reclamation. These analyses show differing results, which DOE is continuing to evaluate. This EIS presents these differing results for public review and comment.

6.0 Alternatives

6.1 Identifying Alternatives

DOE undertook a documented process to identify a reasonable range of alternatives that would satisfy the purpose and need to manage wastes at INTEC. This section summarizes the alternatives selected for detailed analysis in this EIS.

This EIS analyzes the impacts of implementing each of the alternatives during the time frame from 2000 through 2035. Each alternative has a specific time line for associated activities.

The Idaho Settlement Agreement/Consent Order requires DOE to have its mixed HLW ready for shipment to a storage facility or repository outside of Idaho by a target date of 2035. From 2035 through 2095, DOE would no longer be processing waste, but would be shipping and maintaining mixed HLW road-ready for subsequent shipment and would be decommissioning HLW facilities.

DOE is required to maintain controls on radioactive waste or materials under its jurisdiction until such controls are no longer needed. Nevertheless, for the purposes of analysis in this EIS, it is assumed that institutional controls to protect human health and the environment would not be in effect after the year 2095. This assumption is consistent with assumptions in the INEEL *Comprehensive Facility and Land Use Plan* and the planning basis for Waste Area Group 3 at INTEC, under CERCLA. This assumed loss of institutional control means that, at some future time, DOE would no longer control the site and, therefore, would no longer ensure that radioactive doses to the public are within established limits or that actions are taken to reduce dose levels to as low as reasonably achievable.

Further, although accident impacts discussed in Section 3 and 7 of this Summary do not include mitigation, the Federal government is required to respond to any radiological emergency at the INEEL. DOE and other Federal agencies would be available to provide resources to assist in the evaluation of any accident, mitigate potential long-term exposure pathways to humans, and direct subsequent clean-up activities to decontaminate affected areas and reduce radiation levels.

Institutional controls...

are measures DOE takes to limit or prohibit activities that may interfere with operations or result in exposure to hazardous substances at a site. They can take the form of physical measures (such as fences or barriers) or legal and administrative mechanisms (such as land use restrictions or building permits.

Modular Approach

This EIS shows the proposed projects and facilities associated with the waste processing alternatives and treatment options. Projects and facilities are identified individually and can be combined in a building-block fashion to develop other waste processing alternatives. For example, the ion exchange and grouting process used to treat mixed transuranic waste/SBW under the Minimum INEEL Processing Alternative could support other proposed alternatives, where mixed transuranic waste/SBW is treated by the same methods.

6.2 Waste Processing Alternatives

This EIS analyzed the following five waste processing alternatives:

1. No Action
2. Continued Current Operations
3. Separations (with three treatment options)
4. Non-Separations (with three treatment options)
5. Minimum INEEL Processing.

This section describes the alternatives analyzed in this EIS. Diagrams follow the description of each waste processing alternative or treatment option to help clarify the basic processes. DOE developed these alternatives using a modular approach, in which each alternative is comprised of specific projects that are analyzed in this EIS. This approach permits projects within an alternative to be recombined with projects of other alternatives. The resulting creation of hybrid alternatives can increase DOE's flexibility for decision-making.

Table S-1 provides an overview of the modular waste management elements that make up EIS alternatives and options, plus other elements that could be considered in constructing hybrid alternatives and options with respect to mixed HLW treatment technologies, mixed transuranic waste/SBW pretreatment requirements, and post-treatment storage and disposal options.

This EIS tiers from a previous NEPA document, the SNF and INEL EIS, which analyzed and provided the impacts to the environment from continued operation of the calciner on an unpermitted basis.

NO ACTION ALTERNATIVE

NEPA regulations require analysis of a No Action Alternative (Figure S-4) as a baseline for comparison to other alternatives. Under this alternative:

- DOE would place the New Waste Calcining Facility calciner in standby in June 2000. It would not undergo upgrades and no liquid mixed transuranic waste/SBW would be calcined after that date. The New Waste Calcining Facility calciner and bin sets would remain in standby mode indefinitely.
- The High-Level Liquid Waste Evaporator would continue to operate to reduce the liquid mixed transuranic waste/SBW volume and enable DOE to cease use of the five pillar and panel tanks by 2003. Newly generated liquid waste would accumulate in the Tank Farm until 2017, at which time DOE assumes that all remaining tanks would be full.
- Maintenance necessary to protect workers and the environment would continue, but there would be no major upgrades.
- The mixed HLW calcine from Bin Set 1 would be transferred to Bin Set 6 or 7 as discussed in the SNF and INEL EIS, but Bin Set 1 would not be closed.

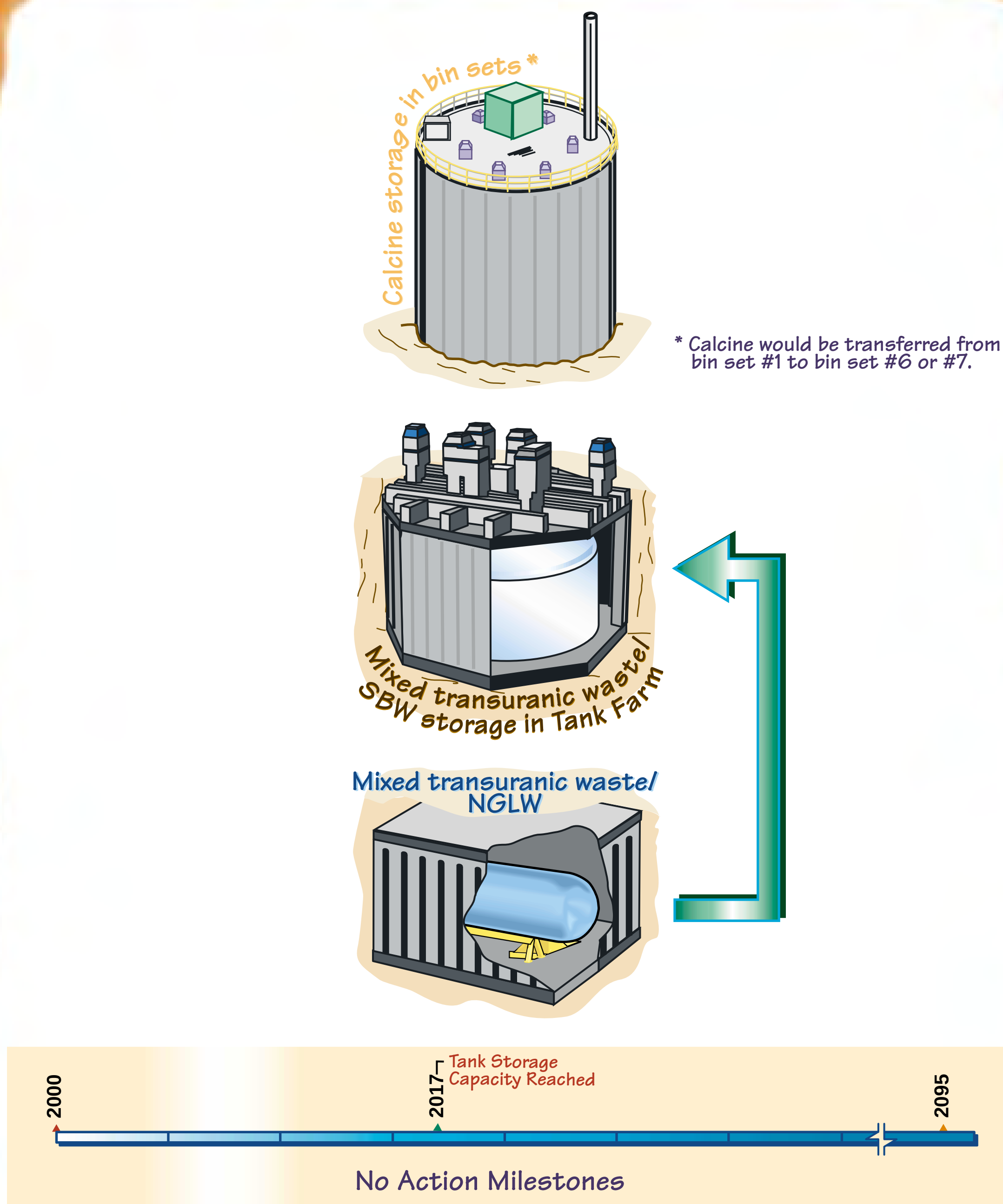
Implementation of this alternative would not enable DOE to cease use of the Tank Farm by 2012 nor make its mixed HLW ready for shipment to a storage facility or repository outside of Idaho by a target date of 2035.

Waste Management Elements

Alternatives and Options	Pre-treatment Storage: As liquid in tanks[1]	Pre-treatment Storage: As calcine in bin sets	Pre-treatment Process Permitted Calciner[2]	Treatment Process: Vitrification borosilicate glass	Treatment Process: Separations CS	Treatment Process: Separations Sr	Treatment Process: Separations TRU	Treatment Process: Grout/cement ceramic HLW	Treatment Process: Grout/cement ceramic LLW	Treatment Process: Grout/cement ceramic TRU	Post-treatment storage on the INEEL	Post-treatment Disposal Destinations: REP HLW	Post-treatment Disposal Destinations: WIPP TRU	Near surface landfill options for LLW: On INEEL	Near surface landfill options for LLW: Off INEEL
NO ACTION ALTERNATIVE	●	●													
CONTINUED CURRENT OPERATIONS ALTERNATIVE		●	●												
SEPARATIONS ALTERNATIVE															
· FULL SEPARATIONS OPTION	●	●		●	●	●	●	●[3]	●		●	●		●	●
· PLANNING BASIS OPTION		●	●	●	●	●	●	●[3]	●		●	●			●
· TRANSURANIC SEPARATIONS OPTION	●	●					●		●	●	●		●	●	●
NON-SEPARATIONS ALTERNATIVE															
· HOT ISOSTATIC PRESSED OPTION		●	●					●			●	●			
· DIRECT CEMENT WASTE OPTION		●	●					●			●	●			
· EARLY VITRIFICATION OPTION	●	●		●				●[3]		●[3, 4]	●	●	●		
MINIMUM INEEL PROCESSING ALTERNATIVE	●	●		●[5]	●		?[6]	?[6]		●[4]	●	●	●	?[6]	?[6]

Cs = cesium, Sr = strontium, HLW = high level waste, TRU = transuranic waste, LLW = low level waste; REP = HLW Repository, WIPP = Waste Isolation Pilot Plant
1. DOE must cease use of five pillar and panel vault tanks by 2003 (these are single-shell tanks with an external secondary contaminant structure that is not expected to meet seismic design criteria). Except for the No Action Alternative, DOE would cease use of the monolithic vault tanks by 2012 to 2016 (these are single-shell tanks with a external secondary contaminant structure that is more likely to meet seismic design criteria than the pillar and panel tanks).
2. Calcination is considered to be pretreatment under RCRA.
3. These waste management elements are currently not included in the alternatives or treatment options but could be considered for development of hybrid alternatives.
4. Liquid mixed transuranic waste/SBW in underground tanks at INTEC is to be treated and sent to WIPP. In the Minimum INEEL Processing Alternative, cesium will be separated and sent to Hanford to be treated with INTEC HLW.
5. Vitrification of calcine will be performed at Hanford, as part of Phase II design decisions.
6. Hanford's Phase II design decisions will determine if these separation technologies will be used and, therefore, what waste fractions will be generated.

TABLE S-1. Modular waste management elements included in EIS alternatives and options .



LEGEND

SBW Mixed transuranic waste/ sodium-bearing waste

NGLW Mixed transuranic waste/ newly generated liquid waste

FIGURE S-4.
No Action Alternative.

CONTINUED CURRENT OPERATIONS ALTERNATIVE

This alternative (Figure S-5) involves calcining the liquid mixed transuranic waste/SBW and adding it to the bin sets, where it would be stored with calcined mixed HLW. Under this alternative:

- The New Waste Calcining Facility calciner would operate until June 2000, when it would be placed on standby pending receipt of a RCRA permit from the State and upgrades to air emission controls required by EPA.
- Upgrades would be completed by 2010. The upgraded facility would operate from 2011 through 2014 to calcine the remaining mixed transuranic waste/SBW, which would be stored in the bin sets. After 2014, the calciner would operate as needed until the end of 2016.
- Beginning in 2015, Tank Farm heels (material left in the tanks after initial processing) and mixed transuranic waste (newly generated liquid waste) would be processed through an ion exchange column. Low-level waste would be grouted for disposal at the INEEL, and transuranic wastes would be disposed of at the Waste Isolation Pilot Plant.
- The mixed HLW calcine in Bin Set 1 would be transferred to Bin Set 6 or 7 as discussed in the SNF and INEL EIS, and Bin Set 1 would be closed in accordance with RCRA regulations. The calcine would be stored in the bin sets indefinitely.

Implementing this alternative would enable DOE to cease use of the Tank Farm by 2014, but it would not enable DOE to make its mixed HLW ready for shipment to a storage facility or repository outside of Idaho by a target date of 2035.

SEPARATIONS ALTERNATIVE

The Separations Alternative comprises three options, each of which uses a chemical separations process, such as solvent extraction, to divide the waste into two final waste fractions-one suitable for disposal in a repository and the other suitable for near-surface disposal at the INEEL or another permitted facility. Separating the radionuclides in the waste into two fractions would decrease the amount of waste that would have to be shipped to a repository, saving needed repository space and reducing disposal costs.

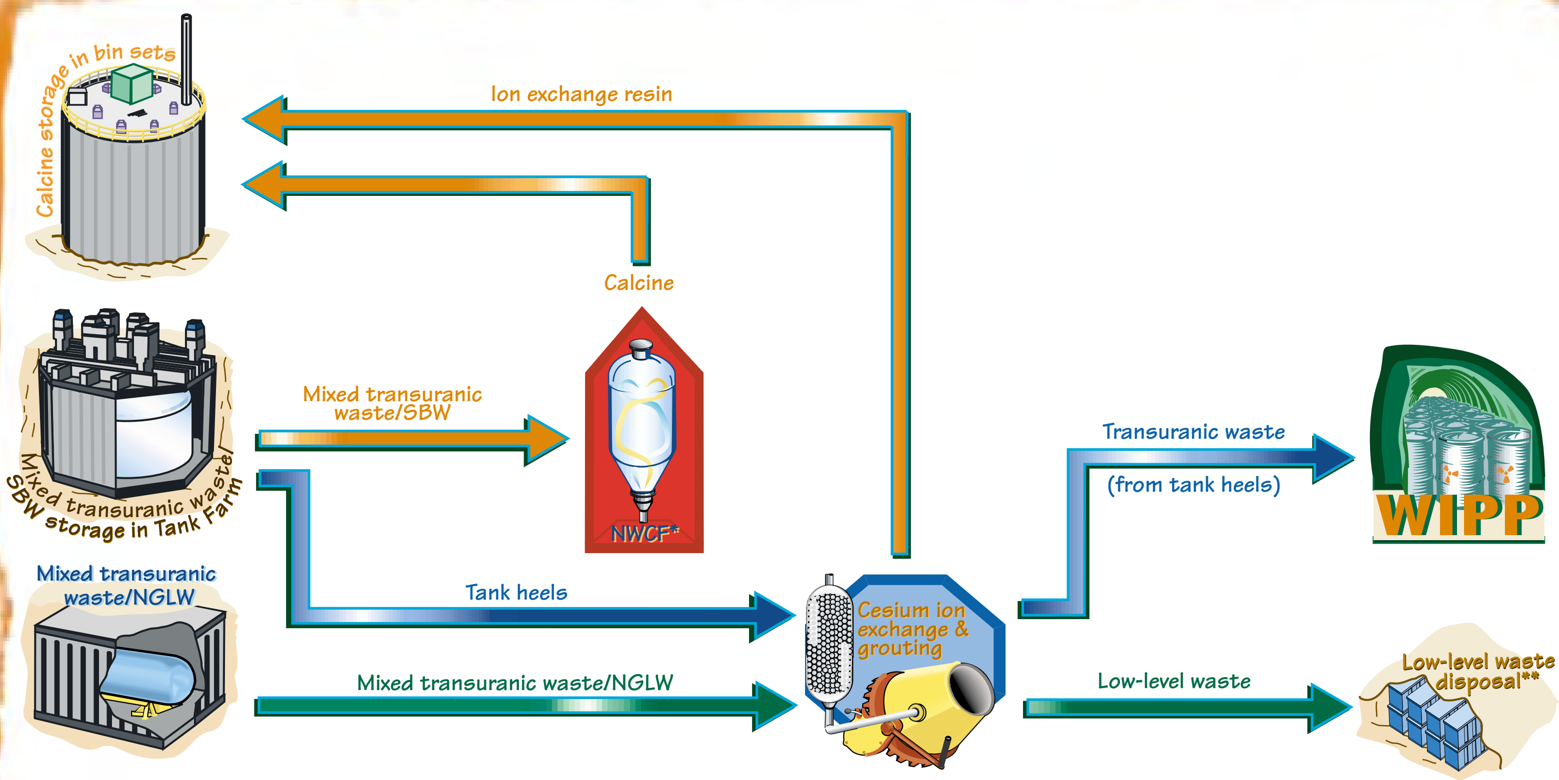
Because HLW would be separated into fractions, DOE would need to determine, before undertaking the separation process, whether any of the fractions are waste incidental to reprocessing that would be more appropriately managed as transuranic or low-level waste rather than HLW. The waste streams that meet the requirements of the waste incidental to reprocessing processes, either by citation or by evaluation, are excluded from the scope of HLW.

The Separations Alternative would include a small incinerator to destroy organic solvents used in the chemical separations process. These solvents would be radioactively contaminated. The project data sheet for the incinerator (Project P118 in Appendix C.6 of this EIS) indicates that the facility would operate approximately 30 days per year. DOE continues to investigate alternative means to treat the organic solvents. The three waste treatment options under the Separations Alternative are described below.

Full Separations Option

This option (Figure S-6) would separate the most highly radioactive and long-lived radioisotopes from both calcined mixed HLW and the liquid mixed transuranic waste/SBW, and vitrify these wastes for disposal in a HLW repository. Under this option:

- DOE would retrieve and dissolve the mixed HLW calcine from the bin sets



LEGEND

LLW	Low-level waste
NGLW	Mixed transuranic waste/ newly generated liquid waste
NWCF	New Waste Calcining Facility
SBW	Mixed transuranic waste/ sodium-bearing waste
WIPP	Waste Isolation Pilot Plant

* Including high-temperature and maximum achievable control technology upgrades.

** Calcine would be transferred from bin set #1 to bin set #6 or #7.

*** Location may be determined by Waste Management Programmatic EIS decision and may be on or off the INEEL.

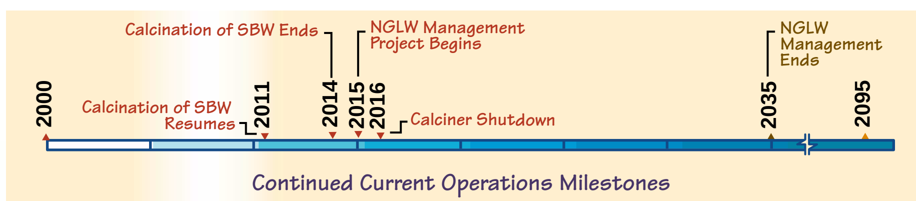
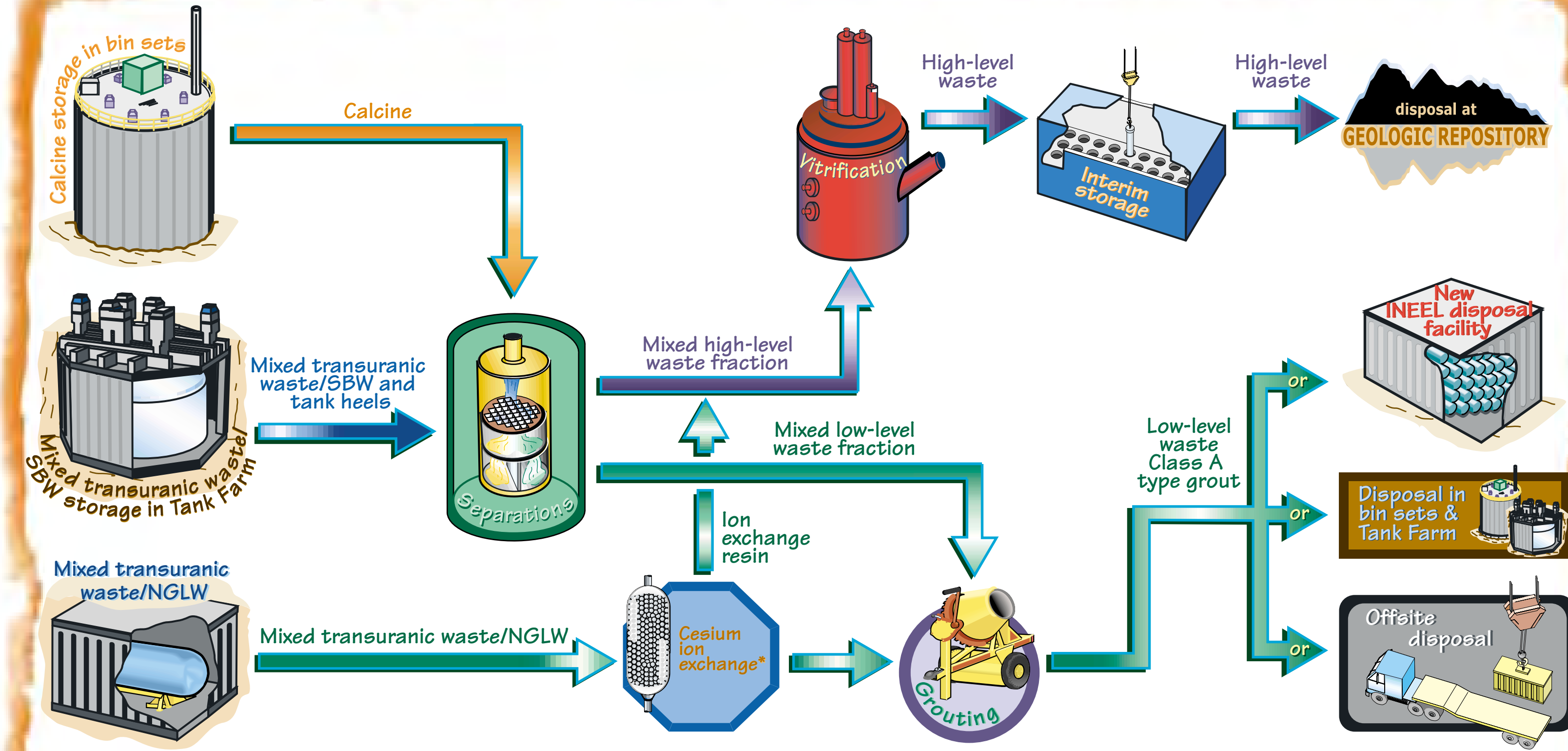
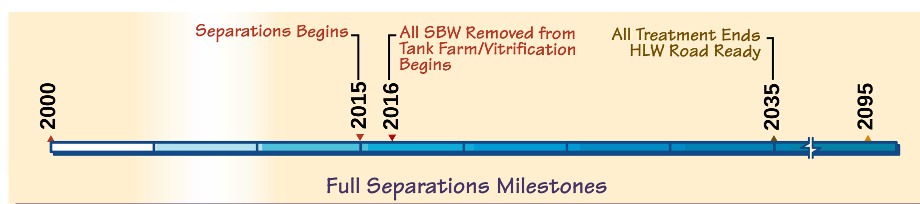


FIGURE S-5.
Continued Current Operations Alternative.





LEGEND

NGLW Mixed transuranic waste/ newly generated liquid waste

SBW Mixed transuranic waste/ sodium-bearing waste

* Some mixed transuranic waste (newly generated liquid waste) may not need to be treated with ion exchange and could be sent directly to the grouting facility.

FIGURE S-6.
Full Separations Option.

and treat the dissolved calcine and mixed transuranic waste/SBW (including tank heels) in a new chemical separation facility to remove cesium, strontium, and transuranics from the process stream. These constituents, termed the "high-level waste fraction," account for most of the radioactivity and long-lived radioactive characteristics of HLW and mixed transuranic waste/SBW.

- The mixed high-level waste fraction would be vitrified in a new facility and stored onsite until shipped to a storage facility or repository.

- The process stream remaining after separating out the mixed high-level waste fraction would be managed as mixed low-level waste. After some pretreatment, the "mixed low-level waste fraction" would be solidified into a grout in a new grouting facility. The concentrations of radioactivity in the grout would result in its classification as Class A type low-level waste, which is suitable for disposal in a near-surface landfill.

- DOE would dispose of the Class A type low-level grout in the empty vessels of the closed Tank Farm and bin sets, in a new INEEL low-level waste disposal facility, or at an offsite low-level waste disposal facility.

Implementing this option would enable DOE to cease use of the Tank Farm by 2016 and make its mixed HLW ready for shipment to a storage facility or repository outside of Idaho by a target date of 2035.

Planning Basis Option

This option (Figure S-7) reflects previously announced DOE decisions and agreements regarding the management of mixed HLW and mixed transuranic waste/SBW with the State of Idaho. It is similar to the Full Separations Option except that, prior to separation, the mixed transuranic waste/SBW would be calcined and stored in the bin sets along with the mixed HLW. Under this option:

- The New Waste Calcining Facility calciner would operate until June 2000, when it would be placed on standby pending receipt of a RCRA permit from the State and upgrades to air emission controls required by EPA.

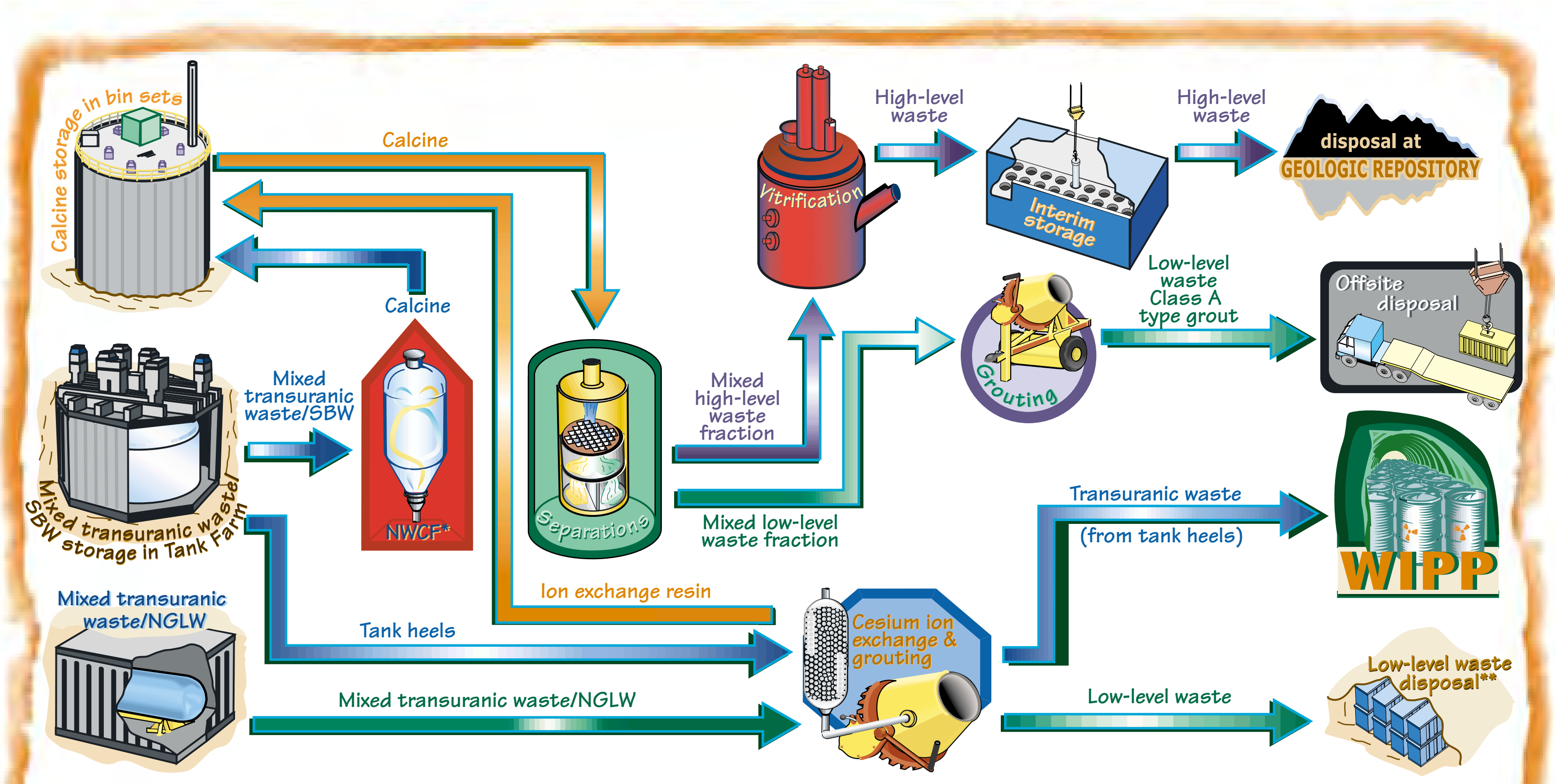
- Upgrades would be completed by 2010 and, under an accelerated schedule, DOE could complete calcining by 2012 and meet the Idaho Settlement Agreement/ Consent Order. An accelerated schedule would require early DOE funding for design activities so that calcine operations could resume in 2010. It would also require modifications to calciner test procedures and would require permits to operate.

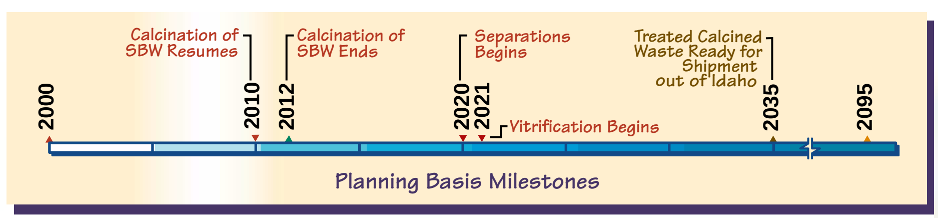
- DOE would calcine the liquid mixed transuranic waste/SBW stored in the Tank Farm and add it to the mixed HLW calcine presently stored in the bin sets.

- Calcine would be retrieved, dissolved, and separated into high-level and low-level waste fractions using the process described in the Full Separations Option.

- The mixed HLW fraction would contain mostly cesium, transuranics, and strontium, which, along with spent resins from the cesium ion exchange columns, account for most of the radioactivity and long-lived radionuclides found in the calcine. This fraction would be vitrified to form HLW glass. The vitrified high-level waste fraction would be placed in a storage facility at the INEEL until shipped to a storage facility or repository outside of Idaho.

- The mixed low-level waste fraction would be denitrated and grouted to form a waste stream that meets the NRC definition of a Class A low-level waste. Under this treatment option, DOE would dispose of the Class A grout only in an offsite low-level waste disposal facility.





LEGEND

NGLW	Mixed transuranic waste/ newly generated liquid waste
NWCF	New Waste Calcining Facility
SBW	Mixed transuranic waste/ sodium-bearing waste
WIPP	Waste Isolation Pilot Plant

* Including high-temperature and maximum achievable control technology upgrades.

** Location may be determined by Waste Management Programmatic EIS decision and may be on or off the INEEL.

FIGURE S-7.
Planning Basis Option.

- Tank heels would be flushed out of the mixed transuranic waste/SBW tanks, and the liquid effluent would be dried, packaged, and sent to the Waste Isolation Pilot Plant for disposal.

Implementing this option would enable DOE to cease use of the Tank Farm by 2012 or 2014 (as discussed above) and enable DOE to make its mixed HLW ready for shipment to a storage facility or repository outside of Idaho by a target date of 2035.

Transuranic Separations Option

There would be no HLW after treatment under this option (Figure S-8). Rather, the resulting waste would more properly be managed as transuranic waste. Under this option:

- DOE would retrieve and dissolve the calcine and would treat the dissolved mixed HLW calcine and liquid mixed transuranic waste/SBW (including tank heels) in a new chemical separations facility. The process would remove transuranics from the process stream, resulting in transuranic and low-level waste fractions.

- The transuranic fraction would be solidified, packaged, and shipped to the Waste Isolation Pilot Plant for disposal.

- The mixed low-level waste fraction would be pretreated and solidified in a new grouting facility along with newly generated liquid waste. Because the low-level waste fraction would contain both cesium and strontium, the concentrations of radioactivity in the grout would be higher than that in the Full Separations Option and would result in its classification as a Class C type low-level waste.

- DOE would dispose of the Class C type grout in the empty vessels of the closed Tank Farm and bin sets, in a new INEEL low-level waste disposal facility, or at an offsite Class C disposal facility.

Implementing this option would enable DOE to cease use of the Tank Farm by 2016 and make the transuranic waste fraction ready for shipment to the Waste Isolation Pilot Plant in New Mexico by a target date of 2035.

NON-SEPARATIONS ALTERNATIVE

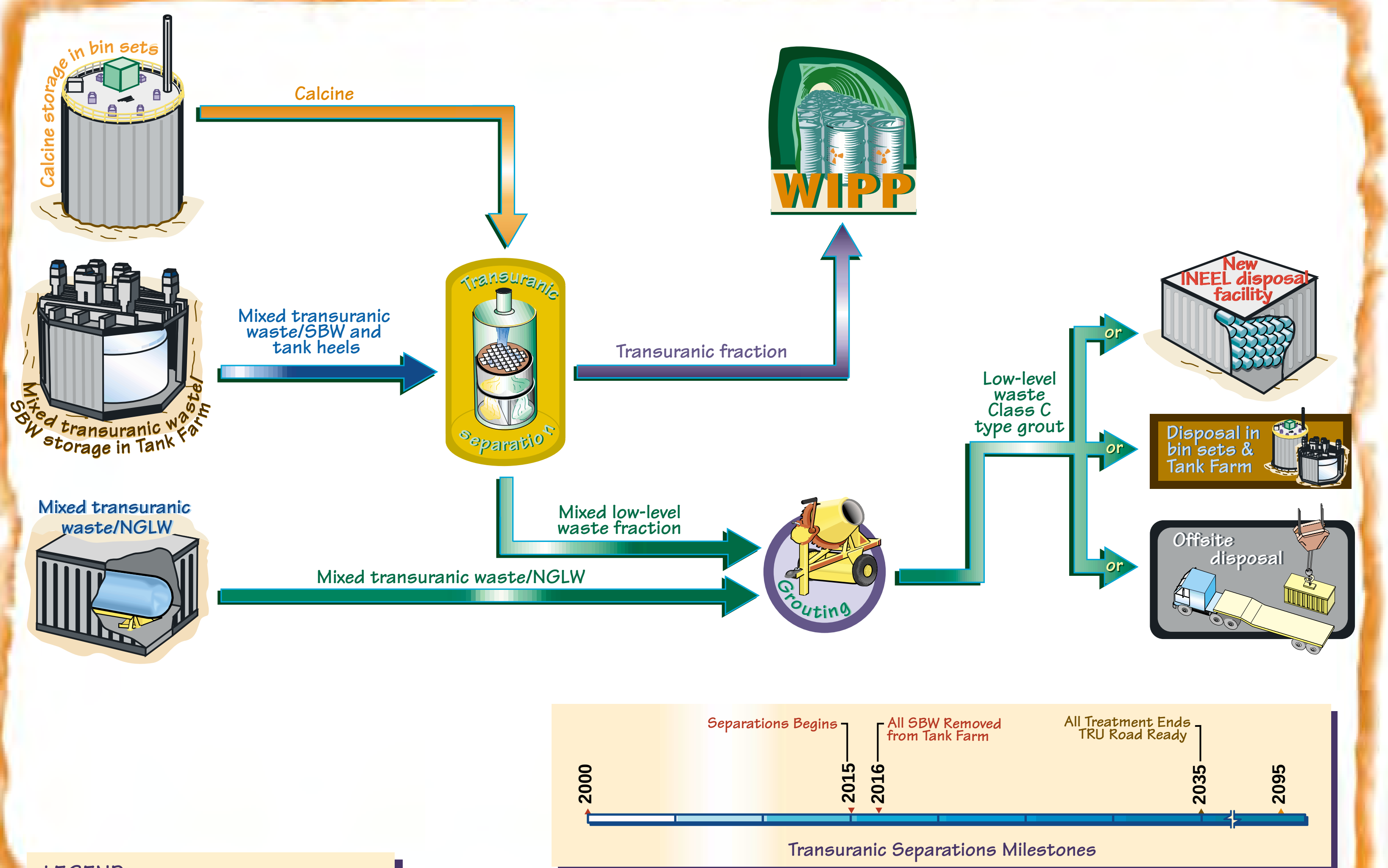
The Non-Separations Alternative would process the mixed HLW and mixed transuranic waste/SBW into an immobilized form by a target date of 2035 for subsequent shipment to a repository. DOE has developed three treatment options for this alternative:

- Hot Isostatic Pressed Waste Option

- Direct Cement Waste Option

- Early Vitrification Option.

In the Hot Isostatic Pressed Waste Option and Direct Cement Waste Option, all the mixed transuranic waste/SBW would be removed from the Tank Farm and calcined in the New Waste Calcining Facility calciner following high-temperature and Maximum Achievable Control Technology upgrades. In the Early Vitrification Option, the mixed transuranic waste/SBW would be retrieved from the Tank Farm and sent directly to a vitrification facility, bypassing calcination.



LEGEND

NGLW	Mixed transuranic waste/ newly generated liquid waste
SBW	Mixed transuranic waste/ sodium-bearing waste
WIPP	Waste Isolation Pilot Plant

FIGURE S-8.
Transuranic Separations Option.

Hot Isostatic Pressed Waste Option

This option (Figure S-9) would calcine the liquid mixed transuranic waste/SBW and add the calcine to the mixed HLW calcine. All calcine would then be converted to an impervious, non-leaching, glass-ceramic waste form with a waste volume reduction of about 50 percent relative to calcined HLW. Under this option:

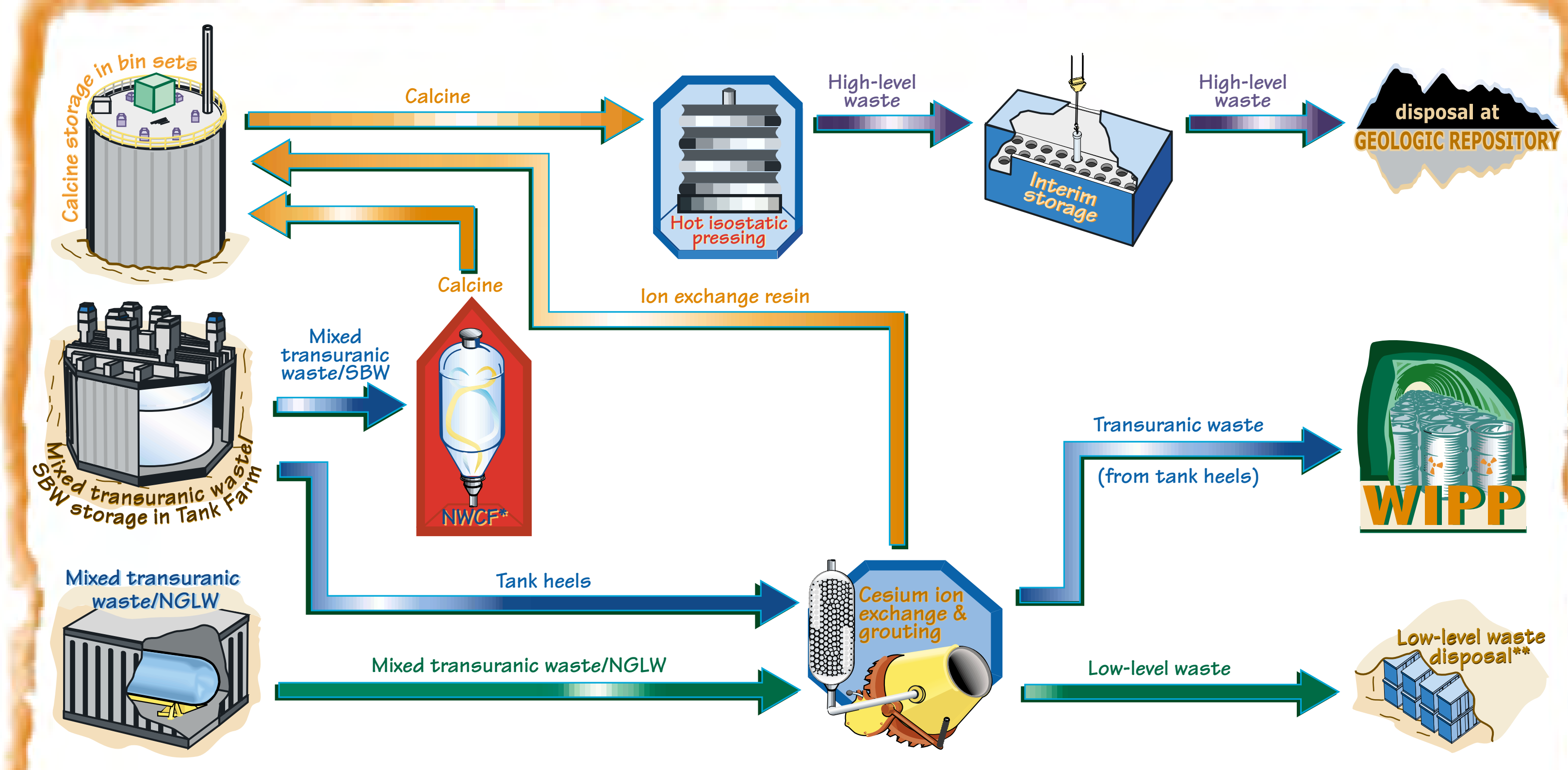
- The New Waste Calcining Facility calciner would operate until June 2000, when it would be placed on standby pending receipt of a RCRA permit from the State and upgrades to air emission controls required by EPA.
- Upgrades would be completed by 2010. The upgraded facility would operate from 2011 through 2014 to calcine the remaining mixed transuranic waste/SBW, which would be stored in the bin sets. After 2014, the calciner would operate as needed until the end of 2016.
- The calcine would be retrieved from the bin sets, blended with silica and titanium powder, and subjected to high temperature and pressure in special cans to form a glass-ceramic product.
- The final product would be packaged in canisters for storage and subsequent disposal in a repository.
- Before 2015, newly generated liquid waste would be concentrated, the effluents stored in new tanks, and then calcined with the mixed transuranic waste/SBW in the New Waste Calcining Facility. Starting in 2015, newly generated liquid waste would be processed through an ion-exchange column, evaporated, and grouted as low-level waste for disposal at the INEEL or offsite.
- Tank heels would be flushed out of the mixed transuranic waste/SBW tanks, and the liquid effluent would be dried, packaged, and sent to the Waste Isolation Pilot Plant for disposal.

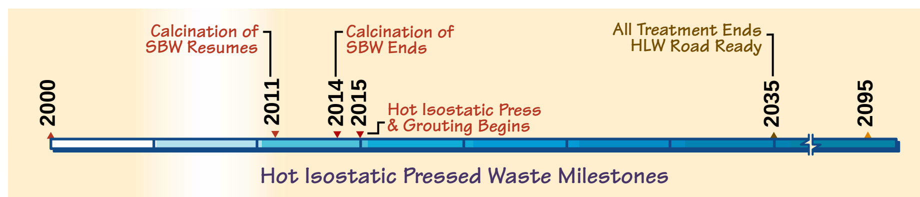
Implementing this option would require a determination of equivalent treatment from EPA for the final waste form (as discussed in Chapter 6 of this EIS). It would enable DOE to cease use of the Tank Farm by 2014 and make its mixed HLW ready for shipment to a storage facility or repository outside of Idaho by a target date of 2035.

Direct Cement Waste Option

This option (Figure S-10) would involve calcining the liquid mixed transuranic waste/SBW and adding the calcine to the mixed HLW calcine. All calcine would be converted to a cement-like solid. Under this option:

- The New Waste Calcining Facility calciner would operate until June 2000, when it would be placed on standby pending receipt of a RCRA permit from the State and upgrades to air emission controls required by EPA.
- Upgrades would be completed by 2010. The upgraded facility would operate from 2011 through 2014 to calcine the remaining mixed transuranic waste/SBW, which would be stored in the bin sets. After 2014, the calciner would operate as needed until the end of 2016.
- The calcine would be retrieved and blended with clay, blast furnace slag, caustic soda, and water and the resulting grout would be poured into stainless-steel canisters. The grout would be cured at elevated temperature and pressure.
- Before 2015, newly generated liquid waste would be concentrated, the effluents stored in new tanks, and then calcined with the mixed transuranic waste/SBW in the New Waste Calcining Facility. Starting in 2015, newly generated liquid waste would be processed through an ion exchange column, evaporated and grouted for disposal as low-level waste at the INEEL or an offsite location.





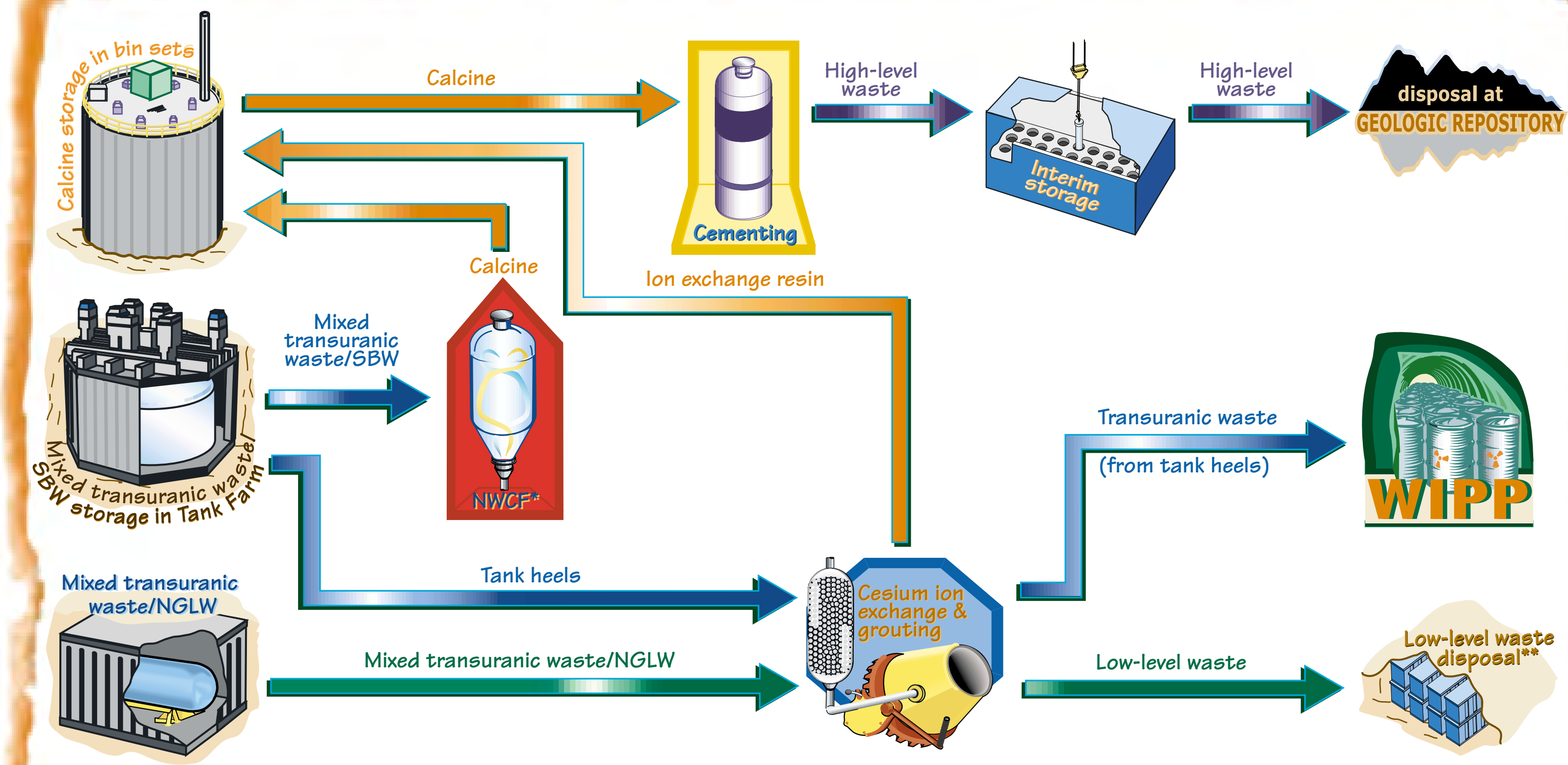
LEGEND

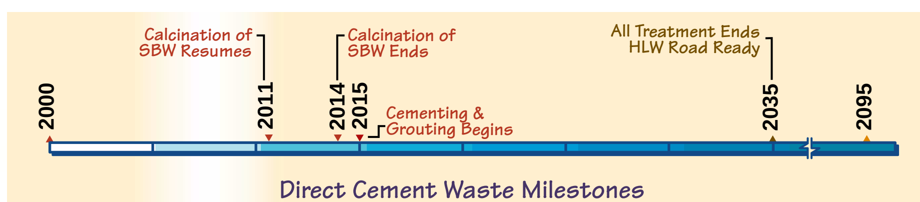
NGLW	Mixed transuranic waste/ newly generated liquid waste
NWCF	New Waste Calcining Facility
SBW	Mixed transuranic waste/ sodium-bearing waste
WIPP	Waste Isolation Pilot Plant

* Including high-temperature and maximum achievable control technology upgrades.

** Location may be determined by Waste Management Programmatic EIS decision and may be on or off the INEEL.

FIGURE S-9.
Hot Isostatic Pressed Waste Option.





LEGEND

NGLW	Mixed transuranic waste/ newly generated liquid waste
NWCF	New Waste Calcining Facility
SBW	Mixed transuranic waste/ sodium-bearing waste
WIPP	Waste Isolation Pilot Plant

* Including high-temperature and maximum achievable control technology upgrades.

** Location may be determined by Waste Management Programmatic EIS decision and may be on or off the INEEL.

FIGURE S-10.
Direct Cement Waste Option.

- Tank heels would be flushed out of the mixed transuranic waste/SBW tanks, and the liquid effluent would be dried, packaged, and sent to the Waste Isolation Pilot Plant for disposal.

Implementing this option would require a determination of equivalent treatment from EPA for the final waste form (as discussed in Chapter 6 of this EIS). It would enable DOE to cease use of the Tank Farm by 2014 and make its mixed HLW ready for shipment to a storage facility or repository outside of Idaho by a target date of 2035.

Early Vitrification Option

This option (Figure S-11) would involve vitrifying both the mixed HLW calcine and the liquid mixed transuranic waste/SBW into a nonleaching, glass-like solid. Under this option:

- DOE would construct a vitrification facility that would process the mixed transuranic waste/SBW from the Tank Farm and the mixed HLW calcine stored in the bin sets into borosilicate glass suitable for disposal in a repository.

- The liquid mixed transuranic waste/SBW (including tank heels) and mixed HLW calcine would be treated in separate vitrification campaigns.

- Liquid mixed transuranic waste/SBW would be blended with one type of glass frit to form a slurry that would be fed to the melter. Glass produced from the liquid mixed transuranic waste/SBW would be disposed of at the Waste Isolation Pilot Plant as remote-handled transuranic waste.

- Mixed HLW calcine would be blended with another type of glass frit and fed to the melter in a dry state. Glass produced from the mixed HLW calcine would be poured into stainless steel canisters and safely stored until shipped to a HLW storage facility or repository.

- Newly generated liquid waste would be sent directly to the melter, bypassing calcination. Glass produced from newly generated liquid waste would be disposed of at the Waste Isolation Pilot Plant.

Implementing this option would enable DOE to cease use of the Tank Farm by 2016 and make its mixed HLW ready for shipment to a storage facility or repository outside of Idaho by a target date of 2035.

MINIMUM INEEL PROCESSING ALTERNATIVE

The Minimum INEEL Processing Alternative (Figure S-12) represents the minimum amount of processing at the INEEL that would still satisfy the purpose and need described previously. This alternative could substantially reduce the amount of construction, handling, and processing of HLW at the INEEL. This alternative presents a representative analysis of offsite transport of mixed HLW calcine followed by a return of treated HLW and low-level waste to the INEEL for storage pending disposal. Under this alternative:

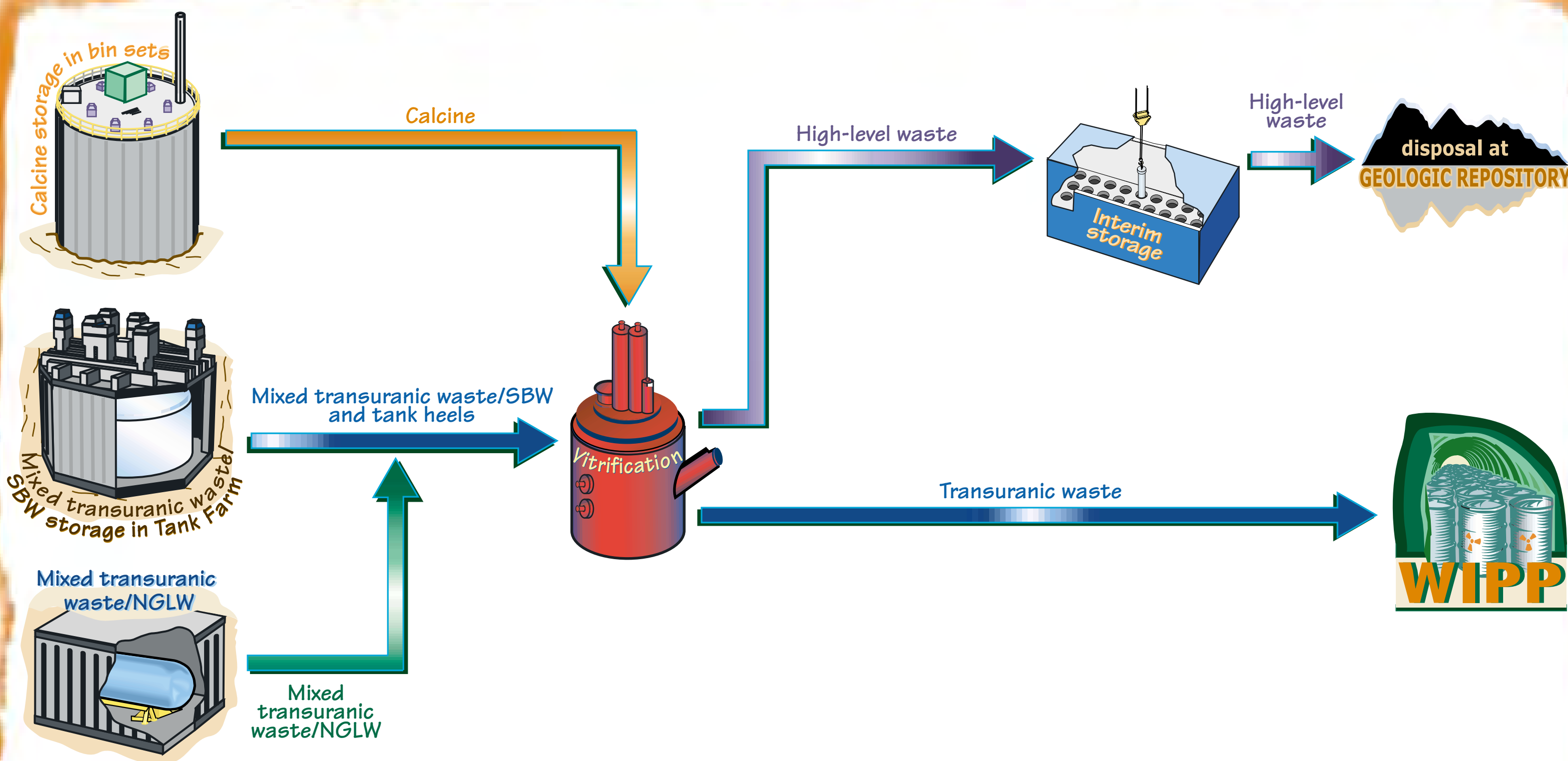
- DOE would retrieve and transport the mixed HLW calcine to a packaging facility, where it would be placed into shipping containers.

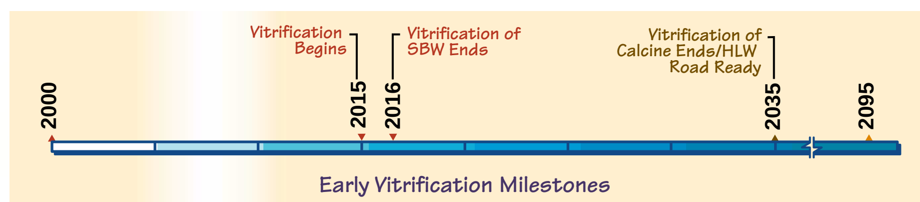
- The containers would then be shipped to DOE's Hanford Site in Richland, Washington, where the mixed HLW calcine would be dissolved and separated into high-activity and low-activity fractions.

- Each fraction would be vitrified. For purposes of analysis, DOE assumes the treated HLW and low-level waste are returned to the INEEL. (Alternatively, the treated wastes could be shipped directly to appropriate offsite facilities rather than returning to the INEEL.)

- The treated HLW would be stored until it is shipped to a storage facility or repository.

- The treated low-level waste would be disposed of in an INEEL facility or

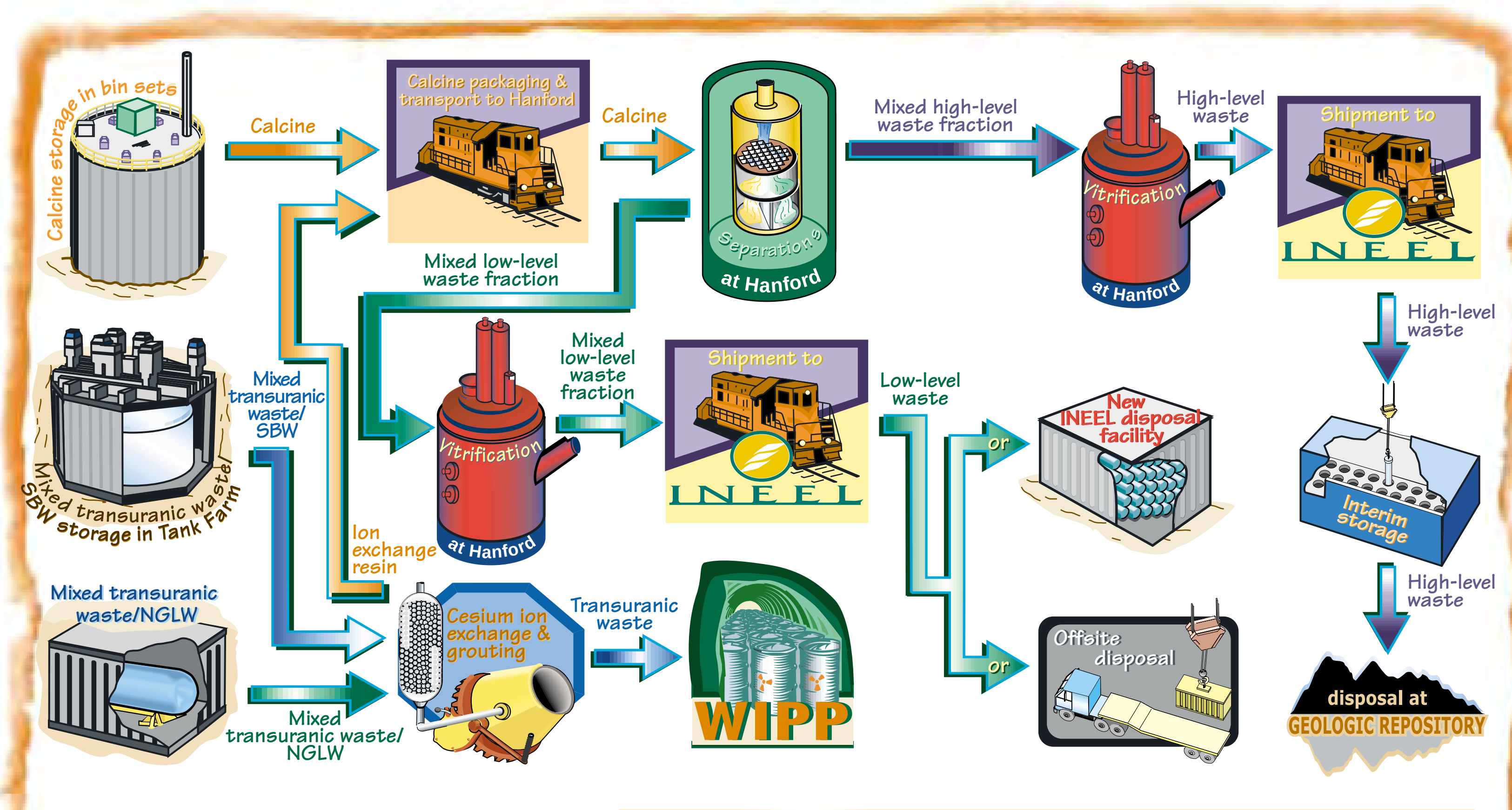




LEGEND

NGLW	Mixed transuranic waste/ newly generated liquid waste
NWCF	New Waste Calcining Facility
SBW	Mixed transuranic waste/ sodium-bearing waste
WIPP	Waste Isolation Pilot Plant

FIGURE S-11.
Early Vitrification Option.



LEGEND

NGLW	Mixed transuranic waste/ newly generated liquid waste
SBW	Mixed transuranic waste/ sodium-bearing waste
WIPP	Waste Isolation Pilot Plant

FIGURE S-12.
Minimum INEEL Processing Alternative.

shipped to an offsite low-level waste disposal facility.

- The mixed transuranic waste/SBW and newly generated liquid waste, including tank heels, would be retrieved, filtered, and transported to a treatment facility on the INEEL, where it would be processed through an ion exchange column to remove cesium. The grout would be packaged in 55-gallon drums and transported to the Waste Isolation Pilot Plant for disposal as contact-handled transuranic waste. This activity would be completed by 2012, allowing DOE to cease use of the Tank Farm by that date. The ion exchange bed material (containing the cesium) would be transported to Hanford along with the mixed HLW calcine for vitrification at a later date.

DOE has awarded a phased contract to privatize certain portions of the Tank Waste Remediation System at the Hanford Site. In the year 2000, DOE will decide whether to proceed with the construction and operations of Hanford Phase I treatment facilities. Current plans are for the Phase I facilities to operate from 2006 through 2018 and process about 10 percent of the total mass (25 percent of the total radioactivity) of the Hanford Site tank waste. The Phase I facilities would not be designed to accommodate HLW from offsite sources.

Assuming Hanford Phase I is successful, the Phase I facilities could be expanded, or additional facilities could be built for a Phase II treatment option capable of processing the remainder of the Hanford tank wastes and the INEEL mixed HLW calcine. Since a decision on proceeding with conceptual design of the Phase II Hanford vitrification facilities is well in the future, DOE cannot determine at this time whether treating INEEL calcined mixed HLW in Hanford facilities would be technically feasible or cost effective. Even if it were feasible to process INEEL mixed HLW at the Hanford Site, DOE would have to consider the potential regulatory implications and any impacts to DOE commitments regarding completion of Hanford tank waste processing. If DOE decides to pursue the Minimum INEEL Processing Alternative, supplemental NEPA documentation will be prepared in due course on alternatives associated with treatment of INEEL mixed HLW calcine at the Hanford Site.

Implementing this alternative would enable DOE to cease use of the Tank Farm by 2012 and make its mixed HLW ready for shipment to a storage facility or repository outside of Idaho by a target date of 2035.

6.3 Facility Disposition Alternatives

The waste processing alternatives and treatment options described in this EIS do not include disposition options for specific facilities except when they are integral to implementing an option (e.g., disposal of Class A type or Class C type low-level waste grout in the Tank Farm and bin sets). The facility disposition alternatives address the final risk component of the Proposed Action to disposition the INEEL facilities used to treat and manage HLW when their missions are completed. The facility disposition alternatives are as follows:

1. No Action
2. Clean Closure
3. Performance-Based Closure
4. Closure to Landfill Standards
5. Performance-Based Closure with Class A Grout Disposal
6. Performance-Based Closure with Class C Grout Disposal.

Implementing any of the waste processing alternatives would involve a variety of different facilities; consequently, the facility disposition alternatives are modular and can be integrated into any waste processing alternative or option. Chapter 5 of this EIS identifies the major new facilities (if any) and existing facilities that would be needed for each waste processing alternative, all of which would be closed under all waste processing alternatives and treatment options in accordance with regulatory requirements.

The general time frame for waste processing actions is 2000 through 2035. From 2035 through 2095 (the assumed end of institutional control for the INEEL), DOE would be implementing facility disposition actions, maintaining road-ready waste pending shipment to a repository, and shipping waste. Where there may be post-closure impacts (i.e., to health and safety or ecological resources), the analysis of impacts is extended for 10,000 years. This time frame is consistent with the period of analysis for long-term impacts in other DOE EISs. It also represents the longest time period for the performance standards in potentially applicable regulations and DOE Orders governing facility disposition activities.

The EIS considers the requirements and constraints on each alternative in order to comply with environmental regulations and agreements. Applicable requirements include those under the Atomic Energy Act, the Nuclear Waste Policy Act, RCRA, CERCLA, a 1992 Notice of Noncompliance Consent Order (plus modifications), and the Idaho Settlement Agreement/ Consent Order.

RCRA Closure of Facilities

The facility disposition analysis considers closure of existing facilities and those facilities that would be constructed for HLW storage, treatment, and disposal. However, because of technological, economic, and health risks, it may not be practical to remove all residual material from the tanks, decontaminate all equipment, and remove all surrounding soils to achieve clean closure. RCRA regulations state that if all contaminated system components, structures, and equipment cannot be adequately decontaminated, then tank systems must be closed in accordance with the closure and post-closure requirements that apply to landfills.

CERCLA Coordination

The CERCLA program divides the INEEL into 10 Waste Area Groups. INTEC, where the facility disposition action would occur under this EIS, is in Waste Area Group 3. Except for the contaminated soils surrounding the Tank Farm, DOE has completed a comprehensive evaluation for the cleanup program at INTEC under the requirements of CERCLA. Under the CERCLA cleanup program, the Federal government and the State of Idaho have made decisions in the Operable Unit 3-13 ROD , which was approved in October 1999, regarding disposition of contaminated soils and other environmental media. While the CERCLA cleanup program is not the subject of this EIS, decisions regarding disposition of HLW facilities have been and will continue to be coordinated with decisions under the CERCLA program.

Facility Disposition Identification

DOE used the following systematic process to identify the existing facilities that would be analyzed in detail in this EIS:

1. Performed a complete inventory of all INTEC facilities

2. Identified which of these facilities are considered HLW facilities or could be affected by HLW programs

3. Determined which facility disposition alternatives would be most appropriate for analysis for each facility, based on the potential characteristics of the residual waste

DOE included the Tank Farm and bin sets as part of the analysis of all six facility disposition alternatives, because they would contain the majority of the residual radioactivity and would contribute the most to residual risk. Residual risk would vary with the different facility disposition alternatives.

For purposes of bounding the analysis, DOE assumed that it would use a single facility disposition alternative (i.e., Closure to Landfill Standards) for closure of most other HLW facilities. The residual radioactive or hazardous material associated with these facilities would be much less than that of the Tank Farm and bin sets, and the overall residual risk at the INEEL would not increase substantially due to the contribution from these facilities. For new HLW facilities, DOE analyzed the Clean Closure alternative. This assumption is based on the DOE requirement that new HLW facilities must be designed so they can be easily decontaminated.

NO ACTION ALTERNATIVE

Under the No Action Alternative, DOE would not close its HLW facilities at INTEC. Nevertheless, over the period of analysis from 2000 to 2035, many of the facilities could be placed in an industrially safe condition (deactivated). Surveillance and maintenance of HLW facilities would be routinely performed to ensure the safety and health of workers and the public until 2095. For purposes of analysis, DOE assumed that institutional controls to protect human health and the environment would not be in effect after 2095.

CLEAN CLOSURE ALTERNATIVE

Under this alternative, all the hazardous wastes and radiological contaminants, including contaminated equipment, would be removed from the facility or treated so the hazardous and radiological contaminants would be indistinguishable from background concentrations. Clean Closure may require total dismantlement and removal of facilities. Use of the facilities (or the facility sites) after Clean Closure would present no risk to workers or the public from hazardous or radioactive constituents.

PERFORMANCE-BASED CLOSURE ALTERNATIVE

Under this alternative, closure methods would be determined on a case-by-case basis, depending on risk. For radiological and chemical hazards, Performance-Based Closure would be in accordance with risk-based criteria. Most above-grade structures would be razed and most below-grade structures would be decontaminated and left in place. Any remaining facilities would be decontaminated such that residual waste and contaminants would comply with applicable requirements to protect workers and the public. Post-closure monitoring might be required on a case-by-case basis.

CLOSURE TO LANDFILL STANDARDS ALTERNATIVE

Under this alternative, facilities would be closed in accordance with State of Idaho and Federal requirements specified in regulations for closure of landfills. Closure to Landfill Standards is intended to protect the health and safety of the workers and the public from release of contaminants from the facility. This could be accomplished by stabilizing waste residuals with grout, installing an engineered cap over the facility, establishing a groundwater monitoring system, and providing post-closure monitoring and care of the waste containment system, depending on the type of contaminants.

PERFORMANCE-BASED CLOSURE WITH CLASS A GROUT DISPOSAL ALTERNATIVE

This is one of two alternatives that would accommodate the potential use of the Tank Farm and bin sets for disposal of the low-level waste fraction. The facility would be closed as described for the Performance-Based Closure Alternative. Following completion of those activities, the Tank Farm or bin sets would be used to dispose of low-level waste Class A type grout produced under the Full Separations Option.

PERFORMANCE-BASED CLOSURE WITH CLASS C GROUT DISPOSAL ALTERNATIVE

This alternative would also accommodate the potential use of the Tank Farm and bin sets for disposal of the low-level waste fraction. The facility would be closed as described above for the Performance-Based Closure Alternative. Following completion of those activities, the Tank Farm or bin sets would be used to dispose of low-level waste Class C type grout produced under the Transuranic Separations Option.

7.0 Results of Analysis

7.1 Overview

Implementing the alternatives considered in this EIS could result in impacts to public health and the environment from processing HLW and dispositioning associated facilities at INTEC. The purpose of analyzing these potential impacts is to give decision-makers and the public information they can use to understand and compare the environmental consequences of alternative courses of action.

A comparison of impacts for the key areas of interest discussed in this section is provided in Table S-2 located at the back of this section. The table presents analysis results for waste processing alternatives, facility disposition alternatives, and cumulative impacts.

Areas of Environmental Analysis

- *Land Use*
- *Socioeconomics*
- *Cultural*
- *Aesthetics and Scenic*
- *Geology and Soils*
- *Air*
- *Water*
- *Ecology*
- *Traffic and Transportation*
- *Health and Safety*
- *Environmental Justice*
- *Utilities and Energy*
- *Waste and Materials*
- *Accidents*

For this EIS, DOE assessed the environmental impacts for 14 areas of interest for the five waste processing and six facility disposition alternatives. In nine of the 14 areas, the results indicate little or no impacts as follows:

Land Use – Estimated land use would be consistent with the INEEL Comprehensive Facility and Land Use Plan. The maximum additional amount of land that would be converted to industrial use at the INEEL would be 22 acres. At Hanford, up to 52 additional acres could be converted to industrial use in the 200 East Area. At both sites, this additional disturbance would be less than 1 percent of the area currently used for industrial purposes.

Socioeconomics – DOE anticipates that total INEEL employment will continue to decline. Future changes in employment as a result of activities described in this EIS would be within the normal range of INEEL workforce changes, and would represent a continuation of current site employment that might otherwise be lower. Other activities at INTEC not related to alternatives discussed in this EIS would take place intermittently and would also be within normal workforce fluctuations.

Cultural – The majority of reasonably foreseeable INEEL actions, including waste processing alternatives and remediation of contaminated sites, would occur in previously disturbed areas. Mitigation measures are in place to help prevent impacts to cultural resources that may be discovered during site development.

Aesthetics and Scenic – DOE would undertake construction activities associated with any waste processing alternative or treatment option in a manner compatible with the general INEEL setting and with the Bureau of Land Management Visual Resource Management class designation for the area. Operational impacts for any of the alternatives and options are estimated to be small.

Geology and Soils – Geologic materials (soils and gravel) required for any of the waste processing or facility disposition alternatives would be obtained from existing on-site sources. DOE estimates that impacts to geologic resources would be small.

Water Usage – Total INEEL water consumption from reasonably foreseeable activities, including waste processing activities, could increase by 188.8 million gallons per year, of which 105.6 million gallons would be associated with implementing the EIS waste processing alternative having the greatest impact. This usage represents an increase of 12 percent of water withdrawn by the INEEL from the Snake River Plain Aquifer relative to current usage. Total INEEL water use would remain at less than 1 percent of the estimated volume of water passing under the site.

Ecology – DOE estimates that impacts to ecological resources for the waste processing and facility disposition alternatives would be small and there would be no impact to threatened or endangered species or critical habitats. Most activities would take place in heavily developed industrial areas that have marginal value as wildlife habitat.

Noise generated by INEEL operations is generally not detectable offsite because all major facilities are located at least 3 miles from the site boundary. Overall noise levels resulting from transportation onsite during construction and operations for all waste processing alternatives and treatment options are expected to be lower than the baseline noise level analyzed for the SNF and INEL EIS.

Environmental Justice – Executive Order 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*, directs Federal agencies to work to achieve "environmental justice" by identifying and addressing the potential for their activities to cause disproportionately high and adverse impacts to minority or low-income populations.

For this EIS, DOE reviewed proposed projects, facilities, and transportation associated with the alternatives. 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 or low-income communities within 50 miles of INTEC.

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 waste processing alternatives and treatment options, under all alternatives, would not result in high and adverse impacts on the population as a whole. Further, DOE did not identify means for minority or low-income populations to be disproportionately affected. Accordingly, no disproportionately high and adverse impacts would be expected for minority or low-income populations.

Utilities and Energy – DOE estimates that the annual use of fossil fuel and electricity would be highest under the Separations Alternative options. Annual usage of electricity in megawatts per year could increase by 60 percent relative to the 1996 INEEL baseline. This increase and the baseline together are less than one-third of the INEEL electric system capacity.

Populations

Minority: individuals who are American Indian or Alaskan Native; Asian or Pacific Islander; Black, not of Hispanic origin; or Hispanic. For this EIS, a minority population is one in which the minority population exceeds 50 percent, or the minority population percentage of the affected area is meaningfully greater than the minority population percentage in the general population.

Low income: individuals with an income below the poverty level defined by the U.S. Bureau of the Census. A low-income population is one in which 25 percent or more of the persons in the population live in poverty.

7.2 Impacts of the Waste Processing Alternatives

Most of the actions to implement the five waste processing alternatives would occur before 2035, as would many of their associated impacts. After 2035, environmental impacts would result mainly from stored waste, including treated HLW and residual contaminants left in the facilities, and from the transporting of treated wastes. In five of the 14 areas analyzed, the results indicate some impacts, although they are generally small.

These areas include air, traffic and transportation, health and safety, waste and materials, and facility accidents.

AIR

Impacts to air resources could result from construction activities and normal operations for the waste processing alternatives and treatment options.

Construction

The primary impact of construction activities would involve the generation of fugitive dust, which would include respirable particulate matter. While dust generation would be mitigated by the application of water and soil additives, relatively high levels of particulates could still occur in localized areas. For construction-related impacts for the proposed waste processing alternatives and treatment options, annual averages are estimated to fall between 1 and 5 percent of the applicable standard for respirable particulate matter at the INEEL boundary nearest to the construction site, and at public road locations. Nitrogen dioxide levels are estimated to be between 0.3 and 0.7 percent of the applicable standard at the INEEL boundary nearest to the construction site and at public road locations, respectively.

Construction activities at the Hanford Site would produce nitrogen dioxide levels that are estimated to be 8 percent of the Federal and State of Washington ambient air standard. All other pollutants are estimated to be less than 1 percent of applicable standards. Respirable particulate matter is not expected to exceed 16 percent of Federal or state standards.

Normal Operations

Waste processing and related activities would result in emissions through filtered exhaust systems at INTEC. Figure S-13 compares total radiological air impacts (in terms of LCF) to the offsite maximally exposed individual for the waste processing alternatives and treatment options. The highest annual dose to the surrounding population (persons residing within a 50-mile radius of INTEC) is estimated be 0.1 person-rem per year or less under all alternatives.

The estimated total collective radiological impact to the surrounding population is compared in Figure S-14 for each waste processing alternative. Offsite doses would be mainly attributable to the intake of iodine-129 through the food-chain pathway. DOE estimates that the maximum impacted noninvolved INEEL worker would receive about 0.0001 millirem per year under the Planning Basis Option or Minimum INEEL Processing Alternative. The highest dose to an offsite individual at the Hanford Site is estimated to be 0.00003 millirem per year.

Nonradiological air emissions would be highest for the Full Separations, Planning Basis, and Hot Isostatic Pressed Waste Options. These emissions would result from fossil fuel consumption to meet the energy requirements (steam) of the waste processing facilities. All levels would be well below applicable standards. Prevention of Significant Deterioration regulations require that agencies evaluate new projects to see if they increase air pollution levels. These regulations apply to radioactive and nonradioactive materials. The Planning Basis Option poses the highest impact due to emissions of sulfur dioxide, which would use up 53 percent of the release increment allowed for this pollutant in a 24-hour period under the regulations. This includes baseline sources and planned future projects. Concentrations would be well within allowable limits for all waste processing alternatives.

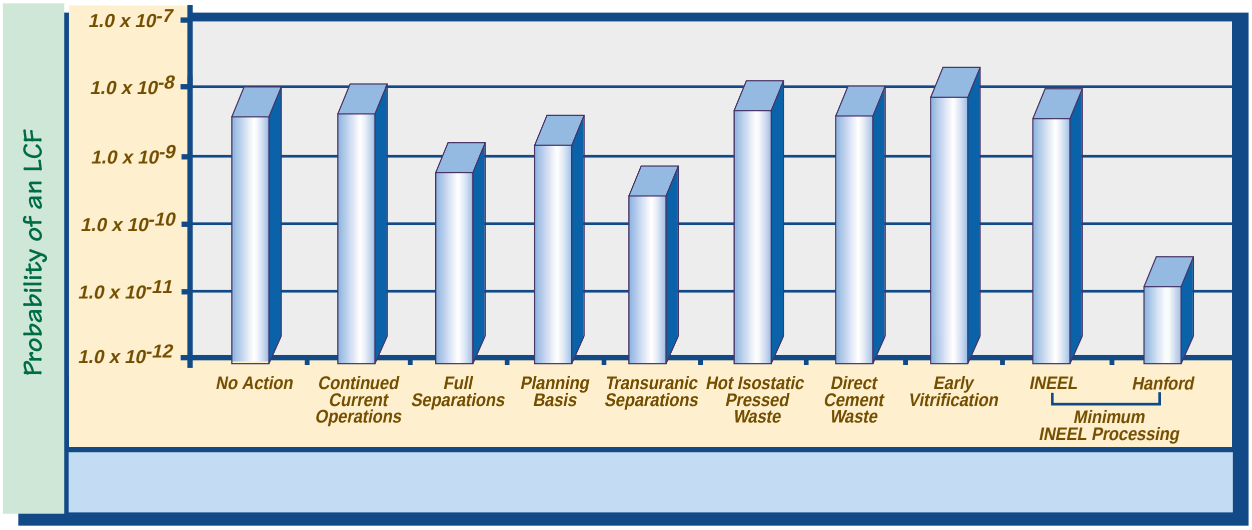


FIGURE S-13.
Estimated total probability of an LCF to the offsite maximally exposed individual due to radiological air emissions by waste processing alternative or treatment option (during normal operations, approximately for the years 2000 to 2035).

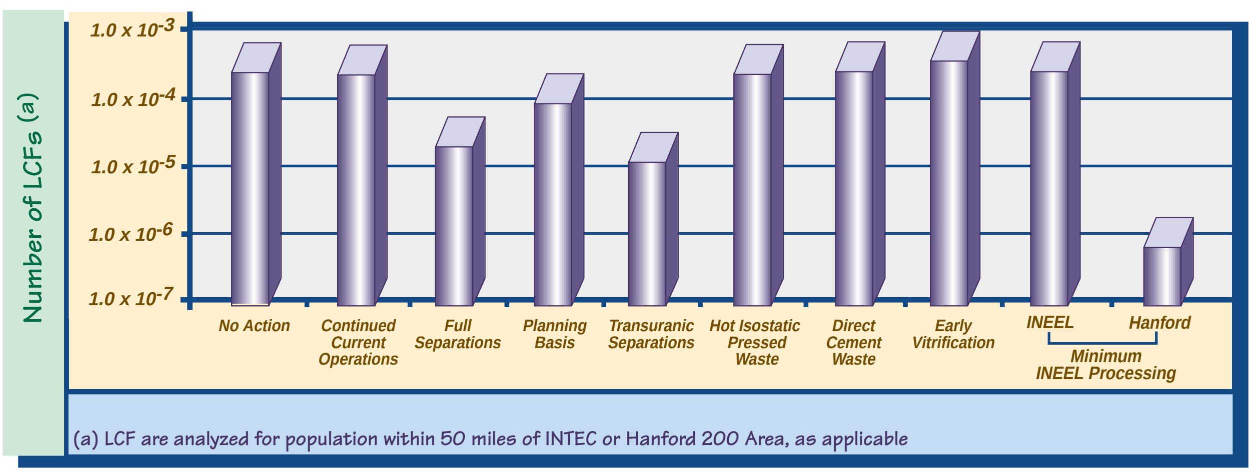


FIGURE S-14.
Estimated total LCF to the population within 50 miles due to radiological air emissions by waste processing alternative or treatment option (during normal operations, approximately for the years 2000 to 2035).

Emissions of fine particulate matter and nitrogen dioxide can also affect visual resources. Conservative screening-level analyses have been applied to estimate potential impacts related to visibility degradation at the Craters of the Moon wilderness area, about 12 miles southwest of the INEEL. The results indicate that there would be no perceptible changes in contrast for all alternatives, but potential changes related to color shift could result. These would be well within the acceptable visibility criteria for a Class I area.

TRAFFIC AND TRANSPORTATION

Transportation is a factor in alternatives that involve construction and operation of facilities and the shipment of waste both on and off-site. Transportation impacts could result from radiation exposure during normal, incident-free transportation or from accidents, as well as from nonradiological vehicle-related accidents.

During incident-free transportation of radioactive waste, the population living and traveling along the transport route and the transportation workers would be exposed to radiation from the shipments. The total LCF for the shipments would be the sum of the estimated number of radiation-related LCF for transportation workers and the general population. Figure S-15 presents and compares the estimated LCF to transportation workers and the public for truck transportation of radioactive materials over the life of the alternatives. Rail shipment impacts for transportation of radioactive materials are about 10 times lower than truck transportation-related impacts and are presented in this EIS.

Figure S-16 compares the estimated total fatalities due to vehicle accidents assumed to occur during shipment of radioactive wastes.

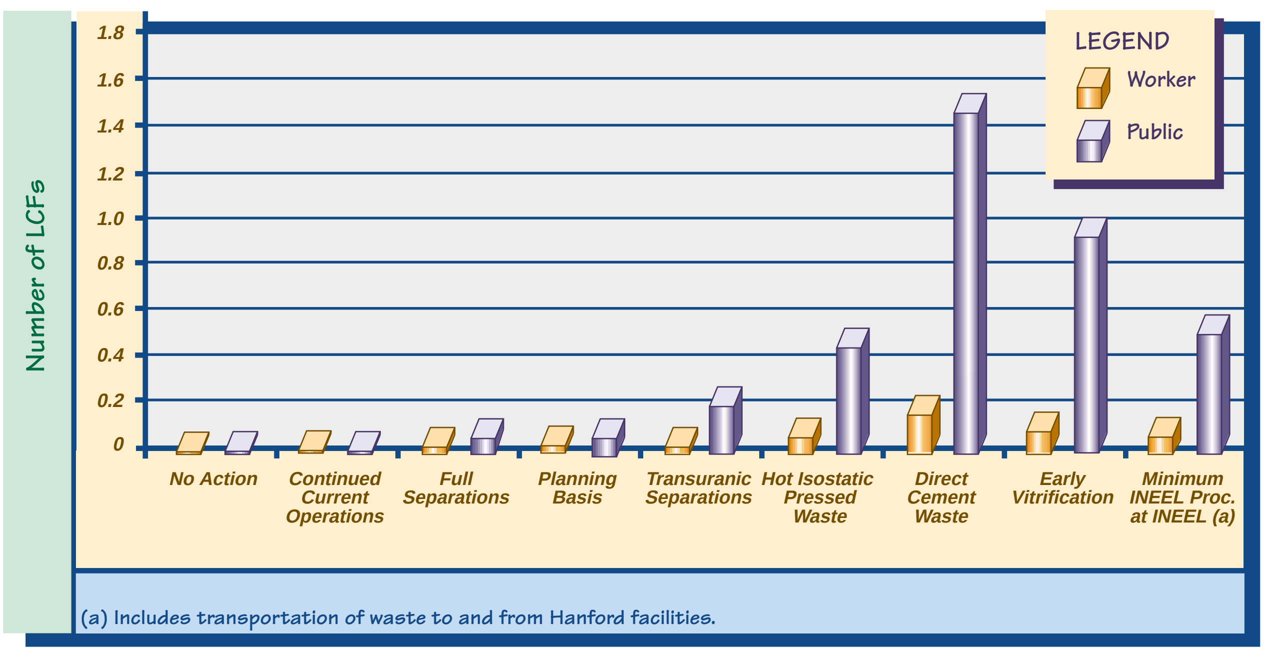


FIGURE S-15.
Estimated cargo-related incident-free impacts from truck transportation (approximately for the years 2000 to 2035).

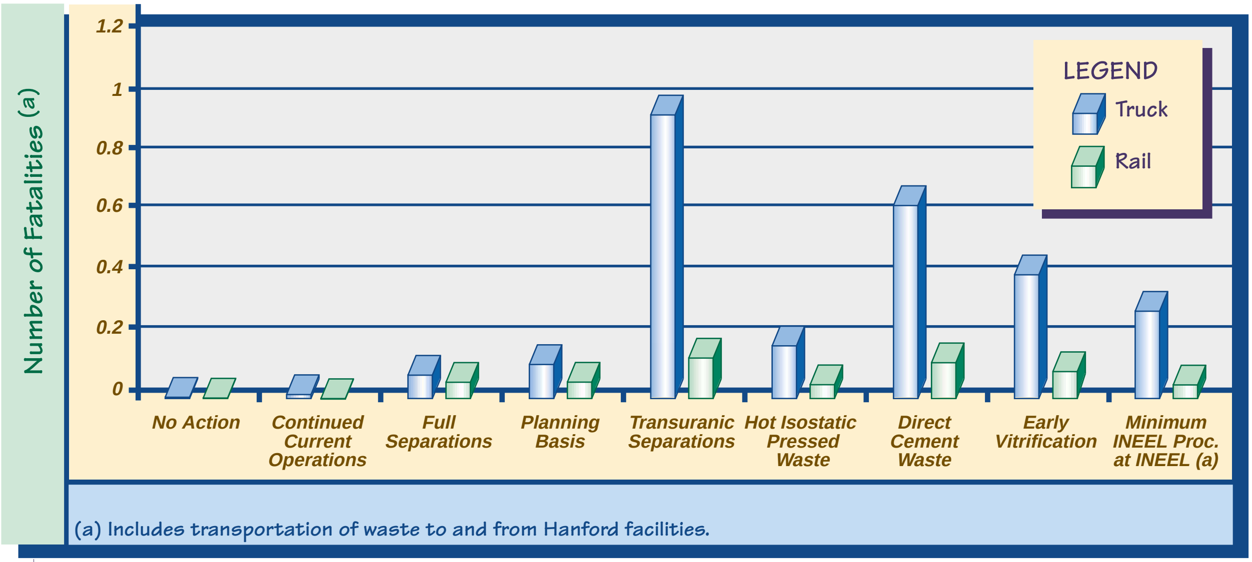


FIGURE S-16.
Estimated impacts to workers and the public from vehicle-related accidents during transportation of radioactive waste (approximately for the years 2000 to 2035).

HEALTH AND SAFETY

Waste processing activities can result in health and safety impacts to the public and workers. This EIS evaluates the following types of health impacts:

- Radiological health impacts
- Nonradiological health impacts from carcinogenic and carcinogenic toxic air pollutants
- Occupational health and safety impacts for workers, based on historical injury and illness rates.

Construction Impacts

All alternatives would result in some amount of radiation exposure to construction workers. Most of the waste processing alternatives and treatment options would result in similar levels of total collective worker dose ranging from an estimated 72 to 120 person-rem. The highest collective dose of 120 person-rem would occur under the Separations Alternative (all treatment options) and the Minimum INEEL Processing Alternative. DOE estimates that this would result in 0.05 LCF for these alternatives.

Nonradiological emissions associated with construction activities would result primarily from fugitive dust caused by the disturbance of land and from the combustion of fossil fuels in construction equipment. DOE has evaluated the potential impacts from these sources and has concluded that construction-related impacts to workers from criteria pollutant emissions are expected to fall within applicable standards, as discussed in the air quality section of this EIS.

The highest total number of lost workdays and total recordable cases during construction is estimated at 240 for the Planning Basis Option and 200 for the Full Separations Option because of the large number of total worker hours associated with these options.

Normal Operations

During normal operations, waste processing and related activities at INTEC would result in releases of radionuclides to the atmosphere, but there would be no discharge of radioactive liquid effluents under any of the waste processing alternatives or treatment options that would result in offsite radiation doses. Therefore, DOE only calculated potential health effects from airborne releases of radioactivity. This EIS presents the total radiological dose and potential LCF that could result from operation of the waste processing and related facilities. The highest cumulative total offsite maximally exposed individual dose is estimated to be 0.03 millirem, and would occur under the Early Vitrification Option. The highest estimated total dose of 0.0014 millirem for the noninvolved worker would occur from the Minimum INEEL Processing Alternative. The maximum estimated dose of 1.7 person-rem for the total collective population dose over the entire operations period would result from the Early Vitrification Option. The highest collective worker dose integrated over the entire operations campaign would occur from implementation of the Direct Cement Waste Option. For this treatment option, the total collective worker dose is estimated to be 1,600 person-rem. Figure S-17 compares the total LCF to involved workers during normal operations.

DOE also evaluated the potential carcinogenic and noncarcinogenic effects of nonradiological emissions during waste processing operations. For the individual noncarcinogens, the maximum concentrations for each of the pollutants occur most frequently from the Planning Basis Option. However, all hazard quotients are estimated to be much less than 1.0, indicating no expected adverse health effects.

The highest carcinogenic air pollutant impacts are projected for those options that involve the greatest amount of fossil fuel combustion, most notably the Planning Basis Option. For this option, nickel concentrations are estimated to be as high as 14 percent of the State of Idaho standard at the INEEL boundary. All other carcinogens are expected to be at very low ambient levels and would have correspondingly low health impacts.

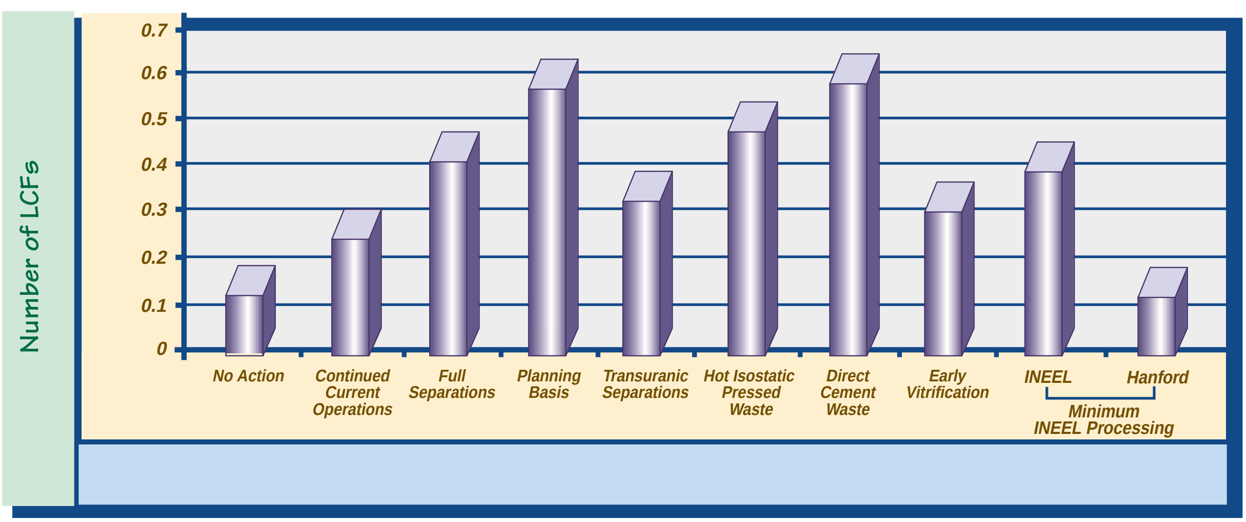


FIGURE S-17.
Estimated radiological impacts to involved workers (normal operations, approximately for the years 2000 to 2035).

WASTE AND MATERIALS

This EIS examines impacts associated with the generation of both radioactive and nonradioactive wastes resulting from construction and waste processing operations. Waste streams may include high-level, transuranic, low-level, mixed low-level, hazardous, and industrial wastes. Industrial wastes are neither radioactive nor hazardous and are disposed of onsite. They are generally of less environmental concern than radioactive and hazardous wastes.

Construction activities produce relatively little radioactive and hazardous waste. The greatest construction impacts for a waste processing alternative would be for the Full Separations Option, which is estimated to produce 1,100 cubic meters of mixed low-level waste, 790 cubic meters of hazardous waste, and 330 cubic meters of low-level waste over the total construction period.

Figure S-18 presents and compares the total waste volumes (excluding industrial wastes) that would result for the operations period, approximately from the year 2000 to 2035, for all waste processing alternatives and treatment options except the No Action and Continued Current Operations alternatives. Neither of these alternatives would treat mixed HLW or mixed transuranic waste/SBW (calcination of mixed transuranic waste/SBW under the Continued Current Operations Alternative is considered "pretreatment" under RCRA regulations).

The No Action Alternative would leave approximately 4,200 cubic meters of mixed HLW calcine in the bin sets and 1.4 million gallons of mixed transuranic waste/SBW in the Tank Farm. The Continued Current Operations Alternative would calcine the mixed transuranic waste/SBW and empty the Tank Farm tanks down to the heels. This alternative would leave approximately 6,000 cubic meters of calcine in the bin sets.

The maximum treated HLW volumes would be produced by the Non-Separations Alternative options. The Hot Isostatic Pressed, Direct Cement Waste, and Early Vitrification options would produce an estimated 3,400 cubic meters, 13,000 cubic meters, and 8,500 cubic meters of treated HLW, respectively. By comparison, the Separations Alternative (Full Separations and Planning Basis Options) would produce an estimated 470 cubic meters of HLW and the Minimum INEEL Processing Alternative would

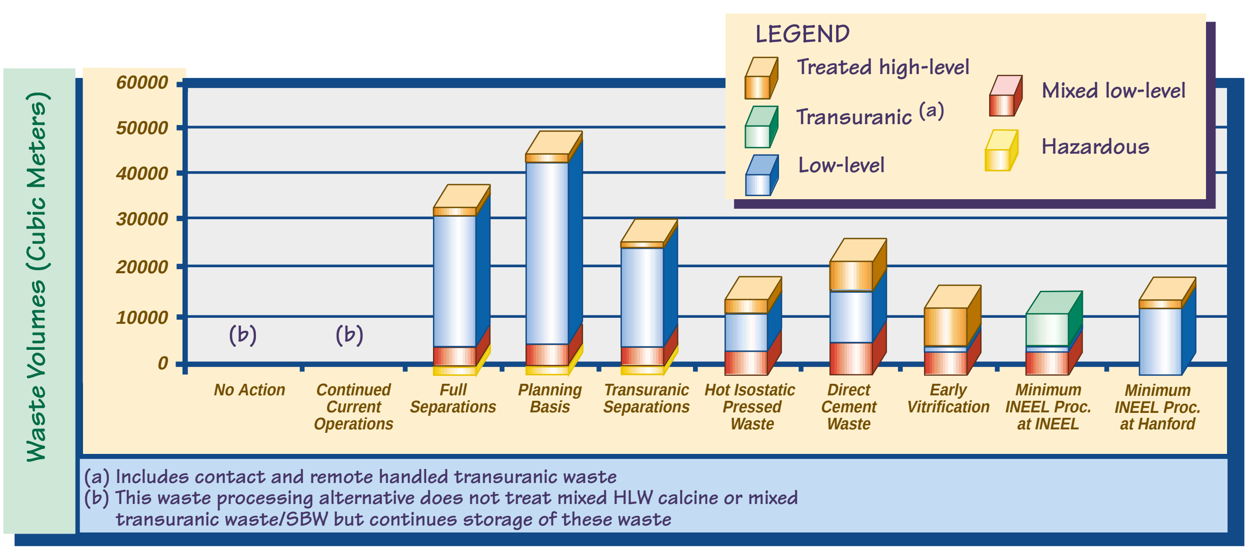


FIGURE S-18.
Summary of estimated total waste volumes produced by waste processing alternatives and treatment option (during normal operations, approximately for the years 2000 to 2035).

produce 730 cubic meters of HLW. The Transuranic Separations Option would produce no HLW and only 220 cubic meters of remote-handled transuranic waste. The greatest volume of contact-handled transuranic waste would be produced by the Minimum INEEL Processing Alternative and is estimated to be 7,500 cubic meters. The greatest volume of remote-handled transuranic waste would be an estimated 360 cubic meters produced by the Early Vitrification Option.

HLW separations activities under the Separations and Minimum INEEL Processing Alternatives would generate a low-level waste fraction. The Full Separations and Planning Basis Options would produce 27,000 cubic meters and 30,000 cubic meters, respectively, of low-level waste Class A type grout. The Transuranic Separations Option would produce 22,700 cubic meters of low-level waste Class C type grout. The Minimum INEEL Processing Alternative would produce 14,400 cubic meters of vitrified low-level waste.

Waste processing activities under the Direct Cement Waste Option would produce the largest quantity of mixed low-level waste, an estimated 8,600 cubic meters. The Full Separations Option would produce the largest quantity of hazardous waste, about 1,600 cubic meters. The largest quantity of low-level waste, about 10,000 cubic meters, would be generated under the Continued Current Operations Alternative and the Planning Basis, Hot Isostatic Pressed Waste, and Direct Cement Waste Options.

FACILITY ACCIDENTS (OFF-NORMAL OPERATIONS)

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 occur (a) more frequent than once in a thousand years (abnormal event), (b) less frequent than once in a thousand years but more frequent than once in a million years (design basis event), or (c) less frequent than once in a million years (beyond design basis events).

Two events involving the long-term degradation and eventual failure of the undergound tanks and a calcine bin set were discussed in Section 3 of this Summary for the No Action and Continued Current Operations Alternatives. Under these alternatives, liquid mixed transuranic waste/SBW and/or mixed HLW calcine are stored indefinitely and it can be assumed that over time the radioactive and hazardous materials would be released into the environment. However, there are also bounding accident scenarios associated with these alternatives, including the seismic rupture of an underground tank or bin set and the failure of a bin set due to flooding, which are discussed below with other selected waste processing alternative accidents. Accident analyses were also performed for the transport of HLW associated with waste processing alternatives.

In discussing anticipated risks posed by potential accidents, it should be noted that the longer an operation continues the longer the window of vulnerability and the larger the probability that the accident will eventually occur. Therefore,

Frequency Ranges

Because even unlikely events can have large and unacceptable impacts on human health and the environment, a bounding accident was analyzed in each of these frequency ranges for this EIS.

Abnormal: more frequent than once in a thousand years.

Design basis: less frequent than once in a thousand years but more frequent than once in a million years.

Beyond design basis: less frequent than once in a million years.

No Action and Continued Current Operations Alternatives that do not result in road-ready waste and involve the storage of this waste at INTEC for an indefinite period of time, exhibit the longest window of vulnerability and therefore the highest anticipated risk. In fact, the probability of the bounding design-basis accident for the No Action and Continued Current Operations Alternatives ranges from a factor of 6 to a factor of 175 more likely than the comparable design basis accidents for other alternatives that place waste in a road-ready form over time.

Bounding accidents for the No Action and Continued Current Operations Alternatives also tend to produce larger releases due to long-term degradation impacts on facility safety features. When the size and makeup of potential releases are considered as well as the total probability of occurrence, the range of anticipated risks vary between a factor of 50 and a factor of almost 10,000.

For all waste processing alternatives, accidents have been analyzed according to the frequency range of the event. Bounding accidents, in terms of radiological dose to workers or the public or in terms of release of hazardous materials, are discussed below along with other accidents that were selected based on their potential impacts to workers, the public, or the environment. Additional information on postulated accidents is provided in Table S-2.

- ***An aircraft crashes into the Borosilicate Vitrification Facility (Beyond Design Basis Event).***

  For all waste processing alternatives and treatment options, the bounding accident involves the crash of an aircraft into the Borosilicate Vitrification Facility that would be built and operated as part of the Full Separations and Planning Basis Options. For this event, the analysis predicted a dose of 600,000 person-rem to the offsite population within 50 miles of INTEC. This could result in up to 300 LCFs due to air impacts for the exposed population.

  This accident would release molten glass fines associated with the vitrification process and, while the accident could result in an offsite impact, long-term environmental impacts would be limited by rapid solidification of the molten material. Most of the molten glass released during this type of accident would be deposited on the ground near the vitrification facility. Leaching of contaminants into the soil would be minimal, allowing for expedited mitigation and cleanup. The molten waste is in a very concentrated form, however, and, if released, would present a significant impact to both workers and to offsite populations if not remediated.

- ***An earthquake breaches an underground waste storage tank full of liquid mixed transuranic waste/SBW, releasing contents to the soil and contaminating the groundwater (Design Basis Event).***

  The No Action Alternative would continue to store liquid mixed transuranic waste/SBW in the underground storage tanks at INTEC. For purposes of analysis, this EIS conservatively assumes that an earthquake occurs in the year 2000, rupturing a full storage tank. (In actuality, the likelihood of this design basis accident is less than once in 10,000 years.)

  The analysis for a single tank failure predicts a release of iodine-129 to the groundwater that is estimated to approach the EPA maximum contaminant level (i.e., as allowed for drinking water resources) assuming no mitigation takes place. Since past activities at the INTEC have already contaminated the groundwater under the INTEC with iodine-129 levels exceeding allowable limits, additional contamination from a breached tanks is estimated to exceed the allowable limits set by EPA for groundwater contamination, potentially posing a risk to human health and the environment.

- ***An earthquake ruptures a bin set, releasing calcined mixed HLW into the environment (Design Basis Event).***

  The accident analysis identified earthquakes as potential sources of major airborne releases from bin sets containing mixed HLW calcine. This postulated seismic accident was assumed to result in a bin-set rupture with a subsequent airborne release. For this event, the analysis predicted a dose of 66,000 person-rem to the population within 50 miles of INTEC. This could result in 33 LCFs to the population.

  Next to the aircraft crashing into the Borosilicate Vitrification Facility, failure of a bin set is estimated to be the most impacting accident in terms of radiological release. However, in terms of dose to the public, it is nearly 10 times lower.

  An aircraft crash, considered to be a beyond design basis accident, could potentially fail a bin set. The analysis predicts that this accident would result in less severe consequences than the more likely design basis seismic accident.

- ***A flood induced failure of a bin set causes a release of stored calcine (Design Basis Event).***

  This accident is assumed to cause failure of a bin set and release stored calcine to the environment. For this postulated event, the estimated dose to the population within 50 miles of INTEC is 45,000 person-rem. This could result in 23 LCFs.

  Either long-term degradation of the calcine bin sets, a seismic event, an aircraft crash, or a flood could disperse mixed HLW calcine into the environment by air or water. Although the primary, short-term impact to the maximally exposed individual and the public would be from airborne contamination, the released calcine could be deposited onto soils surrounding the bins or move with the surface water runoff to low-lying areas, and some fraction of the calcine fines could resuspend in the air directly or as a result of water evaporation. Direct ground contamination from HLW calcine could be expected within a few miles of the INEEL. Calcine could also slowly dissolve and release some contaminants to the groundwater. However, most of the available contaminants would be bound up in the first few feet of the soil column. Iodine-129 and plutonium could migrate to the groundwater over a very long period of time. Any groundwater impacts would be much lower than those analyzed for other accidents such as the seismic induced failure of a storage tank full of liquid mixed transuranic waste/SBW.

- ***A criticality occurs due to mishandling of transuranic waste (Design Basis Event).***

  Both the Transuranic Separations Option and the Minimum INEEL Processing Alternative have the potential for a nuclear criticality accident. In both cases there is a low probability that the mishandling of transuranic waste in storage containers could result in a criticality. This accident could result in a large dose to a nearby, unshielded worker that is estimated to be 218 rem, representing an increased risk of developing a latent fatal cancer of 1 in 5. For this accident, the dose to the maximally exposed individual at the site boundary is estimated to be 3 millirem.

- ***The entire inventory of stored kerosene located at INTEC to support operations of the New Waste Calcining Facility is spilled (Abnormal Event).***

  The maximum reasonably foreseeable hazardous material accident is assumed to release the entire inventory of kerosene. This event is estimated to cause peak benzene groundwater concentrations of 24 times the EPA maximum contaminant level, or 120 micrograms per liter. Such a release would also be the maximum reasonably foreseeable hazardous material accident for public consequences, but no fatalities would be expected. The benzene component of the kerosene could reach the groundwater under normal precipitation conditions in about 200 years. A less probable occurrence would be an aircraft crash into both kerosene storage tanks. This beyond design basis event is estimated to cause a peak benzene groundwater contamination of 180 micrograms per liter.

  In both of these cases the kerosene was assumed to spill and form a pool about 3 inches deep. After pooling, the kerosene could seep into the available soil pore space to a depth of about 16 inches and could cover an area about 100 to 150 feet in diameter. It is estimated that the soil concentration could approach 100 milligrams of kerosene per kilogram of soil. If the kerosene spill were not remediated, it could move by plug flow through the soil toward the aquifer. However, since INTEC would be operational during a kerosene spill, emergency crews would take immediate action to stop the spill, halt the spread of kerosene, and dispose of contaminated soil. It is estimated that remediation could involve removal of 300 to 670 cubic meters of soil.

7.3 Facility Disposition Alternatives

Disposition of new and existing facilities could have both short-term and long-term impacts. The following highlights the major impacts identified in air, traffic and transportation, health and safety, waste and materials, and accidents.

AIR

Air emissions could result from disposition of either new facilities constructed to implement the waste processing alternatives or existing HLW treatment and management facilities at INTEC. These emissions would be temporary in nature, and, in general, much lower than those that would result from operations. Impacts associated with disposition of existing facilities would be well below applicable INEEL and EPA standards. No final closure activities would be associated with the No Action Alternative.

TRAFFIC AND TRANSPORTATION

Based on estimated levels of INEEL employment for facility disposition activities, DOE would expect that traffic flows for Highway 20 would be virtually unaffected during construction, operations, or facilities disposition activities for any of the waste processing alternatives or treatment options. The level of service would remain essentially unchanged.

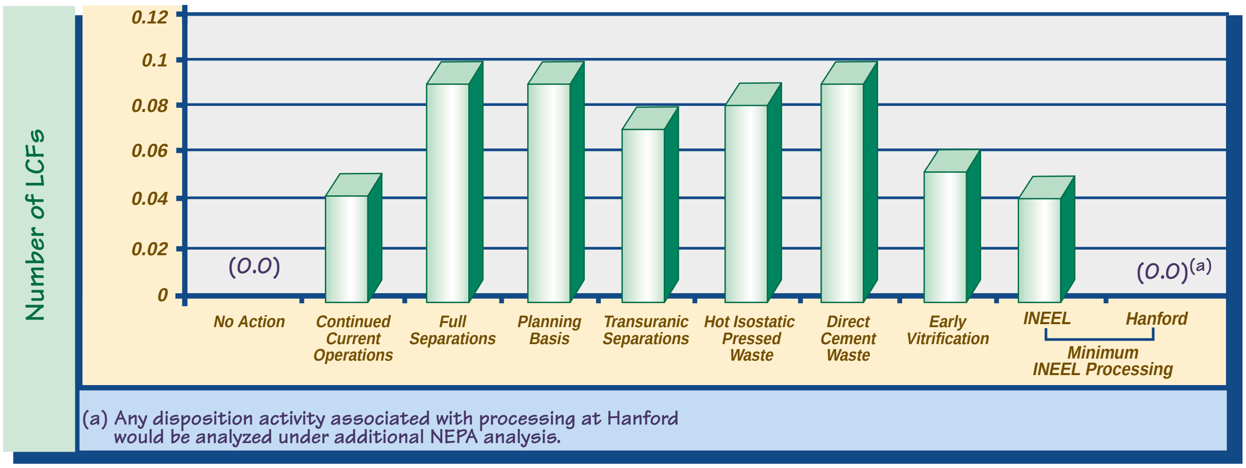


FIGURE S-19.
Estimated radiological impacts to involved workers from disposition of new facilities (clean closure).

HEALTH AND SAFETY

Health and safety effects could result from preparing for disposition of either new facilities constructed to implement the waste processing alternatives and treatment options, or existing HLW management facilities at INTEC. This EIS also evaluates the impacts of the facility disposition alternatives.

Disposition of New Facilities Associated with Waste Processing Alternatives

No disposition activities would be associated with the No Action Alternative. The highest total collective dose to involved workers for the entire disposition period for new facilities would occur for the Full Separations Option, Planning Basis Option, and Direct Cement Waste Option and would correspond to an estimated 0.10 LCF (Figure S-19). The annual radiation doses to the maximally exposed individual, noninvolved worker and the general population for all of the options are estimated to be very small.

DOE also evaluated the potential for occupational injuries. The highest impacts for the entire disposition period for new facilities associated with waste processing would be expected under the Full Separations, Planning Basis, and Hot Isostatic Pressed Waste Options, and are estimated to be 80 recordable injury cases.

Disposition of Existing Facilities Associated with HLW Management

The collective involved worker dose would be highest for the Clean Closure Alternative due to the extensive decontamination efforts required for removing contaminated materials in order to reduce radioactivity to minimum detectable levels. DOE estimates that the maximum possible total collective worker dose would be 7,600 person-rem with a corresponding estimated health impact of 3 LCFs for the period of disposition (approximately for the years 2035 to 2095).

Annual radiation doses associated with airborne radionuclide emissions from the Tank Farm and bin sets under the facility disposition alternatives were evaluated in this EIS. The highest radiation dose would be associated with the Closure to Landfill Standards Alternative; however, this dose would still be much less than the applicable standard for annual exposure. The maximum collective population dose for all closure alternatives would result in nearly zero LCF.

DOE also estimated the occupational safety impacts and has determined values for lost workdays and total recordable cases. DOE expects the highest number of lost workdays and total recordable cases to occur for the Tank Farm Clean Closure Alternative due to the larger number of workers and duration of disposition activities associated with that alternative. For that alternative, the total lost workdays and recordable injuries are estimated to be 2,400 and 290, respectively. Worker occupational health and safety impacts for all other facility disposition alternatives would be much lower.

Long-term Impacts to Groundwater Resulting from Facility Disposition

The largest source of contamination that could reach the public through a groundwater pathway would result from the No Action Alternative, where mixed transuranic waste/SBW is left in the underground storage tanks. After 500 years, it is assumed that all five remaining in-service underground storage tanks would fail, releasing all stored inventory to the soil column. The primary means by which contamination could reach the public would be through leaching into the soil surrounding the facilities and eventually into the aquifer near the facilities. DOE assumes that the maximum individual dose for the No Action Alternative would be incurred by a hypothetical future INTEC resident who is assumed to obtain domestic water from a well drilled into the aquifer contaminated by the degraded tanks. The level of groundwater contamination could be as high as 4.5 picocuries of iodine-129 per liter, and it is assumed that the person would drink 2 liters of water per day for 72 years. This results in an estimated lifetime dose of approximately 66 millirem.

WASTE AND MATERIALS

Waste would be generated from the disposition of new facilities built to support the waste processing alternatives and treatment options. Decontamination operations would generate some mixed low-level and low-level waste for the No Action and Continued Current Operations Alternatives. For disposition of existing HLW facilities (Tank Farm, New Waste Calcining Facility, bin sets, and related facilities), the Clean Closure Alternative would generate the largest estimated waste volumes: industrial waste (185,000 cubic meters); low-level waste (13,000 cubic meters); and mixed-low level waste (12,000 cubic meters). The Performance-Based Closure Alternative would generate the largest volume of hazardous waste (500 cubic meters).

Facility Disposition Accidents (Off-Normal Operations)

A potential exists for accidents as a result of facility disposition. Health and safety impacts from accidents during facility disposition can result from trauma, fire, and exposure to releases of radioactive and hazardous materials. For the various facilities disposition alternatives, the potential for health impacts as a result of radiation or hazardous material accidents was found to be quite limited, because inventories of radioactive and hazardous materials during facilities disposition are expected to be several orders of magnitude less than during facility operations.

The analysis in this EIS shows that the maximum reasonably foreseeable impact from facility disposition would consist of an estimated two fatalities as a result of industrial accidents such as trauma, fire, spills, or falls during clean closure of the Tank Farm. These accidents were evaluated on the basis of the type and degree of facility cleanup required.

7.4 Cumulative Impacts

Adding the impact of an action to the impacts of other past, present, and reasonably foreseeable future actions can result in cumulative impacts to the environment. These individual actions, which may be undertaken by other government agencies, private businesses, or individuals, can be minor, but the combined or "cumulative" effect could be significant. Cumulative impacts are summarized below.

AIR

The cumulative dose to the maximally exposed offsite individual would be about 0.16 millirem per year under the Continued Current Operations Alternative, Planning Basis Option, Hot Isostatic Pressed Waste Option, and Direct Cement Waste Option. The cumulative dose includes the dose from waste processing activities and is virtually the same as the maximum baseline dose of 0.16 millirem per year. The total dose would also be less than 2 percent of the 10 millirem per year airborne dose limit specified in the National Emissions Standards for Hazardous Air Pollutants. This total dose would be in addition to the estimated annual 360-millirem dose from natural background radiation.

Quantitative evaluation of air pollutant impacts determined that all applicable air quality standards would be met at the INEEL site boundary for all reasonably foreseeable site operations and at all other offsite locations within a 50-mile radius.

WATER

Past activities have contaminated soils and groundwater under INTEC. The CERCLA process is currently underway to identify the best way to manage the risks posed by these contaminants. Therefore, any facility disposition alternative presented in this EIS that leaves contaminants in place must be evaluated in the context of the cumulative risk of contaminant loading to the groundwater. The important consideration in such an evaluation is the time it will take contaminants to reach the groundwater and whether or not concentrations will exceed drinking water standards.

Groundwater sampling conducted under the CERCLA process indicates that current groundwater concentrations from historical releases exceed drinking water standards for iodine-129 and strontium-90. The drinking water standard for iodine-129 is 1.0 picocurie per liter and current concentrations are predicted to be about 11 picocuries per liter. For strontium-90 the drinking water standard is 8.0 picocuries per liter with current concentrations predicted to be about about 150 picocuries per liter. In the year 2095, these concentrations are estimated to decrease to 4.7 picocuries per liter for iodine-129 and 8.1 picocuries per liter for strontium-90. Currently, total plutonium in the groundwater is 0.1 picocurie per liter and is anticipated to peak at 36 picocuries per liter in the year 3585. The drinking water standard for plutonium is a total gross alpha radioactivity of 15 picocuries per liter. Cumulative impacts that could occur under those alternatives that would have the greatest potential for long-term cumulative impacts on groundwater are described below.

No Action Alternative – This alternative would leave liquid mixed transuranic/SBW in the tanks indefinitely. If the tanks should leak, contaminants could migrate to the groundwater and add cumulatively to any concentrations present from historical contributions. The degree of cumulative impact would depend on when the leak occurs and how much liquid is released. For example, if all the contents of a single tank should leak in the year 2000, concentrations could result in an estimated 9 percent increase for iodine-129 in the year 2025, 19 percent for strontium-90 in the year 2095, and 71 percent for total plutonium in the year 3585. Although such a leak can be postulated during the period of assumed institutional control (2000-2095), DOE has mechanisms in place to detect and mitigate such an event. Furthermore, the design life of the storage tanks is estimated to be well in excess of 500 years.

Under the No Action Alternative, all five tanks could eventually degrade and release the entire inventory of liquid mixed transuranic/SBW to the ground. For analysis purposes, this event is assumed to occur in 500 years, which is the assumed design life of the tanks. At that time, the strontium-90 in the tanks would have decayed sufficiently so that it would not pose a significant radioactive risk. Also, the iodine-129 in the groundwater from historical activities would have peaked, become diluted, and moved down-gradient in the aquifer. Therefore, the iodine-129 contribution (4.5 picocuries per liter) from the degradation of five tanks would not add cumulatively to the existing contamination. For plutonium, the total contribution from the five tanks that could eventually reach the groundwater would result in 26 picocuries per liter, but would lag behind the historical contribution by 500 years. Thus, like iodine-129, plutonium contributions from five degraded tanks should not add cumulatively to groundwater concentrations introduced by past practices, but could increase the total aquifer contamination and extend the period of time during which drinking water standards could be exceeded in the vicinity of INTEC.

Low-Level Class A and Class C Type Grout Alternatives – Facility disposition alternatives that include filling the tanks with low-level waste, Class A, or Class C type grout would eventually release contaminants to groundwater. Under these alternatives, it was assumed that the contaminants would not be available for transport to groundwater for 500 years (the year 2500) because grout chemistry can be formulated to specifically control release of contaminants and the rate at which these contaminants migrate to groundwater. The contaminant of concern at this time would be iodine-129, because strontium-90 would have decayed sufficiently and plutonium would be removed as part of the separations process. After 500 years, the iodine-129 from historical practices should have dissipated, so that the any contribution from the grout would not result in a cumulative impact.

TRAFFIC AND TRANSPORTATION

Cumulative transportation impacts would result from implementation of the alternatives for this EIS in the context of continuing historical radioactive shipments and reasonably foreseeable shipments. DOE conservatively estimated the total cumulative number of cancer fatalities resulting from domestic U.S. shipments of all kinds of radioactive materials from 1953 through 2037 (DOE and non-DOE activities). These estimates indicate that these shipments collectively may cause 140 LCFs to the public. Of this total, 1.4 LCFs could result from the radioactive waste shipments for the INEEL HLW processing alternative with the highest impact (Direct Cement Waste Option), and 0.9 LCF from other future INEEL programs.

HEALTH AND SAFETY

Airborne contamination is the principal transport pathway through which radioactive materials from the INEEL affect workers and the public. The SNF and INEL EIS evaluated radiation releases and subsequent offsite doses associated with INEEL operations. Doses have always been small and within applicable radiation protection standards. In 1996, for example, the collective radiological dose to the population within 50 miles of the INEEL was 0.24 person-rem. This is representative of the average yearly impacts.

By comparison, the maximum annual collective dose from the waste processing alternatives and treatment options would add 0.10 person-rem to the population living within 50 miles of INTEC. This dose would result from implementation of the Continued Current Operations Alternative, the Planning Basis Option, the Hot Isostatic Pressed Waste Option, or the Direct Cement Waste Option. Other projected releases from new facilities planned at the INEEL would add an additional 0.05 person-rem per year. The most likely outcome is that no LCF would occur as a result of the cumulative radiation dose received by the population from the waste processing alternatives and treatment options evaluated.

DOE believes that institutional controls at the INEEL would prevent public exposure to residual radioactive materials left in place after facilities were closed until at least 2095. Materials left in place could potentially migrate to the aquifer, and public exposure could occur if people use the aquifer for drinking water and other domestic purposes.

The occupational radiation dose received by the entire INEEL workforce would result in about 1 LCF during 10 years of operations. This compares to the natural lifetime incidence of fatal cancers in the same population from all causes of about 2,400 over a 10-year period. The greatest increases in collective worker dose, under the Direct Cement Waste Option, would be about 0.64 LCF over the life of the project.

Public exposure could also result from airborne contaminants due to soil erosion or inadvertent intrusion into disposal areas.

WASTE AND MATERIALS

Waste produced under the waste processing and facility disposition alternatives analyzed in this EIS would be in addition to existing waste already stored or buried on the INEEL. This existing waste includes (a) approximately 145,000 cubic meters of low-level waste; (b) about 62,000 cubic meters of transuranic waste plus an additional 5,300 cubic meters of liquid mixed transuranic waste/SBW; and (c) industrial waste previously deposited in the INEEL Landfill Complex (volume unknown).

DOE estimates that the highest volume of waste generated by the alternatives would nearly double the quantity of low-level waste stored or buried and generate about 365,000 cubic meters of industrial waste. The actual volumes generated may be smaller than estimated because waste minimization and recycling could reduce the quantity of waste.

No Action Alternative	Continued Current Operations Alternative	Separations Alternative	Non-Separations Alternative	Minimum INEEL Processing Alternative
Impacts to Air - Waste Processing				
Radiation dose from emissions would be 6.0×10^{-4} millirem per year to offsite MEI. Collective population dose to the general public is 0.03 person-rem per year. No criteria pollutant would exceed PSD significance threshold. Maximum impact of offsite carcinogenic toxic pollutant emissions would be approximately 1.8 percent of the applicable standard.	Radiation dose from emissions would be 1.7×10^{-3} millirem per year to offsite MEI. Collective population dose to the general public is 0.094 person-rem per year. One criteria pollutant (sulfur dioxide) exceeds PSD significance threshold. Maximum impact of offsite carcinogenic toxic pollutant emissions would be approximately 2.9 percent of the applicable standard.	FULL SEPARATIONS OPTION Radiation dose from emissions would be 1.2×10^{-4} millirem per year to offsite MEI. Collective population dose to the general public is 5.6×10^{-3} person-rem per year. Two criteria pollutants (sulfur dioxide and nitrogen oxides) would exceed PSD significance thresholds. PLANNING BASIS OPTION Radiation dose from emissions would be 1.8×10^{-3} millirem per year to offsite MEI. Collective population dose to the general public is 0.095 person-rem per year. Two criteria pollutants (sulfur dioxide and nitrogen oxides) would exceed PSD significance thresholds. TRANSURANIC SEPARATIONS OPTION Radiation dose from emissions would be 6.0×10^{-5} millirem per year to offsite MEI. Collective population dose to the general public is 3.1×10^{-3} person-rem per year. One criteria pollutant (sulfur dioxide) exceeds PSD significance threshold. Maximum impact of offsite carcinogenic toxic pollutant emissions would be 5.8 to 14 percent of the applicable standard under the Separations Alternative.	HOT ISOSTATIC PRESSED WASTE OPTION Radiation dose from emissions would be 1.8×10^{-3} millirem per year to offsite MEI. Collective population dose to the general public is 0.097 person-rem per year. Two criteria pollutants (sulfur dioxide and nitrogen oxides) would exceed PSD significance thresholds. DIRECT CEMENT WASTE OPTION Radiation dose from emissions would be 1.7×10^{-3} millirem per year to offsite MEI. Collective population dose to the general public is also low (0.095 person-rem per year). One criteria pollutant (sulfur dioxide) would exceed PSD significance threshold. EARLY VITRIFICATION OPTION Radiation dose from emissions would be 8.9×10^{-4} millirem per year to offsite MEI. Collective population dose to the general public is also low (0.048 person-rem per year). One criteria pollutant (sulfur dioxide) would exceed PSD significance threshold. Maximum impact of offsite carcinogenic toxic pollutant emissions would be 2.4 to 5.1 percent of the applicable standard under the Non-Separations Alternative.	At INEEL - Radiation dose from emissions would be 9.5×10^{-4} millirem per year to offsite MEI. Collective population dose to the general public is 0.048 person-rem per year. No criteria pollutant would exceed PSD significance threshold. Maximum impact of offsite carcinogenic toxic pollutant emissions would be 1.2 percent of applicable standard. At Hanford - Radiation dose from emissions would be 1.7×10^{-5} millirem per year to offsite MEI. Collective population dose to the general public is 1.3×10^{-3} person-rem per year. One criteria pollutant (carbon monoxide) would exceed PSD significance threshold.

TABLE S-2. Summary of impacts from waste processing and facility disposition alternatives (1 of 12) .

No Action Alternative	Continued Current Operations Alternative	Separations Alternative	Non-Separations Alternative	Minimum INEEL Processing Alternative
Impacts to Air - Waste Processing (continued)				
The estimated LCF in the population within 50 miles of INTEC related to waste processing under this alternative would be 6.0×10^{-4}.	The estimated LCF in the population within 50 miles of INTEC related to waste processing under this alternative would be 5.5×10^{-4}.	FULL SEPARATIONS OPTION The estimated LCF in the population within 50 miles of INTEC related to waste processing under this option would be 6.0×10^{-5}. PLANNING BASIS OPTION The estimated LCF in the population within 50 miles of INTEC related to waste processing under this option would be 1.7×10^{-4}. TRANSURANIC SEPARATIONS OPTION The estimated LCF in the population within 50 miles of INTEC related to waste processing under this option would be 3.2×10^{-5}.	DIRECT CEMENT WASTE OPTION The estimated LCF in the population within 50 miles of INTEC related to waste processing under this option would be 5.5×10^{-4}. EARLY VITRIFICATION OPTION The estimated LCF in the population within 50 miles of INTEC related to waste processing under this option would be 8.5×10^{-4}. HOT ISOSTATIC PRESSED WASTE OPTION The estimated LCF in the population within 50 miles of INTEC related to waste processing under this option would be 5.5×10^{-4}.	At INEEL - The estimated LCF in the population within 50 miles of INTEC related to waste processing under this alternative would be 6.0×10^{-4}. At Hanford - The estimated LCF in the population within 50 miles of 200-East Area related to waste processing under this alternative would be 1.1×10^{-6}.
Impacts to Transportation - Waste Processing				
No offsite transportation would occur.	Incident-free LCF for the public from truck transport: 0.01 Accident LCF risk for the public from truck transport: 5.0×10^{-5}	Incident-free LCF for the public from truck transport of remote-handled transuranic waste to the Waste Isolation Pilot Plant: 0.23 (Transuranic Separations Option is highest impact option). Accident LCF risk for the public from truck transport: 0.09 (Transuranic Separations Option is highest impact option).	Incident-free LCFs for the public from truck transport of cemented HLW to a HLW repository: 1.5 (Direct Cement Waste is highest impact option). Accident LCF risk for the public from truck transport: 0.02 (Direct Cement Waste is highest impact option).	Incident-free LCF for the public from truck transport: 0.55 Accident LCF risk for the public from truck transport: 0.02

TABLE S-2. Summary of impacts from waste processing and facility disposition alternatives (2 of 12) .

No Action Alternative	Continued Current Operations Alternative	Separations Alternative	Non-Separations Alternative	Minimum INEEL Processing Alternative
Impacts to Waste and Materials - Waste Processing				
Approximately 15,000 cubic meters of industrial waste, 1,500 cubic meters of mixed low-level waste, and 190 cubic meters of low-level waste generated through year 2035.	Approximately 26,000 cubic meters of industrial waste, 3,400 cubic meters of mixed low-level waste, and 9,500 cubic meters of low-level waste generated through year 2035 (includes construction and operation phases).	FULL SEPARATIONS OPTION Approximately 110,000 cubic meters (maximum) of industrial waste, 7,000 cubic meters of mixed low-level waste, and 1,500 cubic meters of low-level waste generated through year 2035 (includes construction and operation phases). PLANNING BASIS OPTION Approximately 110,000 cubic meters (maximum) of industrial waste, 9,000 cubic meters of mixed low-level waste, and 10,000 cubic meters of low-level waste generated through year 2035 (includes construction and operation phases). TRANSURANIC SEPARATIONS OPTION Approximately 82,000 cubic meters (maximum) of industrial waste, 6,400 cubic meters of mixed low-level waste, and 1,200 cubic meters of low-level waste generated through year 2035 (includes construction and operation phases).	HOT ISOSTATIC PRESSED WASTE OPTION Approximately 69,000 cubic meters (maximum) of industrial waste, 7,500 cubic meters of mixed low-level waste, and 10,000 cubic meters of low-level waste generated through year 2035 (includes construction and operation phases). DIRECT CEMENT WASTE OPTION Approximately 80,000 cubic meters (maximum) of industrial waste, 9,700 cubic meters of mixed low-level waste, and 10,000 cubic meters of low-level waste generated through year 2035 (includes construction and operation phases). EARLY VITIRIFICATION OPTION Approximately 65,000 cubic meters of industrial waste, 7,100 cubic meters of mixed low-level waste, and 1,100 cubic meters of low-level waste generated through year 2035 (includes construction and operation phases).	At INEEL - Approximately 61,000 cubic meters of industrial waste, 6,800 cubic meters of mixed low-level waste, and 810 cubic meters of low-level waste generated through the year 2035 (includes construction and operation phases). At Hanford - Approximately 26,000 cubic meters of industrial waste, 0 cubic meters of mixed low-level waste, and 1,500 cubic meters of low-level waste generated through year 2030 (includes construction and operation phases).

TABLE S-2. Summary of impacts from waste processing and facility disposition alternatives (3 of 12) .

No Action Alternative	Continued Current Operations Alternative	Separations Alternative	Non-Separations Alternative	Minimum INEEL Processing Alternative
Impacts to Health and Safety - Waste Processing - Construction Impacts				
Total lost workdays: 34 Total recordable cases: 4	Total lost workdays: 120 Total recordable cases: 14	FULL SEPARATIONS OPTION Total lost workdays: 1,700 Total recordable cases: 200 PLANNING BASIS OPTION Total lost workdays: 2,000 Total recordable cases: 240 TRANSURANIC SEPARATIONS OPTION Total lost workdays: 1,400 Total recordable cases: 170	HOT ISOSTATIC PRESSED WASTE OPTION Total lost workdays: 720 Total recordable cases: 86 DIRECT CEMENT WASTE OPTION Total lost workdays: 680 Total recordable cases: 81 EARLY VITRIFICATION OPTION Total lost workdays: 740 Total recordable cases: 88	At INEEL - Total lost workdays: 840 Total recordable cases: 100 At Hanford - Total lost workdays not reported. Total recordable cases: 227
Impacts to Health and Safety - Waste Processing - Operations Impacts				
Total lost workdays: 310 Total recordable cases: 44	Total lost workdays: 860. Total recordable cases: 120	FULL SEPARATIONS OPTION Total lost workdays: 2,500 Total recordable cases: 350 PLANNING BASIS OPTION Total lost workdays: 3,100 Total recordable cases: 430 TRANSURANIC SEPARATIONS OPTION Total lost workdays: 1,900 Total recordable cases: 270	HOT ISOSTATIC PRESSED WASTE OPTION Total lost workdays: 2,000 Total recordable cases: 290 DIRECT CEMENT WASTE OPTION Total lost workdays: 2,300 Total recordable cases: 330 EARLY VITRIFICATION OPTION Total lost workdays: 1,800 Total recordable cases: 260	At INEEL - Total lost workdays: 1,700 Total recordable cases: 240 At Hanford - Total lost workdays not reported. Total recordable cases: 27
The estimated LCF in involved workers would be 0.19.	The estimated LCF in involved workers would be 0.30.	FULL SEPARATIONS OPTION The estimated LCF in involved workers related to waste processing under this option would be 0.44. PLANNING BASIS OPTION The estimated LCF in involved workers related to waste processing under this option would be 0.61. TRANSURANIC SEPARATIONS OPTION The estimated LCF in involved workers related to waste processing under this option would be 0.39.	HOT ISOSTATIC PRESSED WASTE OPTION The estimated LCF in involved workers related to waste processing under this option would be 0.51. DIRECT CEMENT WASTE OPTION The estimated LCF in involved workers related to waste processing under this option would be 0.64. EARLY VITRIFICATION OPTION The estimated LCF in involved workers related to waste processing under this option would be 0.35.	At INEEL - The estimated LCF in involved workers would be 0.42. At Hanford - The estimated LCF in involved workers would be 0.14.

TABLE S-2. Summary of impacts from waste processing and facility disposition alternatives (4 of 12) .

No Action Alternative	Continued Current Operations Alternative	Separations Alternative	Non-Separations Alternative	Minimum INEEL Processing Alternative
Potential Impacts from Bounding Abnormal Events* - Waste Processing				
BOUNDING ABNORMAL EVENT Long term degradation causes release of calcine waste from a bin set: MEI Dose = 170 millirem (86 per million likelihood of cancer fatality). Dose to a hypothetical maximally exposed future resident = 12000 millirem (6000 per million likelihood of cancer fatality). Offsite population impacts = 1300 person-rem causing 0.65 LCF (This would result in 0.54 LCF per 100,000 in the exposed population).	BOUNDING ABNORMAL EVENT Same as No Action Bounding Abnormal Event.	BOUNDING ABNORMAL EVENT For all options, same as No Action Additional Abnormal Event.	BOUNDING ABNORMAL EVENT For all options, same as No Action Additional Abnormal Event.	BOUNDING ABNORMAL EVENT Same as No Action Additional Abnormal Event.
ADDITIONAL ABNORMAL EVENT Equipment failure causes release during transfer of calcine from bin set: MEI dose = 14 millirem (7 per million likelihood of cancer fatality). Dose to an uninvolved worker = 940 millirem (470 per million likelihood of cancer fatality). Offsite population impacts = 150 person-rem causing 0.075 LCF (This would result in 0.063 LCF per 100,000 in the exposed population).	ADDITIONAL ABNORMAL EVENT Same as No Action Additional Abnormal Event.	ADDITIONAL ABNORMAL EVENT TRANSURANIC SEPARATIONS OPTIONS Operational failure in Class C grout transport system causes release: MEI dose = 5.8 millirem (2.9 per million likelihood of cancer fatality). Dose to an uninvolved worker = 390 millirem (200 per million likelihood of cancer fatality). Offsite population impacts = 71 person-rem causing 0.04 LCF (This would result in 0.03 LCF per 100,000 in the exposed population).		
ADDITIONAL ABNORMAL GROUNDWATER EVENT Long term degradation causes release from SBW tanks: Life-time dose to hypothetical maximally exposed future resident = 65 millirem (33 per million likelihood of cancer fatality)				

*Greater than once in a thousand years

TABLE S-2. Summary of impacts from waste processing and facility disposition alternatives (5 of 12) .

No Action Alternative	Continued Current Operations Alternative	Separations Alternative	Non-Separations Alternative	Minimum INEEL Processing Alternative
Potential Impacts from Bounding Design Basis Events* - Waste Processing				
BOUNDING DESIGN BASIS EVENT Seismic failure causes release from a bin set: MEI dose = 9700 millirem (1900 per million likelihood of cancer fatality). Dose to a hypothetical maximally exposed future resident = 660,000 millirem (67 percent likelihood of cancer fatality). Offsite population impacts = 66,000 person-rem causing 33 LCFs (This would result in 28 LCFs per 100,000 in the exposed population).	BOUNDING DESIGN BASIS EVENT Same as No Action Bounding Design Basis Event.	BOUNDING DESIGN BASIS EVENT For all options, same as No Action Additional Design Basis Event.	BOUNDING DESIGN BASIS EVENT For all options, same as No Action Additional Design Basis Event.	BOUNDING DESIGN BASIS EVENT Same as No Action Bounding Design Basis Event.
ADDITIONAL DESIGN BASIS EVENT Flood induced failure of a bin set causes release of stored calcine: MEI dose = 3,800 millirem (1,900 per million likelihood of cancer fatality). Dose to an uninvolved worker = 260,000 millirem (26 percent likelihood of cancer fatality). Offsite population impacts = 45,000 person-rem, causing 22.5 LCFs (This would result in 19 LCFs per 100,000 in the exposed population).	ADDITIONAL DESIGN BASIS EVENT Same as No Action Additional Design Basis Event.	ADDITIONAL DESIGN BASIS EVENT TRANSURANIC SEPARATIONS OPTION Process explosion in TRU separations facility causing energetic release: MEI dose = 1,300 mrem (650 per million likelihood of cancer fatality). Dose to an uninvolved worker = 86,000 mrem (8.6 percent chance of cancer fatality). Offsite population impacts = 7,900 person-rem causing 4 LCFs (This would result in 3.3 LCFs per 100,000 in the exposed population). Criticality event causes exposure and release from TRU waste shipping facility: Dose to an involved worker = 218 rem (22 percent likelihood of cancer fatality. MEI dose = 3 millirem (1.2 per million likelihood of cancer fatality). Dose to an uninvolved worker = 210 millirem (84 per million likelihood of cancer fatality). Offsite population impacts = 120 person-rem causing 0.06 LCF (This would result in 0.05 LCF per 100,000 in the exposed population).		ADDITIONAL DESIGN BASIS EVENT Same as Separations Alternative Additional Design Basis Event (criticality).

*Greater than once in a million years

TABLE S-2. Summary of impacts from waste processing and facility disposition alternatives (6 of 12) .

No Action Alternative	Continued Current Operations Alternative	Separations Alternative	Non-Separations Alternative	Minimum INEEL Processing Alternative
Potential Impacts from Bounding Design Basis Events* - Waste Processing (continued)				
		Seismic failure of separated high activity waste process equipment causes release: MEI dose = 1,300 millirem (650 per million likelihood of cancer fatality). Dose to uninvolved worker = 86,000 millirem (43,000 per million likelihood of cancer fatality). Offsite population impacts = 7,900 person-rem causing 4 LCFs (This would result in 3.3 LCFs per 100,000 in the exposed population).		
Potential Impacts from Bounding Beyond Design Basis Events - Waste Processing**				
BOUNDING BEYOND DESIGN BASIS EVENT Aircraft crash causes release from a bin set: MEI dose = 420 millirem (210 per million likelihood of cancer fatality). Dose to a hypothetical maximally exposed future resident = 29,000 millirem (1,500 per million likelihood of cancer fatality). Offsite population impacts = 3,500 person-rem causing 1.75 LCFs (This would result in 1.5 LCFs per 100,000 in the exposed population).	BOUNDING BEYOND DESIGN BASIS EVENT Same as No Action Bounding Beyond Design Basis Event.	BOUNDING BEYOND DESIGN BASIS EVENT · FULL SEPARATIONS AND PLANNING BASIS OPTIONS Aircraft crash causes release from Borosilicate Vitrification Facility: MEI dose = 68,000 millirem (3.4 percent likelihood of cancer fatality). Dose to an uninvolved worker = 4,600,000 millirem (100 percent likelihood of cancer fatality). Offsite population impacts = 600,000 person-rem causing 300 LCFs (This would result in 250 LCFs per 100,000 in the exposed population).	BOUNDING BEYOND DESIGN BASIS EVENT · HOT ISOSTATIC PRESSED WASTE OPTION Aircraft crash causes release from Evaporator Facility: MEI dose = 460 millirem (230 per million likelihood of cancer fatality). Dose to an uninvolved worker = 32,000 millirem (3.2 percent likelihood of cancer fatality). Offsite population impacts = 3,500 person-rem causing 1.75 LCFs (This would result in 1.5 LCFs per 100,000 in the exposed population).	BOUNDING BEYOND DESIGN BASIS EVENT Aircraft crash causes release from Railcar Storage Facility: MEI dose = 4,900 millirem (2,500 per million likelihood of cancer fatality). Dose to an uninvolved worker = 340,000 millirem (34 percent likelihood of cancer fatality). Offsite population impacts = 53,000 person-rem causing 26.5 LCFs (This would result in 22 LCFs per 100,000 in the exposed population).

*Greater than once in a million years **Less than once in a million years

TABLE S-2. Summary of impacts from waste processing and facility disposition alternatives (7 of 12) .

No Action Alternative	Continued Current Operations Alternative	Separations Alternative	Non-Separations Alternative	Minimum INEEL Processing Alternative
Potential Impacts from Bounding Beyond Design Basis Events* - Waste Processing (continued)				
		ADDITIONAL BEYOND DESIGN BASIS EVENT • TRANSURANIC SEPARATIONS OPTION Aircraft crash causes release from Evaporator Facility: MEI dose = 460 mrem (230 per million likelihood of cancer fatality). Dose to an uninvolved worker = 32,000 mrem (3.2 percent likelihood of cancer fatality). Offsite population impacts = 3,500 person-rem causing 1.75 LCFs (This would result in 1.5 LCFs per 100,000 in the exposed population).	• DIRECT CEMENT WASTE OPTION Aircraft crash causes release from Cement Waste Facility: MEI dose = 1,000 millirem (500 per million likelihood of cancer fatality). Dose to an uninvolved worker = 71,000 millirem (7.1 percent likelihood of cancer fatality). Offsite population impacts = 11,000 person-rem causing 5.5 LCFs (This would result in 4.6 LCFs per 100,000 in the exposed population. • EARLY VITRIFICATION OPTION Aircraft crash causes release from Borosilicate Vitrification Facility: MEI dose = 730 millirem (370 per million likelihood of cancer fatality). Dose to an uninvolved worker = 50,000 millirem (5 percent likelihood of cancer fatality). Offsite population impacts = 6,600 person-rem causing 3.3 LCFs (This would result in 2.8 LCF per 100,000 in the exposed population).	

*Less than once in a millions years

TABLE S-2. Summary of impacts from waste processing and facility disposition alternatives (8 of 12) .

No Action Alternative	Continued Current Operations Alternative	Separations Alternative	Non-Separations Alternative	Minimum INEEL Processing Alternative
Impacts to Air (New Facilities) - Facility Disposition				
No impacts from No Action Alternative are anticipated.	RADIATION EFFECTS Radiation doses from emissions would be 1.1×10^{-10} millirem per year to offsite MEI and 3.4×10^{-9} person-rem per year to the offsite population.	RADIATION EFFECTS • FULL SEPARATIONS OPTION Radiation dose from emissions would be 3.3×10^{-10} millirem per year to offsite MEI and 1.0×10^{-10} person-rem per year to the offsite population. • PLANNING BASIS OPTION Radiation dose from emissions would be 3.9×10^{-10} millirem per year to offsite MEI and 1.2×10^{-10} person-rem per year to the offsite population. • TRANSURANIC SEPARATIONS OPTION Radiation dose from emissions would be 4.7×10^{-10} millirem per year to offsite MEI and 1.1×10^{-8} person-rem per year to the offsite population.	RADIATION EFFECTS • HOT ISOSTATIC PRESSED WASTE OPTION Radiation dose from emissions would be 1.8×10^{-10} millirem per year to offsite MEI and 4.7×10^{-9} person-rem per year to the offsite population. • DIRECT CEMENT WASTE OPTION Radiation dose from emissions would be 1.3×10^{-10} millirem per year to offsite MEI and 3.8×10^{-9} person-rem per year to the offsite population. • EARLY VITIRIFICATION OPTION Radiation dose from emissions would be 1.4×10^{-10} millirem per year to offsite MEI and 3.9×10^{-9} person-rem per year to the offsite population.	RADIATION EFFECTS At INEEL - radiation dose from emissions would be 5.6×10^{-10} millirem per year to offsite MEI and 1.3×10^{-8} person-rem per year to the offsite population.
	HAZARDOUS/CARCINOGENIC Maximum impacts of carcinogenic toxic pollutant emissions are estimated to be 0.6 percent of the applicable standard.	HAZARDOUS/CARCINOGENIC Maximum impacts of carcinogenic toxic pollutant emissions are estimated to be 1.8 to 2.5 percent of the applicable standard.	HAZARDOUS/CARCINOGENIC Maximum impacts of carcinogenic toxic pollutant emissions are estimated to be 1.7 to 2.1 percent of the applicable standard.	HAZARDOUS/CARCINOGENIC Maximum impacts of carcinogenic toxic pollutant emissions are estimated to be 2 percent of the applicable standard.

TABLE S-2. Summary of impacts from waste processing and facility disposition alternatives (9 of 12) .

No Action Alternative	Continued Current Operations Alternative	Separations Alternative	Non-Separations Alternative	Minimum INEEL Processing Alternative
Impacts to Health and Safety (New Facilities) - Facility Disposition				
No impacts from No Action Alternative are anticipated.	DOSE EFFECTS Estimated radiation dose to involved workers will result in 0.05 LCF and 110 person-rem.	DOSE EFFECTS Estimated radiation dose to involved workers will result in: • FULL SEPARATIONS OPTION 0.1 LCF and 268 person-rem • PLANNING BASIS OPTION 0.1 LCF and 300 person-rem • TRANSURANIC SEPARATIONS OPTION 0.08 LCF and 200 person-rem	DOSE EFFECTS Estimated radiation dose to involved workers will result in: • HOT ISOSTATIC PRESSED WASTE OPTION 0.09 LCF and 230 person-rem • DIRECT CEMENT WASTE OPTION 0.10 LCF and 240 person-rem • EARLY VITIRIFICATION OPTION 0.06 LCF and 160 person-rem	DOSE EFFECTS At INEEL - Estimated radiation dose to involved workers will result in 0.05 LCF and 130 person-rem.
	INDUSTRIAL EFFECTS Total lost workdays: 200 Total recordable cases: 25	INDUSTRIAL EFFECTS Total lost workdays and recordable cases: • FULL SEPARATIONS OPTION 660 and 80, respectively • PLANNING BASIS OPTION 690 and 80, respectively • TRANSURANIC SEPARATIONS OPTION 460 and 55, respectively	INDUSTRIAL EFFECTS Total lost workdays and recordable cases: • HOT ISOSTATIC PRESSED WASTE OPTION 680 and 80, respectively • DIRECT CEMENT WASTE OPTION 650 and 78, respectively • EARLY VITIRIFICATION OPTION 560 and 67, respectively	INDUSTRIAL EFFECTS At INEEL - Total lost work-days: 390 Total recordable cases: 47

TABLE S-2. Summary of impacts from waste processing and facility disposition alternatives (10 of 12) .

No Action Alternative	Continued Current Operations Alternative	Separations Alternative	Non-Separations Alternative	Minimum INEEL Processing Alternative
Impacts to Waste and Materials (New Facilities) - Facility Disposition				
No impacts from No Action Alternative are anticipated.	Approximately 4,800 cubic meters of industrial waste, 11 cubic meters of mixed low-level waste, and 5,600 cubic meters of low-level waste are generated.	FULL SEPARATIONS OPTION Approximately 70,000 cubic meters of industrial waste, 900 cubic meters of mixed low-level waste, and 68,000 cubic meters of low-level waste are generated. PLANNING BASIS OPTION Approximately 72,000 cubic meters of industrial waste, 480 cubic meters of mixed low-level waste, and 73,000 cubic meters of low-level waste are generated. TRANSURANIC SEPARATIONS OPTION Approximately 44,000 cubic meters of industrial waste, 710 cubic meters of mixed low-level waste, and 44,000 cubic meters of low-level waste are generated.	HOT ISOSTATIC PRESSED WASTE OPTION Approximately 68,000 cubic meters of industrial waste, 340 cubic meters of mixed low-level waste, and 50,000 cubic meters of low-level waste are generated. DIRECT CEMENT WASTE OPTION Approximately 95,000 cubic meters of industrial waste, 350 cubic meters of mixed low-level waste, and 49,000 cubic meters of low-level waste are generated. EARLY VITIRIFICATION OPTION Approximately 80,000 cubic meters of industrial waste, 480 cubic meters of mixed low-level waste, and 41,000 cubic meters of low-level waste are generated.	At INEEL - Approximately 28,000 cubic meters of industrial waste, 140 cubic meters of mixed low-level waste, and 15,000 cubic meters of low-level waste are generated.

TABLE S-2. Summary of impacts from waste processing and facility disposition alternatives (11 of 12) .

No Action Alternative	Clean Closure	Performance-Based Closure	Closure to Landfill Standards
Accidents - Facility Disposition			
There are no anticipated accidents.	Approximately 1,033 injuries/illnesses and 2.44 fatalities are calculated.	Approximately 282 injuries/illnesses and 0.64 fatalities are calculated.	Approximately 213 injuries/illnesses and 0.48 fatalities are calculated.

Air	Water	Health & Safety	Waste & Material
Cumulative Impacts - Waste Processing and Facility Disposition			
The maximum cumulative dose to the offsite MEI is 0.16 millirem per year and includes waste processing activities and is less than 2 percent of the 10 millirem per year dose limit.	USE Activities associated with this EIS will require an increased water withdrawal from the aquifer of 12 percent. CONTAMINATION A full-time occupant at INTEC would receive a lifetime dose of 66 milirem from using the contaminated groundwater after failure of 5 underground storage tanks. Because of the 500-year delay in reaching the aquifer, the iodine-129 and total plutonium contamination would not add cumulatively to the existing groundwater contamination. Disposal of Class A or Class C type grout would eventually begin to release contaminants to groundwater after about 500 years. Because of the 500-year delay in reaching the aquifer, the iodine-129 contribution to the groundwater should not add cumulatively to the existing contamination. Alternatives that involve disposal of low-level waste at INTEC are undergoing further evaluation to reduce the uncertainty in estimating long-term impacts to groundwater.	The maximum annual collective dose from waste processing would add 0.10 person-rem to the population living within 50 miles of INTEC. The occupational radiation dose received by the entire INEEL workforce would result in 1 LCF.	The highest volume of waste generated by HLW alternatives would nearly double the quantity of low-level waste and generate 365,000 cubic meters of industrial waste. Alternatives that involve disposal of low-level waste at INTEC are undergoing further evaluation to reduce the uncertainty in estimating long-term impacts to groundwater.

TABLE S-2. Summary of impacts from waste processing and facility disposition alternatives (12 of 12) .

8.0 Other Environmental Review Requirements

8.1 Endangered Species Act

The U.S. Fish and Wildlife Service has made a preliminary determination that the types of actions considered in this EIS would be unlikely to adversely impact any threatened or endangered species or critical habitat under the Endangered Species Act.

Similarly, DOE has determined, on a preliminary basis, that no further consultation with the U.S. Fish and Wildlife Service is required because the proposed actions in this EIS would not likely adversely impact threatened or endangered species or critical habitats under the Endangered Species Act. DOE will consider the comments on this EIS in making a final determination.

8.2 Clean Air Act

States have the primary responsibility to ensure that air quality within their jurisdictional borders is maintained at a level that meets the national ambient air quality standards. This is achieved by implementing source-specific State requirements.

As a minimum, DOE would need a Permit to Construct and a review pursuant to the National Emissions Standards for Hazardous Air Pollutants before beginning construction of any facility. If any facility must be permitted under the Prevention of Significant Deterioration program, Federal Land Managers of pristine (Class I) areas, including Craters of the Moon National Monument, are provided an early opportunity to review a project for visibility concerns. This involvement would be carried out through the State's permit process, and the State is required to provide a copy of the application, including an analysis of the anticipated effects on visibility, to the Class I Federal Land Manager.

8.3 Floodplain/Wetlands Management

DOE has established procedures to ensure that the potential effects of its actions in a floodplain are evaluated, and that floodplain management goals and wetlands protection considerations are incorporated into its decision-making process in order to minimize the impacts of floods to the extent practicable. Because parts of INTEC might be in a flood-prone area, this concern is analyzed in this EIS. If DOE selects an alternative that would be implemented in a floodplain, DOE will follow the requirements for compliance with floodplain activities in accordance with Federal regulations.

DOE is also required to avoid any short and long-term adverse impacts to wetlands whenever there is a practicable alternative. None of the alternatives evaluated in this EIS would affect wetlands.

As a part of the National Pollutant Discharge Elimination System program, the existing INTEC Stormwater Pollution Prevention Plan would have to be revised to reflect new construction activities.

9.0 Reading Rooms and Information Locations

The EIS is available for review at the following Reading Rooms and information locations.

Colorado

U.S. Department of Energy
Rocky Flats Operations Office
Public Reading Room
Front Range College Library
3705 112th Avenue
Westminister, CO 80030

Idaho

Boise Outreach Office
INEEL-Boise City National Bank
895 West Idaho Street
Boise, ID 83706

Boise Public Library
715 Capital Boulevard
Boise, ID 83706

Boise State University Library
Albertson Library
1910 University Drive
Boise, ID 83705

Shoshone-Bannock Library
Bannock and Pima Streets
P.O. Box 306
Fort Hall, ID 83203

INEEL Technical Library
DOE Public Reading Room
2525 N. Fremont Place
University Place
Idaho Falls, ID 83402

Idaho Falls Public Library
457 Broadway
Idaho Falls, ID 83402

Lewis-Clark State College
The Library
500 8th Ave.
Lewiston, ID 83501

University of Idaho Library
Rayburn Street
Moscow, ID 83844

Idaho State University Public Library
741 South 7th Ave.
Pocatello, ID 83209

Twin Falls Public Library
434 2nd Street East
Twin Falls, ID 83301

Montana

Mansfield Library
Government Documents Collection
University of Montana
Missoula, MT 59812

Nevada

U.S. Department of Energy
Nevada Operations Office
Public Reading Room
2621 Losee Rd., B-3 Building
North Las Vegas, NV 89030

New Mexico

US DOE Public Document Collection
University of New Mexico Government Information Department
Zimmerman Library
Albuquerque, NM 87131

Oregon

U.S. Department of Energy
Bonneville Power Administration Reading Room
905 Northeast 11th Avenue
Portland, OR 97232

Utah

Marriott Library
Public Document Collection
University of Utah
295 S. 1500 East
Salt Lake, City UT 84112

Washington

U.S. Department of Energy
Richland Operations Office
Washington State University
WSU Tri-Cities Branch Campus
100 Sprout Road
Richland, WA 99352

Wyoming

Teton County Public Library
125 Virginian Lane
Jackson, WY 83001

Wyoming State Library
Government Documents Collection
2301 Capitol Avenue
Cheyenne, WY 82002

District of Columbia

DOE/Forrestal Building
Freedom of Information Reading Room
1000 Independence Ave., S.W.
Washington, DC 20585


ECOLOGICAL RESOURCES
HEALTH & SAFETY
CULTURAL RESOURCES
WATER RESOURCES
ACCIDENT ANALYSIS
ENVIRONMENTAL JUSTICE
GEOLOGY/ SOILS
AESTHETIC & SCENIC RESOURCES
TRANSPORTATION
SOCIOECONOMICS
WASTE & MATERIALS
LAND USE
AIR RESOURCES
UTILITIES/ ENERGY

U.S. Department of Energy
Idaho Operations Office
Idaho HLW & FD EIS Project Office
850 Energy Drive, MS 1108
Idaho Falls, ID 83401-1563

ADDRESS SERVICE REQUESTED

Welcome

INEEL occupies 890 square miles in southeastern Idaho

INEEL currently stores about 4,200 cubic meters of calcined high-level waste & 1.4 million gallons of mixed transuranic waste/sodium bearing waste

DOE must decide how to treat & prepare these wastes for disposal

DOE must also decide how to disposition the facilities associated with waste generation & storage


Major DOE Sites Discussed in this EIS
INEEL
1 Idaho National Engineering and Environmental Laboratory - Idaho
2 Hanford Site Washington
3 Savannah River Site South Carolina
4 West Valley Demonstration Project New York
5 Candidate Repository Site Yucca Mountain - Nevada
6 Waste Isolation Pilot Plant New Mexico

Idaho High-Level Waste & Facilities Disposition

DRAFT ENVIRONMENTAL IMPACT STATEMENT

DECEMBER 1999 DOE/EIS-0287D

Volume 1

CHAPTERS 1 THROUGH 4

TABLE OF CONTENTS

VOLUME 1: CHAPTERS 1 THROUGH 4

TABLE OF CONTENTS

VOLUME 1: CHAPTERS 1 THROUGH 4 (continued)

TABLE OF CONTENTS

VOLUME 1: CHAPTERS 1 THROUGH 4
(continued)

TABLE OF CONTENTS

VOLUME 1: CHAPTERS 1 THROUGH 4
(continued)

Section | Page

TABLE OF CONTENTS

VOLUME 2: CHAPTERS 5 THROUGH 10

TABLE OF CONTENTS

VOLUME 2: CHAPTERS 5 THROUGH 10
(continued)

Section | Page

TABLE OF CONTENTS

VOLUME 2: CHAPTERS 5 THROUGH 10 (continued)

Section | Page

TABLE OF CONTENTS

VOLUME 2: CHAPTERS 5 THROUGH 10 (continued)

TABLE OF CONTENTS

VOLUME 2: CHAPTERS 5 THROUGH 10 (continued)

TABLE OF CONTENTS

VOLUME 3: APPENDICES A THROUGH C.5

VOLUME 4: APPENDICES C.6 THROUGH E

LIST OF TABLES

VOLUME 1: CHAPTERS 1 THROUGH 4

LIST OF TABLES

VOLUME 1: CHAPTERS 1 THROUGH 4
(continued)

VOLUME 2: CHAPTERS 5 THROUGH 10

LIST OF TABLES

VOLUME 2: CHAPTERS 5 THROUGH 10 (continued)

LIST OF TABLES

VOLUME 2: CHAPTERS 5 THROUGH 10
(continued)

LIST OF TABLES

VOLUME 2: CHAPTERS 5 THROUGH 10 (continued)

LIST OF FIGURES

VOLUME 1: CHAPTERS 1 THROUGH 4

LIST OF FIGURES

VOLUME 1: CHAPTERS 1 THROUGH 4
(continued)

VOLUME 2: CHAPTERS 5 THROUGH 10

LIST OF FIGURES

VOLUME 2: CHAPTERS 5 THROUGH 10 (continued)

State of Idaho's Foreword

To the Draft Idaho High-Level Waste (HLW) and Facilities Disposition Environmental Impact Statement (EIS)

A 1995 court settlement, commonly referred to as the Settlement Agreement, spells out a commitment by both Idaho and DOE to act in good faith to fulfill and support its terms. By participating in the preparation of this EIS, Idaho hopes it can expedite progress toward the Settlement Agreement's goals to treat and remove HLW from the State. The EIS process should facilitate Idaho's negotiations with DOE concerning HLW management by discussing the relative merits of proposed treatment technologies and providing opportunities for public input. In this foreword, the State of Idaho explains its role in the preparation of the EIS and its position on four key policy issues.

Idaho's Role in the EIS

The State of Idaho is a cooperating agency in the preparation of this EIS. Under the National Environmental Policy Act (NEPA), this arrangement is appropriate because Idaho has jurisdiction and expertise regarding issues evaluated in this EIS.

Idaho has regulatory authority over many activities addressed in this EIS, including hazardous waste management, environmental cleanup, and air emission controls. In addition to this regulatory authority, the Settlement Agreement establishes requirements and schedules for managing HLW at the Idaho Nuclear Technology and Engineering Center (INTEC). These terms include:

- By June 30, 1998, convert all non-sodium bearing liquid HLW into a granular powder called calcine (completed).
- By December 31, 2012, convert all sodium-bearing liquid HLW to calcine.
- By December 31, 1999, begin negotiating a plan and schedule for calcined HLW treatment (begun with this EIS).
- Complete treatment of all calcined HLW so that it is ready to be moved out of Idaho for disposal by a target date of 2035.

The Settlement Agreement allows DOE to propose changes to these requirements, provided they are based on adequate environmental analyses under NEPA, and Idaho will agree to such changes if they are reasonable. Because of technology developments and changes needed in existing treatment facilities to properly manage sodium-bearing waste, Idaho agreed with DOE that an EIS could facilitate negotiations required by the Settlement Agreement. A cooperating agency arrangement was an appropriate way for both parties to evaluate HLW treatment options and their respective environmental impacts.

By serving as a cooperating agency, Idaho was able to identify and discuss concerns regarding information and issues presented in this draft EIS, and request changes to preliminary drafts. The State of Idaho was not, however, able to verify every aspect of this draft EIS.

In addition, Idaho and DOE did not have to agree on all issues before DOE published the draft EIS. The Memorandum of Agreement establishing the State of Idaho as a cooperating agency on this EIS recognizes that the two parties can "agree to disagree" on issues, and that the EIS will reflect both positions. Idaho has identified four key policy issues related to this EIS.

Key Policy Issues

1 Idaho finds certain options to be inconsistent with the intent of the Settlement Agreement.

Idaho recognizes that under NEPA, DOE may evaluate alternatives that are not consistent with existing legal obligations. However, Idaho wants to inform decision-makers and the public of options that are inconsistent with the Settlement Agreement.

One of the fundamental reasons Idaho agreed to the 1995 settlement was DOE's commitment to convert all liquid waste in the INTEC Tank Farm into solid form by 2012 and to treat this waste so that it could be removed from Idaho by a target date of 2035. Therefore, the following EIS options are inconsistent with the 1995 court settlement:

- options that leave liquid waste in the INTEC Tank Farm beyond the year 2012; and
- options that result in treated waste from the INTEC Tank Farm not being ready to be moved out of Idaho by 2035.

For example, the No Action Alternative, which leaves liquids in the INTEC Tank Farm and the Continued Current Operations Alternative, which leaves calcined waste at INTEC indefinitely, are inconsistent with the Settlement Agreement. Similarly, alternatives that propose to dispose of low-level waste fractions separated from HLW at

INTEC will not meet the Settlement Agreement's intent to have all HLW treated and removed from Idaho.

Notably, DOE and the State did not select a preferred alternative in the draft EIS. The State and DOE will discuss preferred alternatives after considering public input, and the Final EIS will announce the outcome of these discussions.

2 Idaho maintains that sodium-bearing waste in the INTEC Tank Farm is HLW.

Reprocessing at INTEC used a three-cycle solvent extraction process to recover highly enriched uranium from spent fuel. Each cycle created liquid waste, as did decontamination activities.

DOE's recently adopted Radioactive Waste Management Order (DOE O 435.1) identifies HLW as liquid produced "directly in reprocessing." Idaho interprets this HLW definition to include waste from the first reprocessing cycle ("non-sodium bearing waste") and the second and third cycles ("sodium-bearing waste"). This interpretation is consistent with language in the Settlement Agreement that identifies both sodium-bearing waste and non-sodium bearing waste as HLW. In addition, liquid from the second and third extraction cycles was routed to an evaporator before being discharged to the Tank Farm. As such, these liquids contain radioactive fission products in sufficient concentrations to warrant permanent isolation in a geologic repository.

DOE, however, maintains that only the liquid from the first reprocessing cycle is HLW. This difference of interpretation does not change the environmental impacts of this EIS's alternatives. However, it does affect the process DOE would follow if certain alternatives are selected, and could affect the eventual disposition of the material.

DOE has a process, called a "waste incidental to reprocessing (WIR) determination," to decide if it is more appropriate to classify and manage HLW as transuranic or low-level waste, provided the waste meets certain criteria. Idaho maintains that DOE should manage the sodium-bearing waste as HLW unless and until it completes a WIR determination.

As noted above, even if DOE determines some of the HLW should be classified as other waste types, all of it must be treated and prepared for shipment out of Idaho as the Settlement Agreement intended.

3 Idaho urges DOE to take steps to allow acceptance of certain hazardous constituents at the national geologic repository.

This EIS explains that current DOE policy will not allow the disposal of HLW containing certain hazardous waste constituents at the proposed geologic repository. Unless DOE changes its policy or seeks regulatory exemptions, it is unlikely there will be an appropriate place to receive all of INEEL's HLW.

4 Idaho urges DOE to calculate Metric Tons of Heavy Metal (MTHM) for DOE HLW in a way that more accurately reflects the actual concentrations of radionuclides and relative risk. This approach would allow for the proper disposal of DOE's HLW inventory in a more timely manner consistent with the intent of federal legislation.

Space in the proposed geologic repository is allocated by Metric Tons of Heavy Metal (MTHM). MTHM refers to the amount of energy-producing material in nuclear fuel, primarily uranium and plutonium. DOE has allocated 4,667 MTHM in the proposed repository for its HLW. Determining the

MTHM in spent nuclear fuel is straightforward, since the quantity was established when the fuel was fabricated. Because reprocessing removed plutonium and uranium from different types of nuclear fuel over three cycles, calculating MTHM for DOE's HLW is more complex.

DOE currently estimates MTHM in its HLW based on hypothetical comparisons between "typical" DOE waste and "typical" commercial materials. Using this method, DOE established a standard where one canister of DOE HLW is equivalent to 0.5 MTHM. Although easy to use, this conversion factor does not recognize that much of DOE's waste is significantly less radioactive and poses less risk than the "typical" DOE waste used in the comparison. Therefore, this method overestimates the MTHM in DOE HLW, exceeding the amount allocated in the repository.

DOE has evaluated other methods for calculating MTHM. One method compares the relative radioactivity in DOE HLW with that in a standard MTHM of a commercial spent fuel assembly. Because commercial spent fuel was irradiated for a much longer period of time, it exhibits significantly higher levels of radioactivity and contains much higher concentrations of long-lived radionuclides than DOE spent fuel used for reprocessing. Thus, the amount of radioactivity in DOE HLW is a very small fraction of what is present in an equivalent amount of commercial spent fuel. A second method compares relative radiotoxicity with similar results.

Idaho advocates using either of these approaches to better reflect the relative risk and actual concentrations of radionuclides in DOE HLW. Under these approaches, DOE HLW would be within the capacity established for the proposed repository.

Public Involvement Welcome

Idaho hopes its participation in preparing this EIS contributes to a better understanding of technical and policy-related HLW management issues. Public comment on this document will enhance this discussion.

Acronyms & Abbreviations

In this Environmental Impact Statement (EIS), the U.S. Department of Energy (DOE) has tried to limit the use of acronyms and abbreviations. The few acronyms used in the main body of this EIS (Chapters 1 through 6) are defined in Section AA.1 below. Some acronyms and abbreviations are used only in tables and figures because of space constraints. These table and figure acronyms are defined at the bottom of each table or figure unless already defined in the text. Acronyms used in appendixes appear in lists within those appendixes.

This EIS cites numerous laws, regulations, and Federal Register notices. Section AA.2 presents the standard notation for such resources. DOE attempted not to use numbers that imply a greater level of precision in calculation than is possible. Therefore, Sections AA.3 and AA.4 discuss the use of significant digits and the meaning of scientific notation. To help readers understand the technical material presented in this document, Section AA.5 discusses the selection and definition of the units of measure.

AA.1 Document-wide Acronyms and Abbreviations

AMWTP EIS	*Advanced Mixed Waste Treatment Project EIS*
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CSSF	Calcined Solids Storage Facilities
D&D	decontamination and decommissioning
DOE	U.S. Department of Energy
DOE-ID	U.S. Department of Energy-Idaho Operations Office
EIS	environmental impact statement
EPA	U.S. Environmental Protection Agency
ERPG	Emergency Response Planning Guideline
HEPA	high-efficiency particulate air
HLW	high-level waste
ICPP	Idaho Chemical Processing Plant (now INTEC)
INEEL	Idaho National Engineering and Environmental Laboratory (formerly INEL)
INEL	Idaho National Engineering Laboratory (now INEEL)
INTEC	Idaho Nuclear Technology and Engineering Center (formerly ICPP)
LCF	latent cancer fatality
MTHM	metric tons of heavy metal
NRC	U.S. Nuclear Regulatory Commission
RCRA	Resource Conservation and Recovery Act
SBW	sodium-bearing waste
SNF & INEL EIS	*U.S. Department of Energy Programmatic Spent Nuclear Fuel Management and Idaho National Engineering Laboratory Environmental Restoration and Waste Management Programs EIS*
TWRS EIS	*Tank Waste Remediation System EIS*
TRU	transuranic

AA.2 Citations for Laws and Regulations

This EIS uses accepted abbreviations for referencing the United States Code, the Code of Federal Regulations, and the Federal Register.

United States Code (USC)

The format for United States Code is xx USC yyyy, where xx represents the title and yyyy represents the section. For example, the Atomic Energy Act can be found at 42 USC 2011, et seq. The Latin phrase, *et seq. (et sequentes)* literally means "and the following." *Et seq*. can be interpreted to mean "and the subsequent sections."

Code of Federal Regulations (CFR)

The format for the Code of Federal Regulation is xx CFR yyy, where xx represents the title and yyy represents the part. For example, the U.S. Nuclear Regulatory Commission regulations on high-level waste can be found at 10 CFR 60.

Federal Register (FR)

The format for the Federal Register is xx FR yyyy, where xx is the volume number and yyyy is the page number. For example, the U.S. Nuclear Regulatory Commission's denial of petition for rulemaking on incidental waste is found at 58 FR 12342.

AA.3 Significant Figures

When DOE calculates numbers in this document, two significant digits are used to report the results. When DOE uses accurate values for measuring things, all significant digits are used. Rounding off numbers can make it appear that the totals of a column of figures are inaccurate because they are inexact, but the slight variance is due to the rounding of the values.

AA.4 Scientific Notation

Very small and very large numbers are sometimes written using a shorthand method known as "scientific notation." Scientific notation indicates how many "tens" must be multiplied to make up a number. For example, the number of "tens" in 100 can be expressed as 10×10 and in scientific notation this is written using a positive exponent of 2 or as 10^2. Similarly, very small numbers (less than 1) are written using a negative exponent, so that 1/100 or $1/(10 \times 10)$ is written as 10^{-2}.

The shorthand method of scientific notation is particularly useful where expressing numbers above a million. Such large numbers are written as a decimal between 1 and 10 multiplied by the appropriate power of 10. Thus: 1,490,000 is written as 1.49×10^6 where 10^6 represents one million. Similarly, 1,490,000,000 is written as 1.49×10^9 where 10^9 represents one billion.

In this document, numbers equal to or greater than 1,000 or equal to or smaller than 0.001 are expressed in scientific notation (1×10^3 and 1×10^{-3}, respectively).

AA.5 Units of Measure

This EIS uses both English and metric units of measurement. English units, such as inches, feet, miles, and acres are used throughout the document because the public is familiar with these units. However, scientific disciplines typically use metric units for reporting data and other measurement information. For example, concentrations of contaminants in air or water are commonly presented in metric units, such as milligrams per liter (mg/L). Since environmental regulatory standards also use metric units, it is necessary for compliance reporting to maintain consistency for comparison purposes. The following conversion table indicates how the two systems of units of measurements compare.

Metric Conversion Chart

To convert into metric			To convert out of metric		
If you know	**Multiply by**	**To get**	**If you know**	**Multiply by**	**To get**
Length					
inches	2.54	centimeters	centimeters	0.3937	inches
feet	30.48	centimeters	centimeters	0.0328	feet
feet	0.3048	meters	meters	3.281	feet
yards	0.9144	meters	meters	1.0936	yards
miles	1.60934	kilometers	kilometers	0.6214	miles
Area					
square inches	6.4516	square centimeters	square centimeters	0.155	square inches
square feet	0.092903	square meters	square meters	10.7639	square feet
square yards	0.8361	square meters	square meters	1.196	square yards
acres	0.0040469	square kilometers	square kilometers	247.1	acres
square miles	2.58999	square kilometers	square kilometers	0.3861	square miles
Volume					
fluid ounces	29.574	milliliters	milliliters	0.0338	fluid ounces
gallons	3.7854	liters	liters	0.26417	gallons
cubic feet	0.028317	cubic meters	cubic meters	35.315	cubic feet
cubic yards	0.76455	cubic meters	cubic meters	1.308	cubic yards
Weight					
ounces	28.3495	grams	grams	0.03527	ounces
pounds	0.4536	kilograms	kilograms	2.2046	pounds
short tons	0.90718	metric tons	metric tons	1.1023	short tons
Temperature					
Fahrenheit	Subtract 32 then multiply by 5/9ths	Celsius	Celsius	Multiply by 9/5ths, then add 32	Fahrenheit

Metric Prefixes

Prefix	Symbol	Scientific Notation	Prefix	Symbol	Scientific Notation
exa-	E	1 000 000 000 000 000 000 = 10^{18}	atto-	a	0.000 000 000 000 000 001 = 10^{-18}
peta-	P	1 000 000 000 000 000 = 10^{15}	femto-	f	0.000 000 000 000 001 = 10^{-15}
tera-	T	1 000 000 000 000 = 10^{12}	pico-	p	0.000 000 000 001 = 10^{-12}
giga-	G	1 000 000 000 = 10^{9}	nano-	n	0.000 000 001 = 10^{-9}
mega-	M	1 000 000 = 10^{6}	micro-	µ	0.000 001 = 10^{-6}
kilo-	k	1 000 = 10^{3}	milli	m	0.001 = 10^{-3}

1.0 Background

The Idaho National Engineering and Environmental Laboratory (INEEL) currently manages waste associated with the processing of spent nuclear reactor fuel, including high-level waste (HLW). This waste must be properly managed to help ensure that it does not pose a risk to human health and the environment. This Environmental Impact Statement (often referred to as the Idaho HLW & FD EIS or simply "this EIS") describes technologies and methods the U.S. Department of Energy (DOE) is considering for management of the high-level and related wastes and the disposition of HLW generation, storage, and treatment facilities after their missions are completed. This EIS also provides the environmental consequences and regulatory issues surrounding the various management alternatives under consideration. Chapter 1 introduces background information on the INEEL and the waste management issues pertinent to this EIS.

1.1 INEEL *Overview*

1.1.1 SITE DESCRIPTION

INEEL occupies approximately 890 square miles of dry, cool desert in southeastern Idaho. It is located in the Eastern Snake River Plain, southwest of Yellowstone National Park (132 miles); north of Salt Lake City, Utah (234 miles); and east of Boise, Idaho (198 miles). Figure 1-1 shows the INEEL location. Population centers near the site are Idaho Falls and Rexburg to the east, Blackfoot to the southeast, Atomic City to the south, Pocatello and the Fort Hall Indian Reservation to the south-southeast, and Arco and Howe to the west. Prior to 1996, INEEL was known as the Idaho National Engineering Laboratory (INEL).

1.1.2 ORGANIZATION AND ADMINISTRATION

DOE manages INEEL through three DOE operations offices: (1) the Idaho Operations Office (DOE-ID); (2) the Idaho Branch Office of Pittsburgh Naval Reactors, and (3) the Chicago Operations Office. Bechtel-Babcock & Wilcox Idaho began operating the DOE-ID facilities on October 1, 1999 (previously operated by Lockheed Martin Idaho Technologies Company).

As the principal INEEL 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 nuclear materials stabilization, environmental restoration, and waste management activities. The INEEL Environmental Restoration and Waste Management Program is under the DOE Headquarters Office of Environmental Management established in November 1989. These environmental restoration and waste management activities are defined and carried out within the regulatory environment described in Section 1.2.5, Regulatory Framework for High-Level Waste Management, and Chapter 6, Statutes, Regulations, Consultations, and Other Requirements.

The Idaho Branch Office of Pittsburgh Naval Reactors is responsible for implementation of the Naval Nuclear Propulsion Program (a joint DOE-Navy program) activities at INEEL. These activities are primarily carried out at the Naval Reactors Facility.

DOE-Chicago Operations Office is responsible for operations at Argonne National Laboratory - West located at INEEL. That facility was originally a testing ground for breeder reactor technology and includes several inactive reactors, fuel-making and testing facilities, and support facilities. The current Argonne National Laboratory-West mission includes environmental management activities and technology development for treatment of spent nuclear fuel.

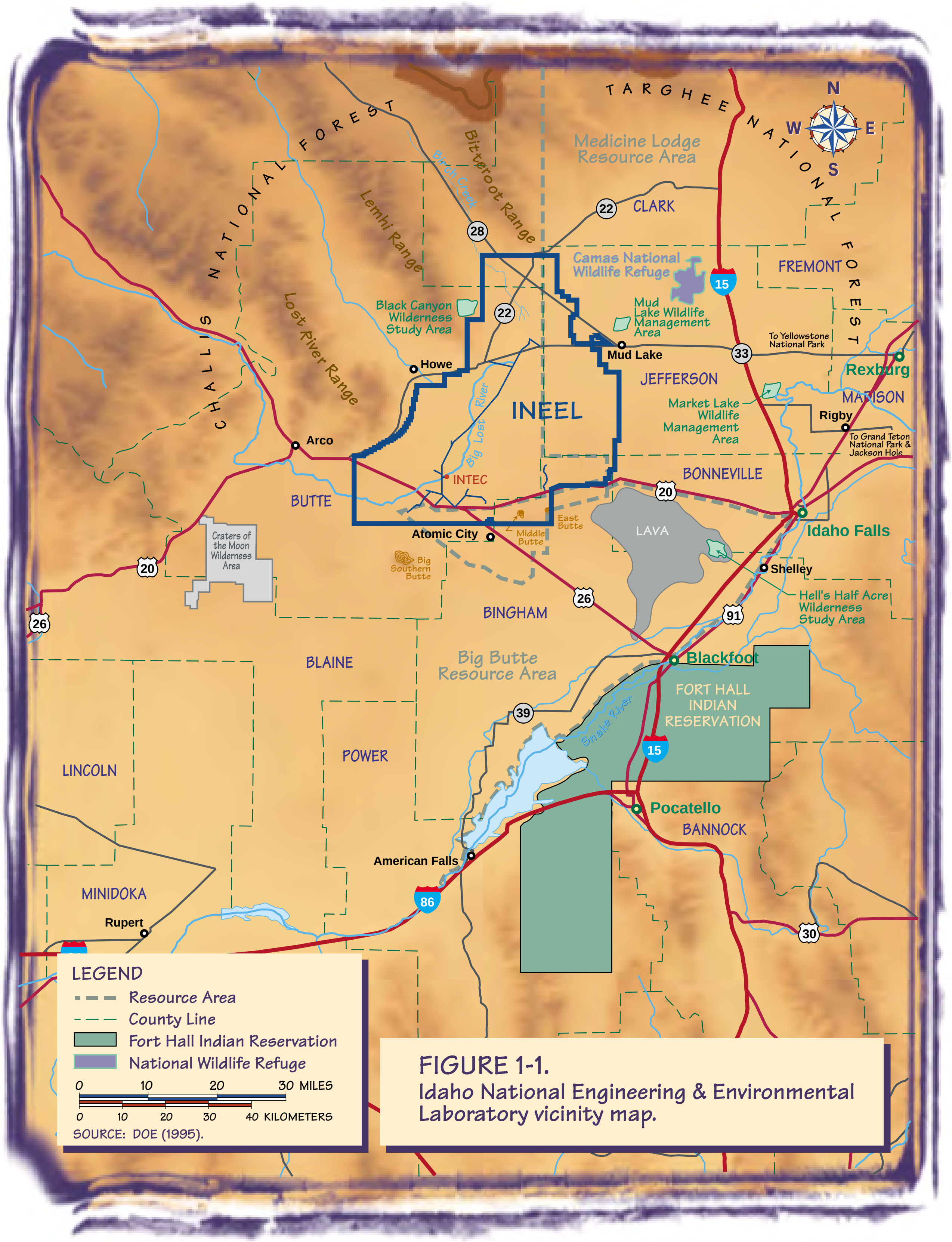


FIGURE 1-1.
Idaho National Engineering & Environmental Laboratory vicinity map.

What is Spent Nuclear Fuel?

Spent nuclear fuel is fuel that has been withdrawn from a nuclear reactor following irradiation. When it is taken out of a reactor, spent nuclear fuel contains some unused enriched uranium and radioactive fission products. Because of its radioactivity (primarily from gamma rays), it must be properly shielded from people.

1.1.3 CURRENT MISSION

The current INEEL Environmental Management Program 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 INEEL include waste management and waste minimization, environmental engineering and restoration, energy efficiency, renewable energy, national security and defense, nuclear technologies, and advanced technologies and methods. INEEL is the lead laboratory for the National Spent Nuclear Fuel Management Program, which sets standards for developing and maintaining the capability to safely manage DOE's spent nuclear fuel. DOE considers the Environmental Management Program a top priority at INEEL (DOE 1995).

The Environmental Restoration mission is to (1) assess and clean up sites where there are known or suspected releases of hazardous substances into the environment and (2) safely manage contaminated surplus nuclear facilities as they are decommissioned. The Waste Management mission is to (1) protect the safety of INEEL employees, the public, and the environment in the design, construction, operation, and maintenance of INEEL treatment, storage, and disposal facilities and (2) operate these facilities in a manner that is cost-effective, is environmentally sound, complies with regulations, and is publicly acceptable. DOE is committed to fulfilling these missions while bringing all INEEL facilities into compliance with local, State, and Federal regulations.

Prior to 1998, INTEC was known as the Idaho Chemical Processing Plant.

Mission activities, including those associated with environmental restoration and waste management, occur primarily in nine major facility areas that were developed since the INEEL site was established in May 1949. Figure 1-2 shows the location of these major facility areas. These areas and their transportation corridors encompass the majority of industrial development and land disturbances on the INEEL site, but make up only 2 percent of the total land area of the site. Public roads and utility rights of way that cross the site make up an additional 6 percent of the total land area (DOE 1995). Selected land uses at the INEEL and in the surrounding region are shown on Figure 1-3. Detailed descriptions of the major facility areas at the INEEL can be found in Volume 2 of the *DOE Spent Nuclear Fuel Management and Idaho National Engineering Laboratory Environmental Restoration and Waste Management Programs Final Environmental Impact Statement*, referred to in this document as the SNF & INEL EIS (DOE 1995) and in the *Idaho National Engineering and Environmental Laboratory Comprehensive Facility and Land Use Plan* (DOE 1997a).

The INEEL High-Level Waste Program is conducted at the Idaho Nuclear Technology and Engineering Center (INTEC). Prior to 1998, this area of the INEEL was known as the Idaho Chemical Processing Plant (ICPP). INTEC is located in the southwestern part of the INEEL site. The INTEC facilities cover approximately

FIGURE 1-2. Major facility areas located at the Idaho National Engineering and Environmental Laboratory.

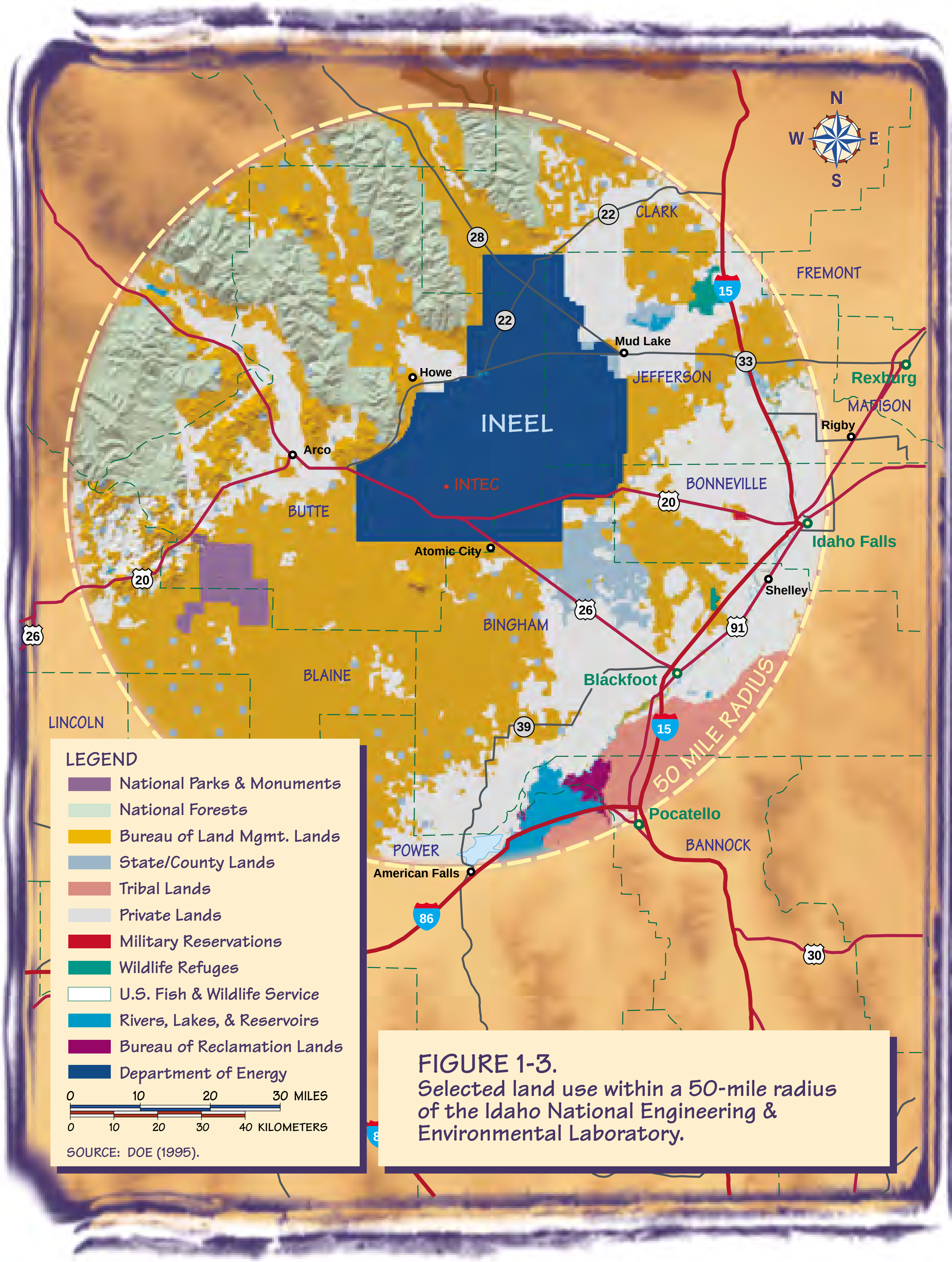


FIGURE 1-3.
Selected land use within a 50-mile radius of the Idaho National Engineering & Environmental Laboratory.

250 acres and contain more than 150 buildings. Figure 1-4 shows major facilities at INTEC.

INTEC's original purpose was to function as a one-of-a-kind processing facility for government-owned nuclear fuels from research and defense reactors. The facility recovered rare gases and uranium for reuse from spent nuclear fuel. DOE stopped processing spent nuclear fuel nationwide in 1992 (DOE 1992).

INTEC's current purpose is to:

- Receive and store DOE-assigned (including naval) spent nuclear fuels
- Treat and store HLW until disposal
- Develop technologies for final disposition of spent nuclear fuel, HLW and mixed transuranic waste [sodium-bearing waste (SBW) and newly generated liquid waste]
- Develop and apply technologies to minimize waste generation and manage radioactive and hazardous wastes

Major operating facilities at INTEC include storage and treatment facilities for spent nuclear fuel, HLW, and mixed transuranic waste/SBW. Mixed and low-level wastes are also managed at INTEC. Other operating facilities at INTEC include process development, analytical, and robotics laboratories.

1.2 High-Level Waste Overview

1.2.1 HIGH-LEVEL WASTE DESCRIPTION

According to Section 2(12) of the Nuclear Waste Policy Act (42 USC 10101), high-level radioactive waste means:

> **(A) The highly radioactive material resulting from the 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 Commission, consistent with existing law, determines by rule requires permanent isolation.**

In July 1999, DOE issued Order 435.1 *Radioactive Waste Management*. This Order and its associated Manual and Guidance set forth the authorities, responsibilities, and requirements for the management of DOE's inventory of HLW, transuranic waste, and low-level waste. Specific to HLW, DOE uses the Nuclear Waste Policy Act definition but has jurisdictional authority consistent with existing law to determine if the waste requires permanent isolation as the appropriate disposal mechanism. This

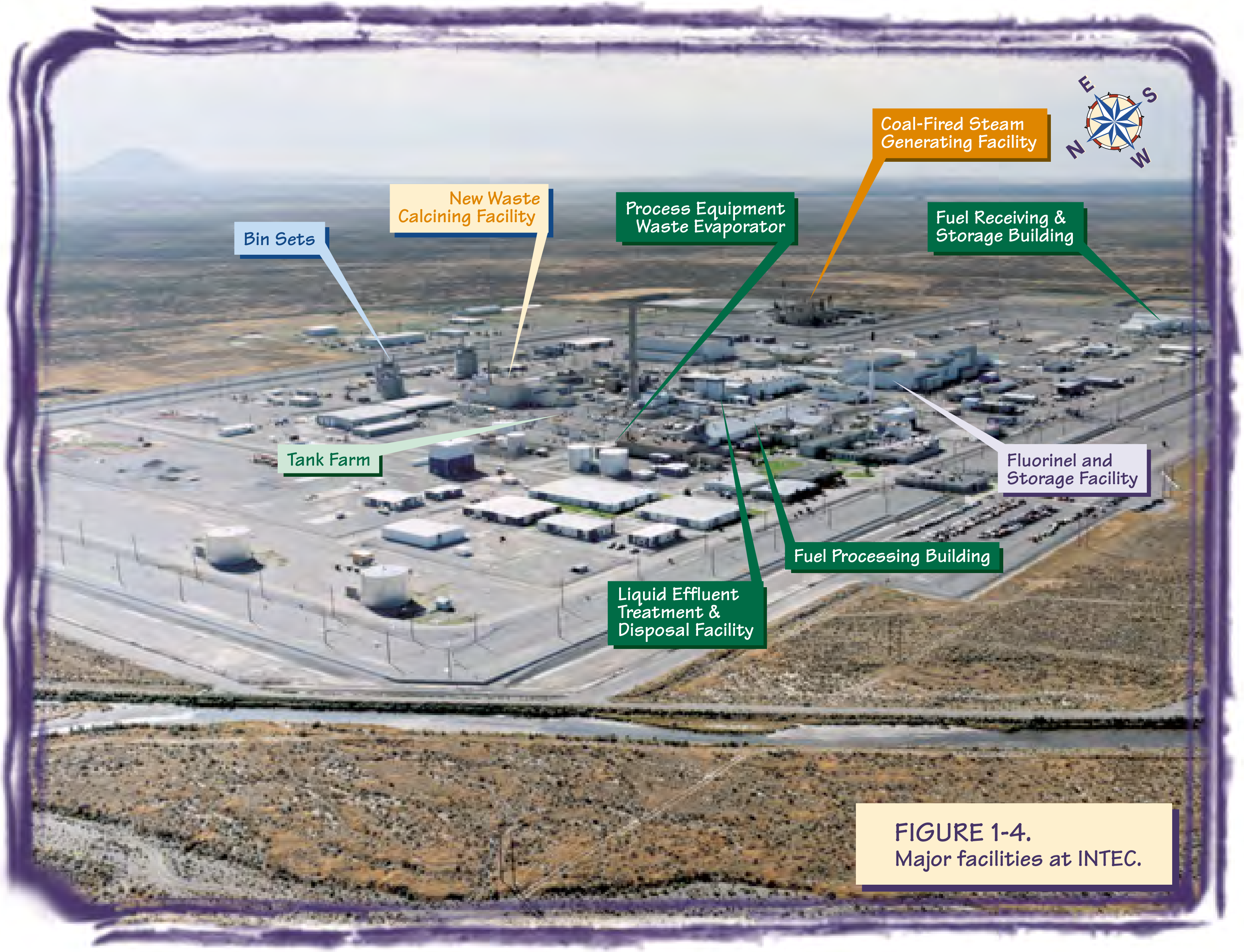


FIGURE 1-4.
Major facilities at INTEC.

Characteristics of HLW

HLW is the highly radioactive material resulting from the processing of spent nuclear fuel, including liquid waste produced directly in processing and any solid material derived from such liquid waste that contains fission products in sufficient concentrations; and other highly radioactive material that is determined, consistent with existing law, to require permanent isolation (DOE 1999a).

Until 1991, DOE processed spent nuclear fuel at INTEC to recover enriched uranium. The fuel, which had been irradiated in a nuclear reactor, was first dissolved in hydrofluoric or nitric acid and then fed to a solvent extraction system where the uranium was separated out. The remaining solution was considered a HLW that was kept in large, below-grade tanks until calcined into a dry, granular powder and transferred to bin sets for storage. This waste contains highly radioactive, but relatively short-lived (approximately 30-year half-life) fission products, such as cesium-137 and strontium-90. It also contains long-lived radionuclides, including transuranics (elements with atomic numbers greater than uranium) that were created when the nuclear fuel was originally irradiated. Transuranics found in the liquid HLW from processing at INEEL include plutonium-238 and americium-241.

Subsequent liquid waste streams associated with spent nuclear fuel processing were created when the extracted uranium underwent purification and when related facilities and equipment were decontaminated. Such liquid wastes were quite dilute, containing only traces of the same radionuclides found in the first cycle extraction solution. Consequently, secondary liquid waste streams were not considered HLW, although at INEEL these wastes were managed as if they were HLW. Management entailed volume reduction by evaporation, discharge to large underground tanks, calcination, and then transfer to bin sets containing HLW calcine. The resulting combination of these calcined wastes resulted in a determination that all of the material in bin sets are considered HLW.

At INTEC, all HLW is also considered a mixed waste because in addition to radionuclides the HLW also contains hazardous materials. Some of the hazardous materials, such as heavy metals, were present in the spent nuclear fuel. Other hazardous materials were introduced during processing and decontamination activities. Examples include mercuric nitrate used as a catalyst to dissolve the fuel and various solvents. The mixed nature of this waste implicates additional management considerations and regulatory requirements.

authority is based on enabling legislation in the Atomic Energy Act, sections 202(3) and 202(4) of the Energy Reorganization Act of 1974, and others. The documents associated with DOE Order 435.1 describe processes for: waste incidental to reprocessing determinations; the characterization, certification, storage, treatment and disposal of HLW; and HLW facility design, decommissioning, and closure. In this EIS, the term HLW and all management aspects related to HLW are used consistent with the DOE Order 435.1 and its associated documents (see Section 6.3.2.2).

1.2.2 HIGH-LEVEL WASTE MANAGEMENT AT INEEL

From 1952 to 1991, DOE processed spent nuclear fuel at INTEC. The process was designed to recover the highly enriched uranium in the fuel using a three-step solvent extraction process. The first solvent extraction cycle resulted in a highly radioactive liquid that was considered a HLW and stored at the Tank Farm, a collection of below-grade tanks at INTEC. Subsequent extraction cycles and decontamination activities generated a liquid waste that was

Waste Terminology

This EIS refers to the various waste streams managed at INTEC in accordance with their radioactive waste classification (i.e., HLW, transuranic waste, or low-level waste) under DOE Manual 435.1-1. In addition, this EIS refers to those INTEC radioactive waste streams regulated as hazardous wastes under RCRA as mixed wastes. The "mixed" designation applies until the waste stream has been treated to its final waste form and any RCRA exemptions such as delisting have been obtained. Many of the INTEC waste streams are also known by their historical, descriptive, or process names (e.g., sodium-bearing waste, newly generated liquid wastes). These descriptive names appear in the Settlement Agreement/Consent Order, Site Treatment Plan, and other INEEL documents that were used as references in the preparation of this EIS. The appendixes of the EIS continue to use these descriptive or process names to facilitate the traceability of the technical information presented in the EIS to the reference materials. The following provides a comparison between these descriptive or process names and the DOE Manual 435.1-1 radioactive waste classifications used in the EIS. The glossary provides ancillary radioactive waste definitions used in this EIS.

<u>Sodium-bearing waste</u>:

SBW is referred to as mixed transuranic waste.

<u>Newly generated liquid waste</u>:

Depending on the concentrations of transuranic radionuclides, newly generated liquid waste is referred to as either mixed transuranic waste or mixed low-level waste.

<u>High-activity waste fraction</u>:

Processing of HLW may include separating the mixed HLW into high- and low-activity waste fractions. The high-activity waste fraction is referred to as either mixed HLW or mixed transuranic waste, depending on the separations processes that are used.

<u>Low-activity waste fraction</u>:

The low-activity waste fraction, which is produced under some alternatives in this EIS, is referred to as mixed low-level waste fraction.

The Tank Farm with New Waste Calcining Facility in the background at INTEC.

concentrated by evaporation and stored at the Tank Farm, where characterization has determined that it meets the definition of a mixed transuranic waste. Because of the high sodium content from decontamination activities, this mixed transuranic waste has been called SBW. In addition, newly generated low-level liquid waste from processes and decontamination activities at INTEC facilities not associated with the HLW program and from other INEEL facilities has also been evaporated and added to these below-grade tanks. All of this liquid waste at the Tank Farm has been managed by the HLW program, calcined with other liquids, and added to the bin sets.

What is Sodium Bearing Liquid Waste?

SBW is liquid waste that is generated from decontamination operations of INTEC facilities involved in the processing of spent nuclear fuel and the treatment of HLW. SBW contains large quantities of sodium and potassium nitrates. Radionuclide concentrations for SBW are generally 10 to 1,000 times less than liquid HLW. Typically, SBW is processed through an evaporator to reduce the volume and stored in the HLW tanks. It has been historically managed within the HLW program because of the existing plant configuration and some physical and chemical properties that are similar to HLW. SBW contains hazardous and radioactive materials and is classified as mixed transuranic waste. Hence, this EIS refers to SBW as mixed transuranic waste.

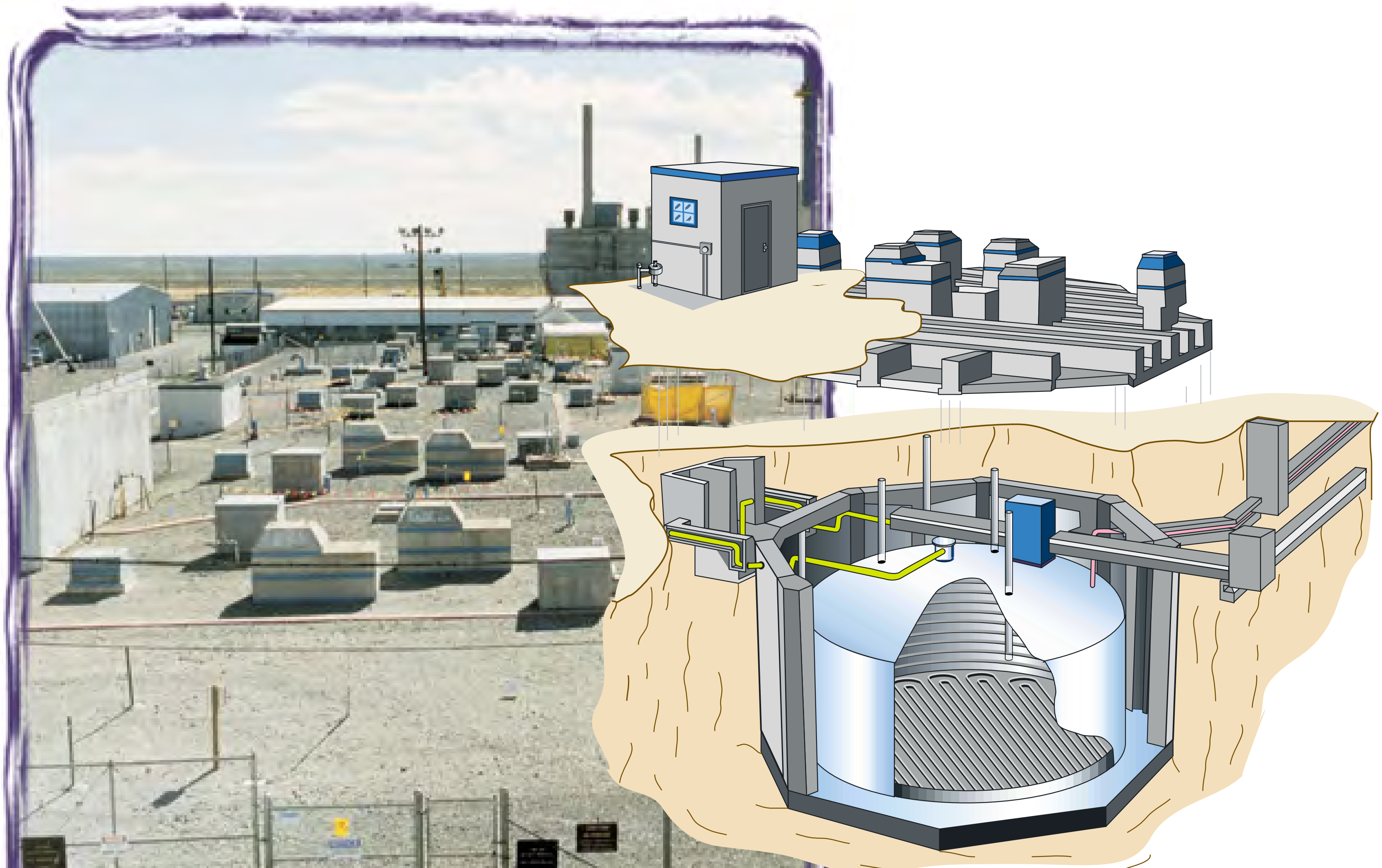
The Tank Farm consists of storage tanks, tank vaults, interconnecting waste transfer lines, valves and valve boxes, cooling equipment, and several small buildings that contain instrumentation and equipment for the waste tanks. Figure 1-5 shows the INTEC Tank Farm with a representative artist's rendition of the tank risers (top right) and of a tank to show tank and vault construction (lower right). Certain other processes at INTEC such as the Process Equipment Waste Evaporator, which concentrates low-level liquid waste, and the Liquid Effluent Treatment and Disposal Facility, which processes evaporator overheads, generate waste that is managed by the HLW Program. Figure 1-6 shows a simplified flow diagram of the INTEC process interrelationships.

Since 1963, liquid wastes stored at the Tank Farm have been converted to a dry, stable granular form called calcine using the waste calcining facilities at INTEC. In addition to putting the liquid into a solid form that poses less risk to the environment, calcining provides a two- to ten-fold volume reduction. As of February 1998, all of the liquid HLW derived from first cycle uranium extraction was converted to calcine. Since that time, calcining of the mixed transuranic waste (SBW and newly generated liquid waste) remaining in the tanks has been underway. There are approximately 1,400,000 gallons of liquid currently in the tanks. Calcine is stored at INTEC in the Calcined Solids Storage Facilities, which are referred to in this EIS as "bin sets." Figure 1-7 shows the seven bin sets at INTEC (six operational and one spare). There are currently about 4,200 cubic meters of mixed HLW calcine in the bin sets.

With DOE's decision to discontinue processing, the mission of INTEC shifted to management of the accumulated HLW from past spent nuclear fuel processing and the wastes generated by activities and ongoing INTEC operations. Many former waste operations and fuel processing facilities at INTEC have been or will soon be shut down as their missions are completed. The Tank Farm, bin sets, New Waste Calcining Facility calciner, and associated support buildings, structures, and laboratories (as well as any HLW management facilities that would be constructed under the waste processing alternatives) would be decontaminated and decommissioned. Decisions regarding closure of these facilities under this EIS, will be coordinated with the INEEL Environmental Restoration Program.

1.2.3 TECHNOLOGY DEVELOPMENT

Since the 1950s, DOE has engaged in numerous research and technology development activities to ensure that HLW and mixed transuranic waste/SBW at INTEC can be safely managed and ultimately prepared for disposition in a geo-



Note: Diameter of tank is 50 feet.

FIGURE 1-5.
Tank Farm at INTEC.

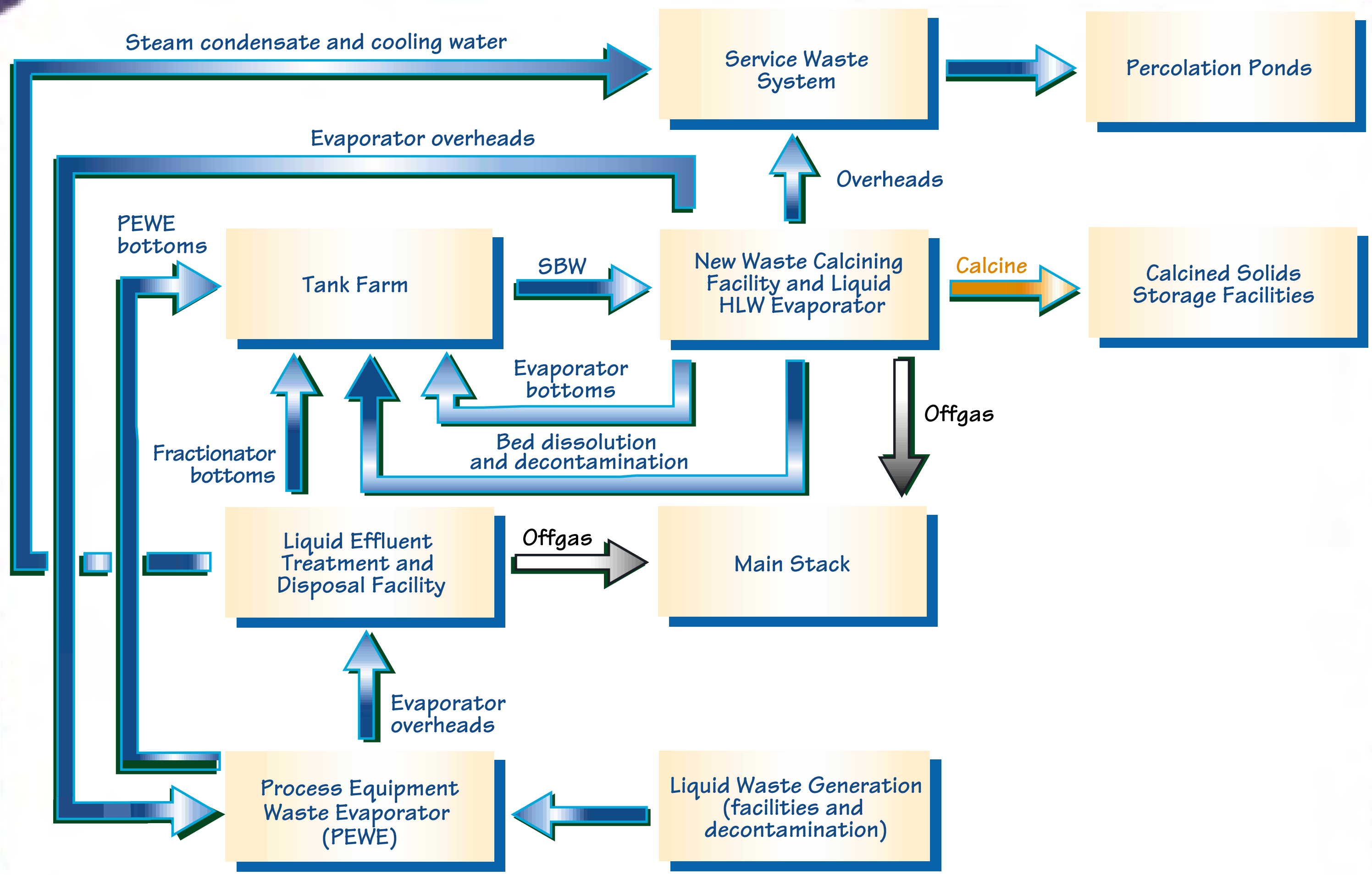
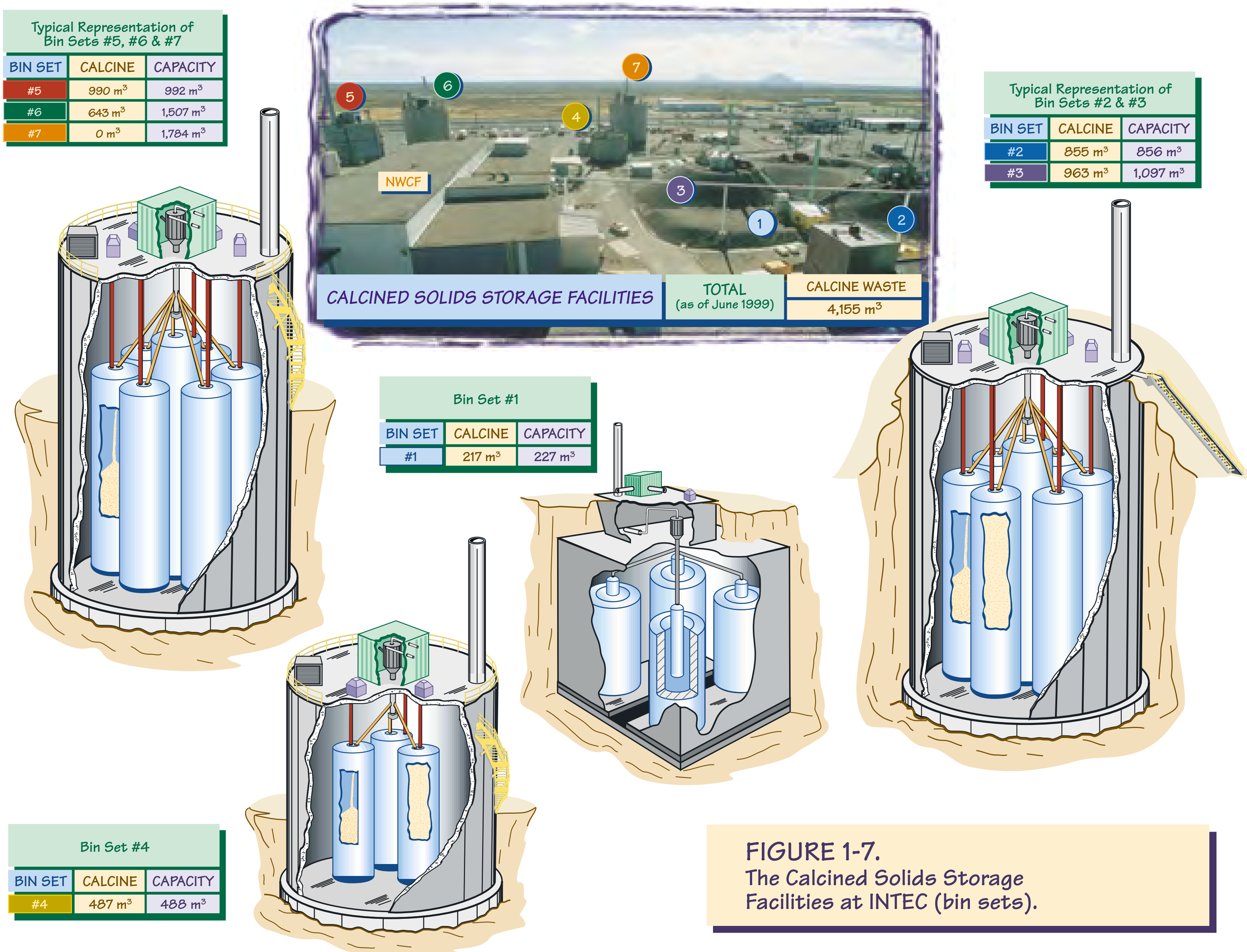


FIGURE 1-6.
Current INTEC high-level waste system simplified flow diagram.



Typical Representation of Bin Sets #5, #6 & #7

BIN SET	CALCINE	CAPACITY
#5	990 m^3	992 m^3
#6	643 m^3	1,507 m^3
#7	0 m^3	1,784 m^3

Typical Representation of Bin Sets #2 & #3

BIN SET	CALCINE	CAPACITY
#2	855 m^3	856 m^3
#3	963 m^3	1,097 m^3

Bin Set #1

BIN SET	CALCINE	CAPACITY
#1	217 m^3	227 m^3

Bin Set #4

BIN SET	CALCINE	CAPACITY
#4	487 m^3	488 m^3

FIGURE 1-7.
The Calcined Solids Storage Facilities at INTEC (bin sets).

What is Waste Incidental to Reprocessing?

The terms "incidental waste" or "waste incidental to reprocessing" refer to a process for identifying wastes that might otherwise be considered HLW due to their origin, but are actually managed as low-level or transuranic waste, as appropriate, if the waste incidental to reprocessing requirements contained in DOE Radioactive Waste Management Manual (DOE M 435.1-1) are met. This is a process by which DOE can make a determination that, for example, wastes residues remaining in HLW tanks, equipment, or transfer lines, are managed as low-level or transuranic waste if the requirements in Section II.B of DOE M 435.1-1 have been or will be met.

The requirements contained in DOE M 435.1-1 are divided into two processes: the "citation" process and the "evaluation" process. When determining whether spent nuclear fuel reprocessing plant wastes are another waste type or HLW, either the citation or evaluation process described in DOE M 435.1-1 shall be used.

- Citation – Waste incidental to reprocessing by "citation" includes spent nuclear fuel processing plant wastes that meet the "incidental waste" description included in the Notice of Proposed Rulemaking (34 FR 8712; June 3, 1969) for promulgation of proposed Appendix D, 10 CFR Part 50, Paragraphs 6 and 7. These radioactive wastes are the result of processing plant operations, such as, but not limited to contaminated job wastes, such as laboratory items (clothing, tools, and equipment).
- Evaluation – Waste incidental to reprocessing by "evaluation" includes spent nuclear fuel processing plant wastes that: (1) have been processed, or will be processed to remove key radionuclides to the maximum extent that is technically and economically practical, (2) will be managed to meet safety requirements comparable to the performance standards set forth in Subpart C of 10 CFR 61 (if low-level waste) or will be incorporated in a solid physical form and meet alternative requirements for waste classification and characteristics authorized by DOE (if transuranic waste), and (3) managed as low-level or transuranic waste pursuant to DOE's authority under the Atomic Energy Act in accordance with the applicable provisions of DOE M 435.1-1.

Those waste streams that meet the requirements, either by citation or evaluation, would be excluded from the scope of HLW. A more detailed discussion of the "waste incidental to reprocessing" process is provided in Chapter 6.

In the absence of an "incidental waste" or "waste incidental to reprocessing" determination, DOE would continue management of HLW due to its origin as HLW regardless of its radionuclide content.

What is Calcination?

Calcine results from heating a substance to a high temperature that is below its melting or fusing point. At INEEL, calcination is carried out in the calciner in the New Waste Calcining Facility where liquid HLW and mixed transuranic waste/SBW are converted into the granular solid known as calcine. The liquid waste is drawn from the Tank Farm and sprayed into a vessel containing an air-fluidized bed of granular solids. The bed is heated by combustion of a mixture of kerosene and oxygen. All of the liquid evaporates, while radioactive fission products adhere to the granular bed material in the vessel. The gases from the reaction vessel (called offgases) are processed in the offgas cleanup system before they are released to the environment.

Calcination reduces the volume of the radioactive liquid waste (usually 2 to 10 times), so less storage space is needed. The final waste form is a dense powder similar in consistency to powdered detergent. These calcined solids are transferred to the Calcined Solids Storage Facilities, commonly referred to as bin sets. The bin sets are a series of concrete vaults, each containing three to seven stainless steel storage bins.

logic repository or other appropriate disposal facility. The technology development and demonstration studies were carried out using the laboratory and pilot plant facilities at INTEC. Areas of technology development, which took place at DOE's national laboratories and major universities include:

- Calcining mixed transuranic waste/SBW
- Separations technologies
- Immobilization technologies
- Removing or stabilizing tank heels
- Retrieving and dissolving calcine

Calcination of Mixed Transuranic Waste (SBW)

The SNF & INEL EIS and Record of Decision determined that HLW and mixed transuranic waste/SBW in the Tank Farm should continue to be calcined while other treatment options were studied. Unlike the liquid HLW, the mixed transuranic waste/SBW cannot be calcined directly due to the presence of low melting point alkali compounds formed during calcination that clog the New Waste Calcining Facility calcine bed. A large amount of nonradioactive aluminum nitrate solution must be added to the waste before it is fed into the calciner. In order to meet its commitments to complete calcination of the liquid mixed transuranic waste/SBW by December 2012, DOE studied alternative methods for calcining this waste. Two techniques emerged as viable candidates: (1) high tempera-

Empty HLW canisters.

ture calcination and (2) sugar-additive calcination (LMITCO 1997). Based on the results of the pilot plant studies, DOE determined high temperature calcination to be the viable technological solution. High temperature calcination will be demonstrated during calciner operations through June 2000.

Separations Technologies

DOE is making every effort to manage waste in the most efficient and environmentally conscious way. As part of this effort, DOE is proposing HLW volume-reduction and treatment processes that would generate low-level wastes as a byproduct. In this regard, DOE has examined several separation techniques to reduce the volume of HLW that must ultimately be disposed of in a repository. These techniques would separate the waste into a small HLW fraction containing most of the short-lived (cesium, strontium) and long-lived (transuranic) radioactive components or a small transuranic waste fraction containing most of the transuranics. These fractions would be treated for acceptance at a repository. In either case, the large volume of remaining waste would be considered a low-level waste fraction and managed accordingly. Thus, in this EIS, the term fraction is used to describe chemical separation products.

Immobilization Technologies

DOE analyzed potential technologies to treat and immobilize calcine and mixed transuranic waste/SBW (LITCO 1995). This study evaluated 27 options using criteria that considered technology, cost, and other factors. DOE identified two ways to treat mixed transuranic waste/SBW and calcine: direct immobilization or radionuclide separation followed by vitrification. Subsequent studies, such as the *High-Level Waste Alternative Evaluation* (LMITCO 1996), examined selected options in greater detail, particularly with respect to cost. This study also considered vitrification of the waste at an alternative DOE site. DOE has also looked at ways to immobilize the low-level waste or transuranic waste fractions resulting from the separation technologies with grout.

Tank Heel Removal/Stabilization

To close the eleven 300,000-gallon waste storage tanks in the INTEC Tank Farm, DOE may need to design, construct, and operate equipment to internally rinse and remove the 5,000- to 20,000-

Vitrification

Vitrification is a method of immobilizing the radionuclides and hazardous constituents in the waste by incorporating them into glass. The waste is combined with frit (finely ground glass or sand) or glass-forming chemicals and the resultant mixture is melted at temperatures between 1,000 and 1,200 degrees Celsius. The molten glass mixture is then poured into stainless steel canisters to solidify.

The waste feed to the vitrification process may be in solid (e.g., calcine) or liquid form. The frit can be varied according to the type of waste in order to produce a glass with the desired characteristics. The type of glass commonly used to immobilize wastes such as those at the INEEL is known as borosilicate glass. The U.S. Environmental Protection Agency (EPA) has specified vitrification (borosilicate glass) as the best demonstrated available technology for treatment of HLW (55 FR 22520; June 1, 1990). Borosilicate glass has been used to vitrify HLW in several facilities in the United States and other countries.

gallon heels (liquid and solids remaining after a tank has been emptied using the currently installed transfer jets). Special heel removal equipment could include mixing pumps to suspend the solids in the heel and keep them in suspension for transfer out of the tanks, and pumps to transfer the mixed heel solution from the tanks. Remote technology could be used to rinse inside the tank (DOE 1995). An ongoing program of technology development continues to explore improved retrieval methods. In June 1999, DOE completed a demonstration testing the ability of a specially formulated grout to move and raise the liquid residue from the bottom of the tank to the level of the jet inlet so that more liquid can be suctioned out of the tank and to stabilize the residue that cannot be removed (DOE 1999b). Figure 1-8 illustrates the steps of tank heel removal and stabilization.

Calcine Retrieval

To remove calcine from the bin sets, DOE would need to design, construct, and operate equipment to access the individual storage bins located within the bin set vaults, retrieve the calcine, and decontaminate the internal surfaces of the bins. Calcine retrieval is expected to use pneumatic techniques similar to the system used to transfer calcine from the New Waste Calcining Facility calciner to the bins. An air jet would agitate the calcine, and a suction nozzle would lift the agitated calcine out of the bin. This technique is expected to remove more than 99 percent of the stored calcine. If required, further cleaning could involve the use of robotics to remove additional calcine from the floor of the bins or other techniques to remove calcine from bin wall surfaces. DOE is examining cleaning techniques that are suitable for remote operation in the high radiation fields in the bins, are compatible with the bin materials, minimize secondary waste generation and environmental impacts, and enhance worker safety.

1.2.4 HIGH-LEVEL WASTE MANAGEMENT IN A NATIONAL CONTEXT

Four DOE sites now manage HLW: INEEL, the Savannah River Site in South Carolina, the Hanford Site in Washington, and the West Valley Demonstration Project in New York. DOE processed spent nuclear fuel at the first three sites. Although the West Valley Demonstration Project was a commercial spent nuclear fuel processing facility, under the West Valley Demonstration Project Act (Public Law 96-368), DOE has responsibility for the treatment of the HLW inventory and disposition of the facilities used during the demonstration.

As a result of processing spent nuclear fuel, DOE has generated approximately 100 million gallons of liquid HLW complex-wide. Approximately 90 percent of this waste remains in storage in liquid form. DOE is proceeding with plans to treat the liquid HLW, converting it to solid forms that would not be readily dispersible into air or leachable into groundwater or surface water. The main way to convert the waste is by vitrification. Vitrification would be expected to produce approximately 22,000 canisters (the canisters vary in volume of vitrified HLW from 0.6 to 1.2 cubic meters) from the current inventory of HLW at all four sites. The INEEL HLW represents approximately 8 percent of the total DOE inventory of immobilized HLW canisters. DOE plans to dispose of the canisters in a geologic repository (DOE 1997b).

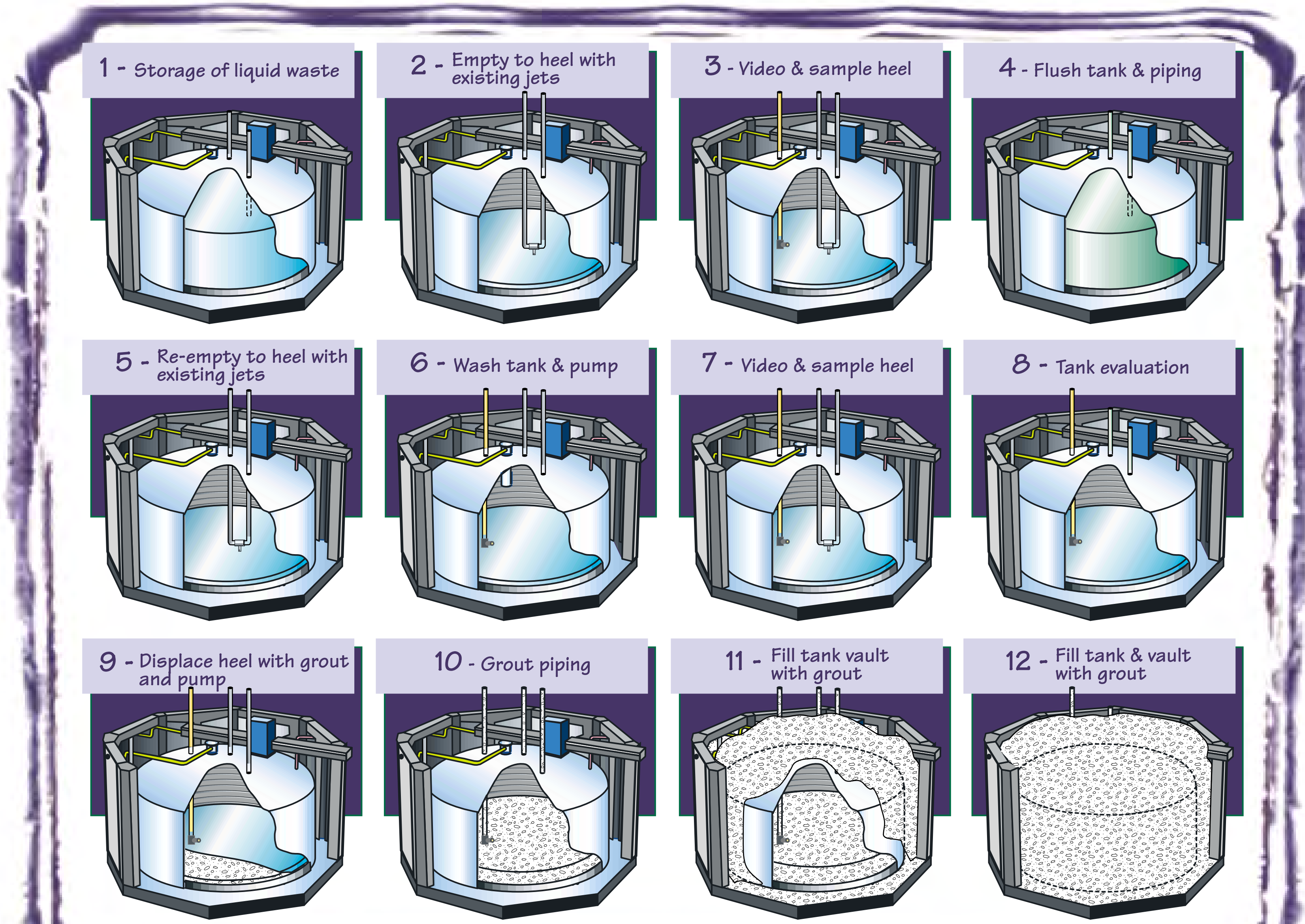


FIGURE 1-8. Tank heel removal and stabilization.

The following sections describe the current status of DOE's HLW management and facility disposition activities at the other sites. The map inside the cover of this EIS indicates the location of these DOE sites.

Savannah River Site

The Savannah River Site currently manages approximately 34 million gallons of HLW in 2 Tank Farms containing a total of 51 tanks. In 1982, DOE prepared an EIS for the Defense Waste Processing Facility, a system for treatment of HLW at the Savannah River Site that includes HLW pretreatment processes, a Vitrification Facility, Saltstone Manufacturing and Disposal, glass waste storage facilities, and associated support facilities (DOE 1982a). That EIS, its Record of Decision, and a subsequent Environmental Assessment, *Waste Form Selection for Savannah River Plant High-Level Waste* (DOE 1982b) provided environmental impact information that DOE used in deciding to construct and operate the Defense Waste Processing Facility to immobilize the HLW generated from processing activities in borosilicate glass. Modifications to the original design for the Defense Waste Processing Facility were implemented following the publication of the 1982 EIS. In a Record of Decision for a supplemental EIS (DOE 1994a), DOE decided to begin operation of the Defense Waste Processing Facility system.

The pretreatment processes would separate HLW into HLW and low-level waste fractions. Since 1990, certain low-level wastes have been blended with cement, slag, and flyash to create a concrete-like waste form known as "saltstone." The saltstone mixture is disposed of onsite in large concrete vaults. In 1996, the vitrification facility began immobilizing the HLW sludges in borosilicate glass. As canisters of vitrified waste are produced, they are stored in shielded, underground concrete vaults pending disposal in a geologic repository.

In 1996, DOE developed the general protocol and performance objectives for operational closure of the Savannah River Site HLW tanks in consultation with the South Carolina Department of Health and Environmental Control and EPA Region IV (DOE 1996a). DOE completed the first closure of a Savannah River Site HLW storage tank in 1997. This closure configuration includes *in situ* stabilization of the residual material (the tank heel) that cannot practicably be removed using available waste removal techniques.

Hanford Site

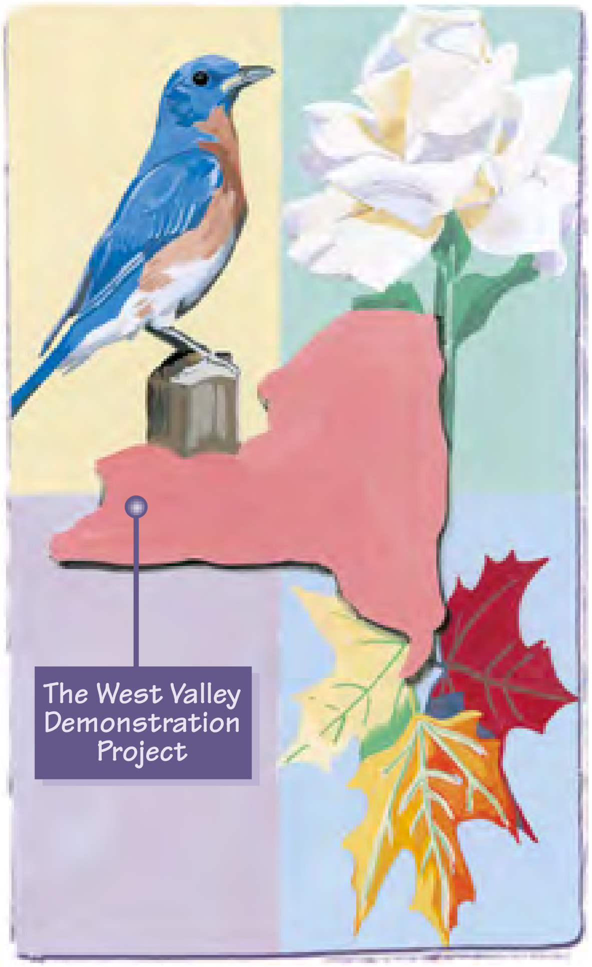
The Hanford Site currently manages approximately 54 million gallons of HLW in 177 underground tanks (149 single-shell tanks and 28 double-shell tanks). The waste consists of highly alkaline sludge, saltcake, slurry, and liquids. The *Tank Waste Remediation System Final EIS*, issued in August 1996, evaluated management and disposal alternatives for the Hanford tank waste. The Record of Decision calls for phased implementation of the proposal to retrieve the waste, separate it into HLW and low-activity waste fractions, vitrifying both fractions, with the low-activity waste disposed of onsite and the HLW stored onsite until it can be shipped offsite for disposal in a geologic repository (DOE 1996b). Closure of the Hanford HLW tanks will be the subject of a future National Environmental Policy Act review.

DOE plans to acquire Hanford tank waste treatment and immobilization services for Phase I from a private vendor who will design, construct, and operate the facilities. In 1997, DOE entered into a Memorandum of Understanding with the Nuclear Regulatory Commission (62 FR 1286; March 18, 1997) for support in regulating the nuclear, radiological, and process safety of these private facilities. The Memorandum establishes a cooperative process to help DOE develop a regulatory program that is consistent with the Nuclear Regulatory Commission's regulatory approach. The process will facilitate the possible transition of the regulatory responsibilities from DOE to the Nuclear Regulatory Commission at some later date.

West Valley Demonstration Project

The Western New York Nuclear Service Center is owned and managed by the New York State Energy Research and Development Authority. The Center contains a commercial spent nuclear fuel processing facility that operated from 1966 to 1972 and generated approximately 600,000 gallons of liquid HLW. Under the West Valley Demonstration Project Act of 1980, DOE assumed possession of the portion of the facility that includes the former reprocessing facility and the HLW tanks, waste lagoons, and waste storage areas. The Act also assigned the Nuclear Regulatory Commission to provide oversight in the areas of radiation health and safety.

In 1982, DOE prepared an EIS and then issued a Record of Decision for the operation of the West Valley Demonstration Project that selected concentration and chemical treatment followed by vitrification as the immobilization technology for the Project's HLW inventory (47 FR 40705;



September 15, 1982). Vitrification of the HLW began in July 1996. Approximately 300 canisters of vitrified HLW are being produced and stored, pending disposal in a geologic repository (DOE 1997b).

In 1996, DOE and the New York State Energy Research and Development Authority prepared a draft EIS (not yet finalized) that evaluates alternatives for completion of the West Valley Demonstration Project activities including management of the wastes produced from vitrifying the liquid HLW, dispositioning of the associated tanks and facilities, and long-term management or closure of the West Valley site (DOE 1996c, 1997c). The Nuclear Regulatory Commission will develop decommissioning criteria for the site, based on the results of this EIS, and review the closure reports and performance assessments prepared for closure, including its incidental waste determination (NRC 1998).

Geologic Repository at Yucca Mountain

The Nuclear Waste Policy Act, as amended (42 USC 10101 et seq.), establishes a process for determining whether to recommend the site to the President for development of a repository. As part of this decisionmaking process, the Secretary of Energy is to undertake the physical characterization of the Yucca Mountain site. If DOE recommends approval of the site and if the President considers the site qualified for an application for construction authorization, the Nuclear Waste Policy Act, as amended, directs the President to submit a recommendation of the site to Congress. Within 60 days of the day the President recommends the site, the Governor and Legislature of the State of Nevada can submit a notice of disapproval of the site to Congress. If the Governor and Legislature do not submit a notice of disapproval within 60 days, the site designation becomes effective. If they submit a notice of disapproval, the site is disapproved unless Congress passes a resolution approving the repository site during the first period of 90 calendar days of continuous session.

Section 114(d) of the Act instructs the Nuclear Regulatory Commission to limit the first repository to emplacement of a quantity of spent nuclear fuel containing 70,000 metric tons of heavy metal (MTHM) or a quantity of solidified HLW resulting from reprocessing that amount of spent nuclear fuel until a second geologic repos-

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), exclusive of other materials, such as cladding, alloy materials, and structural materials. A metric ton equals approximately 2,200 pounds. Section 6.3.2.4 more fully describes issues related to MTHM.

itory is in operation. Current projections of the spent nuclear fuel and HLW inventories from civilian and government sources exceed 70,000 MTHM.

In a report required by Section 8 of the Nuclear Waste Policy Act of 1982 (Public Law 97-425), the Secretary of Energy was required to recommend to the President whether defense HLW should be disposed of in a geologic repository with commercial spent nuclear fuel. Table 1-1 of that report, *An Evaluation of Commercial Repository Capacity for the Disposal of Defense High-Level Waste* (DOE 1985), provided MTHM equivalence for HLW.

The MTHM quantity for spent nuclear fuel is determined by the actual heavy metal content of the fuel. The Nuclear Waste Policy Act also specifies that the 70,000 MTHM limitation as it applies to HLW is to be determined by the "...quantity of solidified high-level radioactive waste resulting from the reprocessing of such a quantity of spent nuclear fuel...." That method of determining an MTHM "equivalence" does not recognize the differences in radiological content between spent nuclear fuel and HLW (i.e., HLW has much lower levels of radionuclides).

DOE would emplace 10,000 to 11,000 waste packages containing no more than 70,000 MTHM of spent nuclear fuel and HLW in the repository. Of that amount, 63,000 MTHM would be spent nuclear fuel assemblies that would be shipped from commercial sites to the repository. The remaining 7,000 MTHM would consist of about 2,333 MTHM of DOE spent nuclear fuel and HLW currently estimated to be approximately 8,315 canisters (the equivalent of 4,667 MTHM) that DOE would ship to the repository (DOE 1999c). To determine the number of canisters of HLW included in the waste inventory, DOE used 0.5 MTHM per canister of defense HLW. DOE has recognized that determination of appropriate MTHM equivalence was necessary, therefore, DOE considered several equivalency techniques, including the method based on spent nuclear fuel reprocessed, a method based on total radioactivity in the material, and a method based on radiotoxicity (Knecht et al. 1999). For a brief description of these techniques see Chapter 6. Though DOE has recognized these other equivalency techniques, DOE will use the 0.5 MTHM per canister approach. DOE has used the 0.5 MTHM per canister approach since 1985 (DOE 1985).

DOE is continuing to conduct site characterization activities at Yucca Mountain to determine whether that site is suitable for geologic disposal of spent nuclear fuel and HLW. DOE has prepared a draft EIS (DOE 1999c) that evaluates potential environmental impacts from the construction, operation and monitoring, and eventual closure of the repository, including potential long-term post-closure effects. The final EIS is scheduled to be completed in the year 2000 and will accompany any Secretary of Energy recommendation to the President as required by the Nuclear Waste Policy Act.

Final technical standards for the HLW to be disposed of in the geologic repository are not yet

available. Analyses in the repository EIS and other DOE National Environmental Policy Act documents and decisions based on these analyses regarding management of spent nuclear fuel and HLW are based on the best available knowledge regarding these draft technical standards. DOE will evaluate alternative treatments for the HLW at INEEL based on the current waste acceptance criteria for the candidate repository (DOE 1996d, 1999d; TRW 1997).

1.2.5 REGULATORY FRAMEWORK FOR HIGH-LEVEL WASTE MANAGEMENT

Environmental restoration and waste management activities at INEEL are subject to numerous laws and regulations that apply to the treatment, storage, and disposal of wastes, and the determination of cleanup standards and schedules. This section discusses the specific requirements for management of HLW and disposition of associated facilities at INTEC. This information is repeated in Chapter 6, Statutes, Regulations, Consultations and Other Requirements, which also provides supplemental information on environmental regulations and DOE-ID's compliance status.

Federal and state requirements for the management of HLW and disposition of associated facilities at INTEC include those established under:

- Atomic Energy Act
- Nuclear Waste Policy Act
- EPA Environmental Radiation Protection Standards
- Resource Conservation and Recovery Act
- Comprehensive Environmental Response, Compensation, and Liability Act
- Idaho Settlement Agreement/Consent Order and Notice of Noncompliance Consent Order.
- Site Treatment Plan (under the Federal Facility Compliance Act)

Table 1-1 further identifies site-specific agreements between DOE and the State of Idaho that affect the management of HLW and disposition of associated facilities at INTEC. The table also provides a summary of the specific milestones and their current status.

Atomic Energy Act

The Atomic Energy Act of 1954 (42 USC 2011, et seq.) establishes responsibility for the regulatory control of radioactive materials including radioactive wastes. Pursuant to the Atomic Energy Act, DOE established a series of standards called Orders to protect health and minimize danger to life or property from activities at its facilities.

Potential exists for Congress to direct the Nuclear Regulatory Commission to assume regulatory authority over DOE facilities in the timeframe of the activities analyzed in this EIS. DOE has engaged in joint pilot projects with the Nuclear Regulatory Commission to assess the feasibility of Nuclear Regulatory Commission regulation at DOE facilities. Based on these pilot projects, DOE has identified a number of unresolved issues that should be evaluated further. Because DOE is not actively pursuing Nuclear Regulatory Commission regulation of DOE's facilities, the effects of Nuclear Regulatory Commission regulation of DOE-ID facilities, if any, are not discussed in this EIS (Richardson 1999a,b,c,).

Nuclear Waste Policy Act

The Nuclear Waste Policy Act of 1982, as amended (42 USC 10101 et seq.), established a national policy for disposal of HLW and spent nuclear fuel in a geologic repository.

EPA Environmental Radiation Protection Standards

In 1993, EPA issued "Environmental Radiation Protection Standards for the Management and Disposal of Spent Nuclear Fuel, High-Level, and Transuranic Waste," codified in 40 CFR 191. These standards provide for isolation of the radioactive portion of the waste in order to limit

Table 1-1. Agreements between DOE and the State of Idaho for operations at INTEC.

Agreement	Summary of milestones	Status of milestones/comments
1992 Consent Order, and Amendments, Resolving a 1990 Notice of Noncompliance under RCRA (Notice of Noncompliance Consent Order)	- DOE must cease use of the five pillar and panel tanks by March 31, 2009 - DOE must cease use of remaining tanks by June 30, 2015 - DOE must close the calciner if operation is not commenced by January 1, 1993, or operation is discontinued for three consecutive years	This Consent Order has been modified three times to reflect changes agreed upon between the State and DOE. None of these milestones are currently in effect.
1994 Modification to Notice of Noncompliance Consent Order	- DOE must calcine all HLW by January 1, 1998 - DOE must evaluate and select technologies for SBW and calcine by June 1, 1995	DOE has met these milestones.
1995 Settlement Agreement/Consent Order, resolving the cases of Public Service Co. of Colorado v. Batt and United States v. Batt	- Begin negotiation of a plan and schedule for treatment of calcined waste by December 1999 - Complete calcination of SBW by December 31, 2012 - Treat all calcined waste by a target date of December 31, 2035 so that it is ready for removal from Idaho	DOE is currently in compliance with this Settlement Agreement/Consent Order. RCRA compliant tanks are planned for operation by 2005 so that existing tanks can be emptied by 2012. Ability to meet commitments for calcination may be affected by subsequent decisions regarding treatment technologies. In the event any required NEPA analysis results in the selection after October 16, 1995, of an action which conflicts with any action identified in this Agreement, DOE or the Navy may request a modification of this Agreement to conform the action in the Agreement to that selected action. Approval of such modification shall not be unreasonably withheld.
1998 Modification to Notice of Noncompliance Consent Order	- DOE must cease use of the pillar and panel tanks by June 30, 2003 - DOE must cease use of the remaining tanks by December 31, 2012	These milestones are in effect, except for the requirement regarding operation of the calciner (see below).

Table 1-1. (continued.)

Agreement	Summary of milestones	Status of milestones/comments
	- DOE must place the calciner in a standby mode by April 30, 1999, unless and until a hazardous waste permit is received. DOE will determine on June 1, 2000 whether to operate or not and submit a schedule for closure or for permitting	
1999 Modification to Notice of Noncompliance Consent Order	- The date for operation of the calciner is extended to June 1, 2000 - Begin submitting monthly air emission reports - Complete a plan and schedule for inspection and corrosion coupon evaluation of the tanks by November 15, 1999	The potential lack of availability of the calciner after June 1, 2000 could impact milestone for completion of calcination by December 31, 2012.

releases to the environment, including releases to underground sources of drinking water, for 10,000 years after disposal. This regulation would be generally applicable to the disposal of HLW or transuranic waste into any disposal system other than the proposed geologic repository at Yucca Mountain, which is exempt from these standards because site-specific standards (proposed 40 CFR 197, "Environmental Protection Standards for Yucca Mountain, Nevada") are being developed. It may therefore be applicable to residual materials left in the tanks or bins at INTEC if DOE determines the residue would be classified as HLW or transuranic waste.

On August 27, 1999 (64 FR 46976), EPA proposed "Environmental Radiation Protection Standards for Yucca Mountain, Nevada" to be codified in 40 CFR 197. These regulations would contain the site-specific public health and safety standards governing storage or disposal of radioactive material within the proposed repository at Yucca mountain.

Resource Conservation and Recovery Act/Idaho Hazardous Waste Management Act

The HLW, mixed transuranic waste/SBW, and associated wastes managed at INTEC are a combination of "characteristic" (e.g., toxic or corrosive) and "listed" hazardous wastes that are regulated under the Resource Conservation and Recovery Act (RCRA) (DOE 1998a). RCRA requires regulated wastes to be treated in accordance with the applicable land disposal restrictions treatment standards before disposal. A technology for treatment of the waste that does not comply with all of the applicable treatment standards could only be used if a treatment variance or determination of equivalent treatment were obtained.

The treated waste form is still considered "mixed waste" under RCRA. Idaho presently has no mixed waste disposal capacity, and the candidate geologic repository at Yucca Mountain would not accept RCRA-regulated wastes. Therefore, it would also be necessary for DOE to obtain a "delisting" for the treated waste in order to pursue disposal at any unpermitted facility.

The existing INTEC waste management facilities are regulated by the Idaho Division of Environmental Quality and EPA as "interim status" facilities under RCRA. The major existing HLW facilities addressed by this EIS that are regulated under RCRA include:

- Tank Farm
- Calcined Solids Storage Facilities (bin sets)
- New Waste Calcining Facility calciner
- Process Equipment Waste Evaporator
- Liquid Effluent Treatment & Disposal Facility

The Idaho Hazardous Waste Management Act regulates operations and closure of these facilities. New treatment facilities to implement DOE's decisions based on this EIS would also be regulated under RCRA.

Comprehensive Environmental Response, Compensation, and Liability Act

CERCLA, as amended by the Superfund Amendments and Reauthorization Act (42 USC 9601 et seq.), provides a statutory framework for cleaning up waste sites containing hazardous substances and provides an emergency response program in the event of a release (or threat of a release) of a hazardous substance to the environment. The INEEL was placed on the National Priorities List in 1989 due to confirmed releases of contaminants to the environment. The State of Idaho, EPA, and DOE signed a Federal Facility Agreement and Consent Order in 1991 that outlines a process and schedule for conducting investigation and remediation activities at the INEEL. To better manage the investigation and cleanup, the Agreement divides the INEEL into 10 Waste Area Groups.

Facility closure decisions under this EIS must be approved by the Idaho Division of Environmental Quality. In addition, facility disposition decisions must be coordinated with the INEEL Environmental Restoration Program's Record of Decision under CERCLA for Waste Area Group 3. (Waste Area Group 3 is an area containing suspected release sites designated for investigation under the INEEL Federal Facility Agreement and Consent Order which encompasses the INTEC area.)

Notice of Noncompliance Consent Order

In 1992, DOE and the Idaho Department of Health and Welfare signed a consent order to resolve the Notice of Noncompliance issued by EPA Region 10 on January 29, 1990 (Monson 1992). This Notice of Noncompliance Consent Order addresses concerns regarding the RCRA secondary containment requirements for the INEEL HLW tanks by prescribing dates by which the tanks must be removed from service. In accordance with this Consent Order and an August 18, 1998 modification (Cory 1998), five of the tanks (known as pillar and panel tanks) must be removed from service ("cease use") on or before June 30, 2003 and the remaining tanks on or before December 31, 2012. DOE-ID and the Idaho Division of Environmental Quality have agreed to define "cease use" as emptying the tanks to their "heels" (Cory 1998). A third modification to the Consent Order on April 19, 1999 (Kelly 1999) further stipulates that DOE must place the New Waste Calcining Facility calciner in a standby mode by June 1, 2000 unless the facility receives a hazardous waste permit for continued operation.

National Environmental Policy Act

A thorough understanding of environmental impacts that may occur when implementing proposed actions is a key element of Department of Energy decision-making. The National Environmental Policy Act provides Federal agency decision-makers with a process to consider potential environmental consequences (beneficial and adverse) of proposed actions before agencies make decisions. An important part of this process is the opportunity for the public to learn about and comment on proposed agency actions before a decision is made.

Passed by Congress in 1969, the Act requires Federal agencies to consider the potential environmental impacts of their proposed major actions before implementing them. If a proposed action could have a significant impact on the environment, the agency must prepare an Environmental Impact Statement.

Environmental Impact Statement:

A detailed environmental analysis for any proposed major Federal action that could significantly affect the quality of the human environment. A tool to assist in decision-making, it describes the positive and negative environmental effects of the proposed undertaking and alternatives. A draft EIS is issued, followed by a final EIS.

Scoping:

An early and open process in which the public is invited to participate in identifying issues and alternatives to be considered in this EIS. DOE allows a minimum of 30 days for the receipt of public comments.

Alternatives:

A range of courses of action that would meet the agency's purpose and need for action. NEPA requires that an EIS consider a No Action Alternative.

Comment Period:

A regulatory minimum 45-day period for public review of a draft EIS during which the public may comment on the environmental analyses and suggest revisions or additional issues or alternatives to be evaluated in the final EIS. The agency considers these comments in its preparation of the final EIS.

Record of Decision:

A public record of the agency decision, issued no sooner than 30 days after publication of a final EIS. It describes the decision, identifies the alternatives (specifying which were considered environmentally preferable) and the factors balanced by an agency in making its decision.

Settlement Agreement/ Consent Order

In October 1995, the State of Idaho, the Department of the Navy, and DOE settled the cases of Public Service Company of Colorado v. Batt, involving the management of spent nuclear fuel at INEEL. The resulting Consent Order (USDC 1995) requires DOE among other things to:

- Complete calcination of all remaining non-sodium bearing liquid HLW by June 1998 (completed February 1998)
- Start negotiations with the State of Idaho by December 31, 1999 regarding a plan and schedule for treatment of calcined waste
- Start calcination of liquid mixed transuranic waste/SBW by June 2001 (begun February 1998)
- Complete calcination of liquid mixed transuranic waste/SBW by December 2012
- DOE presently contemplates that a plan and schedule shall provide for the completion of the treatment of all calcined waste located at INEEL by a target date of December 31, 2035, so that it is ready for removal from the State of Idaho

The Settlement Agreement/Consent Order also addresses the potential that the National Environmental Policy Act process may result in selection of an action that conflicts with the actions in the Agreement. In that event, DOE may request that the Agreement be modified to conform to the selected actions.

Site Treatment Plan

Under the Federal Facility Compliance Act of 1992, DOE was required to enter into an agreement with the State of Idaho as to how it would attain compliance with applicable treatment requirements for mixed wastes at INEEL. The Site Treatment Plan (DOE 1998a) sets forth the terms and conditions that DOE must comply with to satisfy the land disposal restrictions applicable to the hazardous components of the mixed wastes at INTEC. The Plan proposes treatment of mixed HLW and mixed transuranic waste/SBW by calcination through the New Waste Calcining Facility and a new Remote-Handled Immobilization Facility for processing the waste into forms suitable for disposal. In accordance with provisions of the Site Treatment Plan, these waste treatment proposals are updated annually by DOE.

1.3 EIS Scope and Overview

This EIS examines potential environmental impacts associated with managing mixed HLW and mixed transuranic waste/SBW and closing the HLW management facilities at INTEC. The EIS also includes an alternative under which the Idaho HLW would be treated at the Hanford Site.

The EIS has been prepared in accordance with requirements established under the National Environmental Policy Act of 1969, as amended (42 USC 4321 et seq), the Council on Environmental Quality (40 CFR 1500 et seq.), and DOE (10 CFR 1021). In addition, this EIS seeks to fulfill the objectives of NEPA as discussed in the Western Governors' Associations' Policy Statement (WGA 1996).

What is Road Ready?

The Settlement Agreement/Consent Order states that "DOE shall accelerate efforts to evaluate alternatives for the treatment of calcined waste so as to put it in a form suitable for transport to a permanent repository or interim storage facility outside Idaho." In this EIS, DOE uses the term "road ready" to describe the condition the waste must be in so that it can be transported out of Idaho and be accepted by a designated storage or disposal facility.

In order to be "road ready" to leave Idaho, the mixed HLW must meet the appropriate regulatory requirements for shipping radioactive waste over U.S. highways or rail systems. Meeting regulatory requirements includes putting the treated waste into a canister that can then be overpacked with a transportation cask. The transportation cask will be designed for protection from normal, incident-free transportation, as well as from accident conditions. In order to be accepted by a designated storage or disposal facility, the waste must meet the specific waste acceptance criteria of that facility.

For example, the waste acceptance criteria for HLW at a geologic repository are being developed by DOE. These criteria include performance assessment standards, such as how much heat can be generated over time, safety analysis concerns, and any other requirements that NRC, the licensing authority, determines are appropriate. On June 1, 1990 EPA determined that the principal waste form for HLW geologic disposal is borosilicate glass, (40 CFR 268.42) a standard that has gained international acceptance (DOE 1996d, 1999d; TRW 1997). Other waste forms may be considered and granted equivalency, if it can be demonstrated that the waste meets the criteria for acceptance at the disposal facility.

A key element of DOE decisionmaking is a thorough understanding of environmental impacts that may occur when implementing a proposed action. DOE, with the State of Idaho as a cooperating agency, has prepared this draft EIS to (1) assess various treatment and disposal alternatives and (2) provide the necessary background, data, and analyses to help decisionmakers and the public understand the potential environmental impacts of each alternative. DOE will present its decision in a Record of Decision, which will be issued after the final EIS is complete.

During DOE's initial activities preparing this EIS, it became apparent that the State of Idaho has special expertise and perspectives that can assist DOE in its data gathering and analysis activities. From the perspective of DOE, it was advantageous to obtain input from the State on the regulatory implications of implementing the various alternatives considered in the EIS as early as possible in the process. From the State's perspective, early consideration of these regulatory implications and consideration of the technical aspects of the alternatives by State experts would improve the EIS and facilitate DOE's program toward meeting the legal requirements of the Idaho Settlement Agreement/Consent Order, a goal the State has a very strong interest in seeing met. Among other things in the Idaho Settlement Agreement/Consent Order, DOE agreed to evaluate alternatives for the treatment of mixed HLW and treat all mixed HLW at INEEL so that it is ready to be moved out of Idaho for disposal by a target date of 2035. The EIS will help DOE make informed decisions about how best to carry out these activities. Agencies that agree to work together on an EIS can do so formally in several different ways (40 CFR 1501 et seq.). Accordingly, on September 24, 1998, the State of Idaho and DOE entered into a Memorandum of Understanding in which both parties agreed that the most effective relationship would be one in which DOE serves as "Lead Agency" and the State serves as the "Cooperating Agency."

The organization of this EIS is as follows. Chapter 2 identifies DOE's purpose and need for action. The alternative methods for achieving the purpose and need are described in Chapter 3, Alternatives. The affected environment for the proposed waste processing and facility disposition activities is described in Chapter 4 of the EIS. The environmental consequences of the alternatives are presented in Chapter 5. Chapter 6, Statutes, Regulations, Consultations, and Other Requirements, provides more details on related environmental statutes and regulations. Chapters 7 through 9 list references, document preparers and the conflict of interest disclosure statement, respectively. The appendices provide technical information, including analytical methods, detailed results, and a glossary of terms used.

1.3.1 OTHER RELATED NEPA AND CERCLA DOCUMENTS

DOE must manage the HLW generated at facilities across the country that were involved in the processing of spent nuclear fuel. Under current DOE plans, certain types of waste would be disposed of at geologic repositories, such as the Waste Isolation Pilot Plant for defense transuranic waste or the potential repository at Yucca Mountain for HLW and spent nuclear fuel. DOE must formulate alternatives for management of HLW and mixed transuranic waste/SBW at INTEC that are consistent with alternatives considered in other EISs that relate to INEEL. Consistency means that the Idaho HLW & FD EIS should reasonably take into account activities considered in other EISs that may affect the management of wastes or disposition of facilities at INEEL.

An EIS may use previously developed information and analyses by "tiering" from other EISs. This EIS will use and supplement, as necessary, the information contained in the SNF & INEL EIS (DOE 1995) and the *Final Waste Management PEIS for Managing Treatment, Storage, and Disposal of Radioactive and Hazardous Waste* (Waste Management PEIS) (DOE 1997b).

Volume 2 of the SNF & INEL EIS is a sitewide EIS for INEEL that assessed impacts from environmental restoration and waste management actions that may be taken over a 10-year period from 1995 to 2005. Volume 2 analyzed the potential environmental impacts associated with ongoing mixed HLW treatment, storage, and management operations at the INEEL. In a Record of Decision based on the SNF & INEL EIS (60 FR 28680; June 1, 1995), DOE decided to resume operation of the New Waste Calcining Facility calciner and to convert the mixed HLW and mixed transuranic waste/SBW to calcine prior to further treatment. DOE also decided to construct a facility to treat the mixed HLW calcine (and any remaining liquid waste) in accordance with RCRA requirements and on a schedule to be negotiated with the State of Idaho under the Federal Facility Compliance Act. In addition, DOE would install special equipment in the Tank Farm to rinse the tanks' interior walls and remove the tank heels in preparation for closure. The mixed HLW calcine in bin set 1 (which does not meet current design standards) would be transferred to bin set 6 or 7, or modifications would be made to mitigate stress on bin set 1.

This EIS analyzes the environmental impacts of HLW and mixed transuranic waste/SBW management and facility disposition alternatives that encompass a broader timeframe than the 10-year period evaluated in Volume 2 of the SNF & INEL EIS. Decisions under this EIS will include (1) the future operational use of the New Waste Calcining Facility calciner, (2) the type of separations and/or immobilization technologies to be used for the mixed transuranic waste/SBW and mixed HLW at INTEC, and (3) methods for closure of HLW management facilities.

The Waste Management PEIS, issued in May 1997, is a DOE complex-wide study examining the environmental impacts associated with managing five types of radioactive and hazardous wastes generated by past, present, and future activities at a variety of sites located around the United States. The five types of waste examined in the Waste Management PEIS are low-level mixed waste, low-level waste, transuranic waste, hazardous waste, and HLW. The Waste Management PEIS characterizes and identifies the volumes of HLW at DOE facilities nationwide, including the INEEL, and uses or updates information presented in the SNF & INEL EIS. For HLW, the Waste Management PEIS only evaluated the storage of immobilized HLW canisters; treatment and disposal of HLW were not analyzed. The preferred alternative in the Waste Management PEIS is for each of the four sites (one of which is INEEL) to store its own immobilized HLW canisters onsite until shipment to a geologic repository for disposal. The Record of Decision to proceed with DOE's preferred alternative of decentralized storage for immobilized HLW was issued August 26, 1999 (64 FR 46661). The storage of INEEL's immobilized HLW under the waste processing alternatives in the Idaho HLW & FD EIS is consistent with the HLW Record of Decision based on the Waste Management PEIS.

The low-level waste fraction from HLW processing at INEEL, Hanford, West Valley, and Savannah River was specifically excluded from the scope of the Waste Management PEIS. This reflected an understanding in 1995 that each site would specifically evaluate these waste fractions as part of their site specific EISs.

In addition to the programmatic EISs described above, other related National Environmental Policy Act analyses and documents that will be considered in the Idaho HLW & FD EIS include:

The Advanced Mixed Waste Treatment Project (AMWTP) EIS – The AMWTP EIS analyzes possible environmental impacts of treatment of mixed low-level, transuranic waste, and alpha-contaminated mixed low-level waste at INEEL. The AMWTP EIS is potentially relevant to the proposed HLW EIS because a portion of the inventory of radioactive waste at INTEC may be considered for treatment at the proposed AMWTP. The final EIS was issued in January 1999 (DOE 1999e). The Record of Decision to proceed with DOE's preferred alternative for construction and operation of the AMWTP (64 FR 16948) was issued April 7, 1999. In accordance with the Settlement Agreement/Consent Order, DOE must complete construction of the AMWTP by December 2002 and commence operations no later than March 2003.


Tiered EIS reports affecting this EIS.

Draft EIS for the Treatment and Management of Sodium-Bonded Spent Nuclear Fuel (DOE 1999f) - This draft EIS, issued in July 1999, analyzes impacts of alternatives for treatment and management of DOE's inventory of sodium-bonded spent nuclear fuel, much of which is stored at INEEL. This type of fuel contains metallic sodium between the cladding and fuel to improve heat transfer during reactor operations. Treatment of this fuel may be needed prior to disposal due to its reactive and pyrophoric characteristics. Sites analyzed for treatment of this fuel are the Argonne National Laboratory - West at the INEEL and either the F Canyon or Building 105-L at the Savannah River Site. The draft EIS for sodium-bonded fuel evaluates management and treatment of some of the same types of waste that are evaluated in the Idaho HLW & FD EIS.

CERCLA Record of Decision for Waste Area Group 3 – The INEEL Environmental Restoration Program evaluated potential remedial actions. During that evaluation, DOE identified discharges to the existing percolation ponds at INTEC to be a major factor in moving contaminants from the vadose zone under INTEC to the Snake River Plain aquifer. Alternatives to the existing percolation ponds were evaluated in Davison (1998), including recycling, discharging to the Big Lost River, evaporation ponds, and moving the percolation ponds away from INTEC. This evaluation is consistent with the Secretarial Policy on the National Environmental Policy Act (DOE 1994b), which states that DOE will rely on the CERCLA process for the review of actions to be taken under CERCLA and incorporate National Environmental Policy Act values of public involvement and understanding of environmental impacts. DOE, through the CERCLA Record of Decision for the Operable Unit 3-13 portion of Waste Area Group

3 (DOE 1999g), decided to replace the existing percolation ponds with new percolation ponds to be constructed approximately 10,200 feet southwest of the current percolation ponds. A wastewater land application permit application for the new ponds will be submitted to the State of Idaho by the spring of 2000. The existing ponds are not expected to receive wastewater after August 31, 2001 as the new ponds are planned to be operational by July 31, 2001. However, under the Record of Decision, the existing ponds will stop receiving wastewater prior to December 31, 2003. The impacts resulting from this decision and other remedial actions at INTEC carried out by the INEEL Environmental Restoration Program are presented as cumulative impacts in this Idaho HLW & FD EIS.

The Waste Isolation Pilot Plant Disposal Phase Final Supplemental EIS (DOE 1997d) – This supplemental EIS analyzes the treatment and storage of transuranic waste and disposal of such waste at the Waste Isolation Pilot Plant in Carlsbad, New Mexico. The final supplemental EIS was issued in September 1997. The Record of Decision for disposal of transuranic waste at the Waste Isolation Pilot Plant (63 FR 3624) was issued January 23, 1998. That decision calls for disposal of up to 175,600 cubic meters of transuranic waste at the Waste Isolation Pilot Plant after treatment, as necessary, to meet the waste acceptance criteria (Revision 5). A Record of Decision for the facility locations of treatment and storage of transuranic waste (63 FR 3629; January 23, 1998), based on the Waste Management PEIS, was issued at the same time. Some radioactive waste at INTEC may be affected by these transuranic waste management decisions based on this supplemental EIS and the Waste Management PEIS.

EIS for a Geologic Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain (DOE 1999c) – The Yucca Mountain EIS analyzes the potential environmental impacts associated with the disposal of HLW and spent nuclear fuel in a potential geologic repository at Yucca Mountain in Nevada. The draft EIS was issued August 13, 1999 (64 FR 44200). The EIS is scheduled for completion in August 2000 and would accompany any DOE recommendation to the President on whether to develop Yucca Mountain as a geologic disposal site. INEEL's HLW could be eligible for disposal at Yucca Mountain should it be approved as a repository.

Final Environmental Impact Statement, Tank Waste Remediation System (DOE 1996b) – The Tank Waste Remediation System EIS evaluated alternatives for retrieval, treatment, and disposal of the Hanford tank wastes. The final EIS was issued in August 1996, and DOE's Record of Decision was published February 26, 1997 (62 FR 8693). A supplement analysis (DOE 1998b) considered new information and data obtained since the final EIS. The Tank Waste Remediation System EIS is relevant to the Idaho HLW & FD EIS because a portion of the inventory of radioactive waste at INTEC is being considered for treatment at the Hanford Site.

1.3.2 SCOPING PROCESS

The scoping process for the Idaho HLW & FD EIS began on September 19, 1997, when DOE published in the Federal Register its Notice of Intent to prepare an EIS to evaluate alternatives for managing HLW and associated radioactive wastes and facilities at INEEL (62 FR 49209). The Notice of Intent included DOE's preliminary identification of EIS issues.

In accordance with the Idaho HLW & FD EIS Public Scoping Plan, DOE sponsored a number of activities and worked with stakeholders to identify new alternatives and issues and allow for meaningful information exchange. The activities included open houses; booths and displays at shopping malls throughout southern Idaho; presentations to schools and civic groups; individual briefings to key stakeholders such as government and Tribal officials, interest groups, site employees, and the INEEL Citizens Advisory Board; and public scoping workshops.

Scoping workshops were conducted in Idaho Falls and Boise, Idaho. DOE made announcements in local newspapers and other media to alert the public about these meetings. The workshops provided both formal and informal ways for the public to express their views and obtain information about the intended scope of the analysis. Participants worked in breakout groups to identify issues and other alternatives the EIS should address. These issues and alternatives were entered as comments into the administrative record, along with written comments and transcriptions of personal interviews with stakeholders. The scoping period ended November 24, 1997.

During the scoping process, DOE received more than 900 comments addressing 49 categories under 8 issues areas (DOE also considered 69 comments it received either before or after the scoping period). The eight areas are: (1) alternatives; (2) environment, safety, and health; (3) legal, regulatory, and political; (4) National Environmental Policy Act process and public participation; (5) social, economic, and cultural; (6) technical issues; (7) other; and (8) out of scope. The key issues that were identified during the prescoping and scoping activities included:

Treatment Criteria – There is considerable uncertainty regarding the proposed repository at Yucca Mountain and the final technical standards for wastes that could be disposed of there. Given those uncertainties, determine what criteria DOE should use to establish that the waste form(s) produced are suitable for disposal in a geologic repository outside the State of Idaho (i.e., that a "road ready" waste form has been achieved).

Disposal – If a geologic repository is not available, determine what other disposal options exist for HLW outside the State of Idaho.

Storage/Disposal in Idaho – Clearly examine and explain any proposal to store or dispose of treated waste over the Snake River Plain aquifer, including performance-based or landfill closure of the Tank Farm as opposed to clean closure.

Hazardous Constituents – Develop a strategy for dealing with RCRA-regulated hazardous constituents.

Technical Viability/Privatization – Demonstrate in advance that the alternative selected will work. Stakeholders were cautious regarding privatization of the proposed actions.

Cost-risk benefits – The alternative selected should reduce health and safety risks enough to justify the cost of treatment and any additional risk to workers posed by the treatment activities.

Funding – Cleanup of the INEEL site is important, and the Federal government should seek adequate funding to honor its commitments to do so.

Compliance Concerns – Numerous, and in some cases conflicting, compliance requirements exist for the INEEL HLW management and facilities disposition activities. These conflicts should be clarified, and the compliance factors prioritized. The majority of the commenting stakeholders support the Settlement Agreement/Consent Order. Some stakeholders advocate consideration of a "fully compliant" alternative.

The results of the scoping activities for this EIS are documented in the Scoping Activity Report (DOE 1998c). DOE has used the comments to refine the alternatives and options analyzed in this EIS as described in Chapter 3.

Subsequent to the scoping period, three DOE documents with potential to influence the Idaho HLW & FD EIS were subjected to public evaluation and comment. These documents are (1) the Waste Area Group 3 Remedial Investigation/Feasibility Study (Rodriguez et al. 1997; DOE 1997e); (2) DOE's Office of Environmental Management Remediation Plan for the DOE Weapons Complex (DOE 1998d); and (3) the AMWTP EIS (DOE 1999e). To the extent that public comments on these documents affect the Idaho HLW & FD EIS, DOE addressed them in this EIS.

2.0 Purpose & Need for Agency Action

2.1 Purpose and Need for Agency Action

From 1952 to 1991, DOE and its predecessor agencies reprocessed spent nuclear reactor fuel at the Idaho Chemical Processing Plant, located on the Snake River Plain in the desert of southeast Idaho. This facility, now known as the Idaho Nuclear Technology and Engineering Center (INTEC), is part of the Idaho National Engineering and Environmental Laboratory (INEEL), a nuclear research complex that has served both peaceful and defense related missions for the nation.

Processing operations at INTEC utilized solvent extraction systems to extract uranium-235 and other defense-related materials from spent nuclear reactor fuel and, in the process, generated HLW as well as other wastes. HLW is a product of the first extraction cycle of the reprocessing operation. Subsequent extraction cycles, follow-up decontamination activities, and liquids from HLW treatment activities produced additional liquid waste, less radioactive than HLW, and best characterized as mixed transuranic waste. Since the decontamination solutions contained high levels of sodium, this liquid waste is referred to as mixed transuranic waste/sodium bearing waste (SBW). At INTEC, all of these liquid wastes were stored in eleven 300,000-gallon underground tanks. Over several years, much of the liquid waste was fed to a treatment facility and converted to a dry granular substance called calcine. The calcine, which is stored in large, robust bin sets, is a more stable waste form, posing less environmental risk than storing liquid radioactive waste in underground tanks. However, the calcine would not meet current waste acceptance criteria for disposal in a geologic repository and further treatment would be necessary to convert the HLW into a waste form acceptable for disposal in the geologic repository.

In 1998, DOE completed calcining all remaining liquid HLW. At present, approximately 4,200 cubic meters of HLW calcine is stored in INTEC bin sets and the remaining 1.4 million gallons left in the underground tanks are considered to be mixed transuranic waste.

History of High-Level Waste

In a 1969 staff paper published by the Atomic Energy Commission ("Siting of Commercial Fuel Reprocessing Plants and Related Waste Management Facilities"), high-level liquid wastes were described as "those, which by virtue of their radionuclide concentration, half-life, and biological significance, require perpetual isolation from the biosphere, even after solidification."

It was anticipated that the only liquid source of waste meeting these criteria would be the liquid generated during the first cycle of a process that extracted key radionuclides from dissolved irradiated nuclear reactor fuel. Liquid wastes from subsequent extraction cycles typically did not contain radionuclides at levels that warranted permanent isolation. However, these wastes could be considered HLW if concentrated to the point where radionuclide concentrations and half-lives would pose a significant long-term risk to the biosphere. The Nuclear Waste Policy Act of 1982, as amended, determined that a geological repository would be used for providing the necessary permanent isolation.

2.2 Timing and Regulatory Considerations Important and Relevant to Purpose and Need

Since the 300,000-gallon underground storage tanks at INTEC were not built to current hazardous waste management standards, it is DOE's objective to empty them and initiate tank closure in compliance with applicable regulations. DOE intended to empty the tanks by calcining all of the liquid waste. This course of action was selected in a 1995 Record of Decision as the appropriate treatment (60 FR 28680; June 1, 1995). Further, commitments regarding when the liquid waste would be calcined were made to the State in the 1995 Idaho Settlement Agreement/Consent Order (USDC 1995) and subsequently included in the Site Treatment Plan Consent Order. Since 1995, new regulatory considerations have necessitated another review of treatment options.

Some of these considerations include technical constraints, which have hindered DOE's efforts to sample offgas emissions from the New Waste Calcining Facility calciner, as well as logistical problems associated with obtaining representative constituent samples from the large volumes of mixed transuranic waste/SBW stored in the tanks. Emission and waste characteristic data is needed to support a RCRA permit application, which DOE must submit to the State of Idaho in order to continue running the calciner. If such a permit has not been obtained by June 1, 2000, the State has ordered DOE to cease calciner operations until such a permit is granted (Kelly 1999).

In addition to the RCRA permit, EPA has new air quality standards for hazardous waste combustion units. These standards must be met to allow continued operation of the calciner after 2002. Physical upgrades to the calciner and collection of additional data would be required in order to comply with these new standards, at considerable expense. For these reasons, DOE needs to reconsider its decision to operate the calciner and consider the relative merits of other alternatives that would empty the tanks of liquid mixed transuranic waste/SBW and meet time commitments to the State of Idaho.


Calcined Solids Storage Facilities.

Getting the liquid mixed transuranic waste/SBW out of the underground tanks by 2003 for the five pillar and panel vault tanks and 2012 for remaining tanks is not the only commitment DOE has to the State of Idaho. DOE is also committed to treating the calcine so that it can be put in a form that can be transported out of Idaho to a disposal or storage facility by a target date of December 31, 2035 (USDC 1995). In a 1995 Record of Decision, DOE selected a treatment technology (radionuclide partitioning) to be tested for potential use. If testing proved successful, DOE would move forward and prepare a site-specific National Environmental Policy Act analysis, comparing the potential environmental impacts of a radionuclide partitioning facility to other available treatment alternatives. DOE needs to prepare this analysis now since there is a requirement in the Settlement Agreement/Consent Order that directs DOE and the State of Idaho to start negotiations regarding the plan and schedule for treatment of the calcined waste by December 31, 1999. For both parties to participate in meaningful discussions on this subject, both partners need to understand the available alternatives and their potential impacts. Further, in order for DOE to act on the outcome of these negotiations, a Record of Decision must be issued based on an EIS.

As required under the National Environmental Policy Act, an EIS must analyze environmental impacts associated with related project actions. In this case, actions related to selecting a treatment technology for HLW and mixed transuranic waste/SBW include storage and disposal alternatives associated with the various waste streams from these processes as well as disposition of the facilities once the job is complete. This analysis is necessary so that an assessment of cumulative impacts associated with the various treatment, storage, and disposal options can be presented and put into perspective with other activities that may affect the environment. At INTEC, for example, a remedial investigation and feasibility study and consequent CERCLA Record of Decision (DOE 1999) has resulted in the selection of remedial actions for areas of historical contamination. One of the criteria used to select a remediation alternative is the calculated risk to human health and the environment. However, these risk calculations do not factor in any additional risks posed by the treatment, storage, and disposal options that DOE needs to identify for HLW and mixed transuranic waste/SBW.

DOE needs to move forward and identify potential risks to human health and the environment from the various HLW and mixed transuranic waste (SBW and newly generated liquid waste) management options. This is necessary because cleanup remedial actions selected under the Record of Decision for the Operable Unit 3-13 portion of Waste Area Group 3 and the ongoing CERCLA evaluations for the remainder of Waste Area Group 3 may affect waste processing and facility disposition options at INTEC. A timely EIS that integrates environmental impacts identified through the CERCLA cleanup process with those identified for HLW and mixed transuranic waste/SBW management options is essential for informed decision making. CERCLA evaluations are required to incorporate National Environmental Policy Act values under DOE policy but are not subject to the Act. This EIS evaluates the cumulative impacts of CERCLA actions as well as alternatives for the management of HLW and mixed transuranic waste/SBW.

In addition to the reasons discussed above, the following factors are relevant to the timing for this EIS. First, it is not too soon for DOE to begin an environmental analysis of technologies that would begin operation by 2007. The alternative treatment technologies evaluated in this EIS will require lead time for conceptual design and engineering. Adding these years to a schedule for construction and the operational lifetime of a selected technology leaves DOE little flexibility in meeting commitments set forth in the Settlement Agreement/Consent Order. Second, this EIS is being prepared at a time when there is considerable funding uncertainty. By evaluating innovative alternative scenarios and technologies, DOE is maximizing its scope of possibilities, and by so doing will be better prepared to deal with future resource constraints without compromising commitments to the State of Idaho.

The necessary lead time for facility development and funding of alternative technologies accelerates previous estimates of time when a DOE Record of Decision would be needed to select a calcine treatment technology. When the Settlement Agreement was being negotiated in 1995, it was assumed that the calciner would continue operation until 2012, and issuing a Record of Decision on a technology for treating the calcine could occur as late as December 31, 2009, without jeopardizing the target date of December 31, 2035 for having all the waste treated and ready to leave Idaho. However, after the Settlement Agreement/Consent Order was signed, it was determined that there are alternative technologies that would not involve calcining waste prior to further treatment. Initial engineering analyses of such alternatives, with associated schedules taking into account the time required for design and funding acquisition, revealed that if DOE wanted to select one of these technologies, decisions would have to be made as early as the year 2000. Thus, the timing of this EIS will enable DOE to meet the Consent Order and the Record of Decision milestone contained in the Settlement Agreement far in advance of what was initially considered necessary, but to do otherwise would make it difficult, to meet the target date of December 31, 2035 milestone for getting the waste ready to leave Idaho.

2.3 Role of this EIS in the Decision-Making Process

Chapter 3 of this EIS describes the range of reasonable alternatives to satisfy the purpose and need. Currently, neither DOE nor the State of Idaho (acting as a cooperating agency) has identified a preferred alternative. Based on information presented in this draft EIS and other considerations such as public comment, DOE and the State of Idaho will enter into discussions about which alternative would be preferable. To achieve mutual objectives, the alternative selected may be a hybrid of the alternatives presented in the draft EIS. If agreement on a preferred alternative can be reached, then the final EIS will be issued stating the selection. If agreement is not reached, then the final EIS will be issued setting forth the State's and DOE's preference.

In accordance with the Settlement Agreement/ Consent Order, DOE must begin negotiations with the State of Idaho by December 31, 1999 regarding the plan and schedule for treatment of the calcined waste. This EIS provides a basis for negotiations since the process of trying to reach consensus on a preferred alternative will necessitate discussions about relevant plans and schedules. Further, if on the basis of this EIS, DOE wants to propose modifications to the Settlement Agreement/Consent Order, the information in this document and the cooperative process used to ensure its adequacy will benefit related discussions between the State and DOE.

Based on this EIS and other applicable information, DOE expects to make the following decisions:

- How to treat INTEC mixed HLW so that it can be transported out of Idaho to a storage facility or repository.

- How to treat and where to dispose of other radioactive wastes that are associated with the HLW management program at INTEC.

- How to manage treated INTEC wastes that are ready to be transported out of Idaho.

- How to close HLW-related facilities at INTEC, including certain liquid waste storage tanks, bin sets, the New Waste Calcining Facility, facilities that would be constructed under the waste processing alternatives and treatment options, and associated laboratories and support facilities.

3.0 Alternatives

The alternatives described in this EIS are designed to meet the purpose and need described in Chapter 2, to manage mixed HLW and mixed transuranic waste (SBW and newly generated liquid waste) in a way that complies with regulatory requirements, such as the land disposal restrictions under RCRA, to protect the health and safety of INEEL workers and the public, and to conserve the nation's natural and financial resources. The alternatives selected for detailed analysis in this EIS are described in this chapter, and the impacts are presented in Chapter 5, Environmental Consequences. Those alternatives considered but not selected for detailed analysis are briefly described in Section 3.3 along with reasons for their elimination from further study [40 CFR 1502.14(a)]. DOE's selection process for identifying alternatives is described in Appendix B, Waste Processing Alternative Selection Process. DOE has not identified a preferred alternative; it will be identified in Section 3.5 of the Final EIS.

This EIS has two types of alternatives: waste processing and facility disposition. Waste processing alternatives provide means to retrieve, process, and dispose of or prepare for disposal the mixed HLW and mixed transuranic waste (SBW and newly generated liquid waste). (Appendix C.7, Description of Input and Final Waste Streams contains information on the product waste stream quantities associated with each alternative.) Facility disposition alternatives describe possible scenarios to disposition facilities that have been or will be used in INEEL's HLW program. The waste processing alternatives and the facility disposition alternatives generally can be considered to be independent of each other. However, the number and type of facilities required, and therefore the scope and methods for facility disposition, will depend on the waste processing alternative selected. Thus, the various options for implementing the waste processing alternatives affect facility disposition and the number and type of existing facilities and facilities that would be constructed to support waste processing depend upon the alternative selected. Although waste processing and facility disposition alternatives are separate, the cumulative impacts analysis combines the effects of waste processing and facility disposition.

There are five waste processing alternatives, including the No Action Alternative, which is required by the National Environmental Policy Act regulations [40 CFR 1502.14(d)]. Some of these waste processing alternatives have multiple options for implementation. The alternatives and their options are described in Section 3.1.

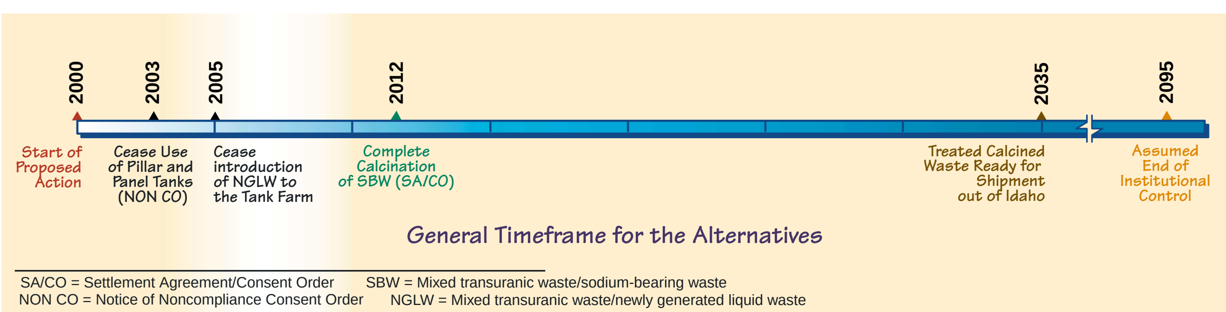
There are six facility disposition alternatives as described in Section 3.2. The six disposition alternatives are not applicable to all facilities because of varying residual amounts of radioactive and/or chemical contaminants.

For the ease of the reader, the waste processing alternatives do not include any specific facility disposition options, except for those cases where facility disposition is an integral part of implementation of the option (e.g., disposal of low-level waste Class A or Class C type grout in the Tank Farm and bin sets). However, DOE intends to make decisions regarding HLW facilities (including existing facilities and facilities that would be constructed under the waste processing alternatives).

Time lines for alternatives analyzed in the EIS

The general timeframe for the waste processing alternatives analyzed in this EIS extends from the year 2000 through 2035. The year 2035 is when, in accordance with the Settlement Agreement/Consent Order, DOE must have all HLW treated and ready to be shipped to a storage facility or repository outside of Idaho. Specifically, this agreement states that all the liquid in the eleven 300,000-gallon, below-grade tanks would be calcined, treated, and ready to be transported out of Idaho by a target date of December 31, 2035. Within this time frame and depending on the different treatment and disposal options analyzed, each waste processing alternative has a specific time line.

The general timeframe is delineated on the time line shown below. Interim milestones shown on this time frame represent key HLW commitments DOE made with respect to management of the liquid in the eleven 300,000-gallon below grade tanks and calcine in the bin sets. The time



General Timeframe for the Alternatives

line reflects a commitment by DOE to end use of the five pillar and panel tanks by 2003. In the year 2005, DOE intends to divert all newly generated liquid waste to tanks that are compliant with State and Federal regulations. The source of this waste is largely decontamination activities at INTEC that are not directly associated with the HLW management program and liquids generated by other INEEL facility operations. Liquid waste produced through the HLW management program, such as calciner operations and decontamination activities, will continue to be added to the tanks until all waste is calcined or otherwise processed and the tanks are emptied to their heels. The Settlement Agreement/Consent Order specifies that calcination shall be complete by 2012. Treatment of calcine can continue until 2035, when it must all be ready to be moved out of Idaho. However, if a storage facility or repository is available before 2035, then DOE could begin shipping the treated waste out of Idaho at an earlier date.

Except for the No Action Alternative and a slightly modified version, the Continued Current Operations Alternative, time frames for the remaining waste processing alternatives adhere to a completion date of 2035. However, because some of the waste processing alternatives evaluate new treatment technologies at INTEC that would not use the calciner, the 2012 date for having all liquids out of the tanks would not be practicable under those alternatives. Time frames in these instances are dictated by the amount of time needed to design, construct, and permit a new treatment facility and how long it will take to treat the liquid and the calcine using the selected technology.

For environmental consequence calculations, the processing alternatives analyzed in this EIS assume treated waste destined for storage or disposal sites outside of Idaho will be ready for shipment by 2035, but there is no assumption about what specific years the waste would be shipped. Impacts associated with storage of treated HLW at INEEL are presented on an annual basis out to the year 2095. Also, from 2035 to 2095, DOE would no longer be processing waste but would be decommissioning and dispositioning facilities. For purposes of analysis, the year 2095 was selected as the end of DOE's institutional control, which is in agreement with the *INEEL Comprehensive Facility and Land Use Plan* (DOE 1997) and the planning basis for the Waste Area Group 3 under the CERCLA. Loss of institutional control means that DOE no longer controls the site and therefore can no longer ensure that impacts to the public are within established limits. However, DOE is required to maintain controls on radioactive waste or materials under its jurisdiction until such time controls are no longer needed.

In addition to the timeframes previously discussed, the Settlement Agreement/Consent Order states: "In the event any required NEPA analysis results in the selection after October 16, 1995, of an action which conflicts with any action identified in this Agreement, DOE or the Navy may request a modification of this Agreement to conform the action in the Agreement to that selected action. Approval of such modification shall not be unreasonably withheld."

3.1 Description of Waste Processing Alternatives

DOE's five waste processing alternatives are:

1. No Action
2. Continued Current Operations
3. Separations
4. Non-Separations
5. Minimum INEEL Processing

These alternatives and their options for implementation are described in Sections 3.1.1 through 3.1.5. For purposes of analysis, DOE has broken down the actions to implement each alternative and option into discrete projects. There are multiple projects comprising an alternative or option. Some projects are used repeatedly for the various alternatives and options. Projects that are very similar between alternatives and options are generally represented by a single bounding project. This modular approach allows DOE, in its Record of Decision, to select an alternative containing elements of more than one alternative described in this chapter, producing a hybrid alternative.

The major INTEC facilities that would be constructed under the five waste processing alternatives are presented in Table 3-1. INTEC was selected for analysis as the site for these waste processing facilities because of the proximity to the Tank Farm, bin sets, and other existing facilities required for the alternatives. Proximity is important because it shortens piping runs, increases efficiency of operations, and minimizes areas where radioactive materials are managed at the INEEL. For more detailed information, see Appendix C.6, Project Information, which describes the individual projects. Table 3-2 provides an overview of some of the key attributes of the alternatives and options. Section 5.2 describes the environmental impacts of these alternatives.

3.1.1 NO ACTION ALTERNATIVE

The No Action Alternative (Figure 3-1) would maintain the status quo beginning in the year 2000. It assumes the calciner at the New Waste Calcining Facility would be placed in standby in June 2000. The New Waste Calcining Facility would not undergo upgrades to make it compliant with the Maximum Achievable Control Technology rule for air emissions, and no mixed transuranic waste would be calcined after June 2000. The High-Level Liquid Waste Evaporator would continue operating to reduce the volume of mixed transuranic waste and enable DOE to cease use of the five pillar and panel tanks in the Tank Farm in 2003. The mixed transuranic waste inventory at the time the High-Level Liquid Waste Evaporator completes its operation in 2003 would remain in the Tank Farm. Maintenance necessary to protect workers and the environment would continue, but there would be no major upgrades. The mixed HLW calcine in bin set 1 (which does not meet current design standards) would be transferred to bin set 6 or 7, as described in the SNF & INEL EIS Record of Decision (60 FR 28680; June 1, 1995) or modifications would be made to mitigate stress on bin set 1. All mixed HLW would remain in the bin sets indefinitely. All tanks available in the Tank Farm (i.e., all tanks except the pillar and panel tanks) would be full of mixed transuranic waste in approximately 2017. Other facilities depending on the capacity of the Tank Farm for operation eventually would be shut down due to their inability to discharge liquid waste. Under this alternative, DOE would not meet its commitment to cease use of the Tank Farm by 2012 and to make its mixed HLW road ready by 2035.

Table 3-1. INTEC facilities that would be constructed under the waste processing alternatives.

	Alternative/Option								
	No Action	Continued Current Operations	Full Separations	Planning Basis	Transuranic Separations	Hot Isostatic Pressed Waste	Direct Cement Waste	Early Vitrification	Minimum INEEL Processing
Calcine Retrieval and Transport System (bin set 1 only)	●	●	–	–	–	–	–	–	–
Calcine Retrieval and Transport System	–	–	●	●	●	●	●	●	●
NGLW Treatment Facility	–	●	–	●	–	●	●	–	–
Waste Separations Facility	–	–	●	●	–	–	–	–	–
Transuranic Separations Facility	–	–	–	–	●	–	–	–	–
Vitrification Plant	–	–	●	●	–	–	–	–	–
Class A Grout Plant	–	–	●	●	–	–	–	–	–
Class C Grout Plant	–	–	–	–	●	–	–	–	–
Hot Isostatic Press Facility	–	–	–	–	–	●	–	–	–
Cement Facility	–	–	–	–	–	–	●	–	–
Early Vitrification Facility	–	–	–	–	–	–	–	●	–
Interim Storage Facility [a]	–	–	●	●	–	●	●	●	●
Low-Activity Waste Disposal Facility	–	–	●	–	●	–	–	–	● [b]
Calcine Packaging Facility	–	–	–	–	–	–	–	–	●
SBW and NGLW Treatment Facility	–	–	–	–	–	–	–	–	●
New Analytical Laboratory	–	–	●	●	●	●	●	●	●
Waste Treatment Pilot Plant	–	–	●	●	●	●	●	●	●

a. The supporting engineering documents for this EIS refer to this facility as an "Interim Storage Facility." The use of the word "interim" means that the waste is stored road ready until shipment to a repository.
b. For vitrified low-activity waste returned from Hanford.
● indicates the facility is associated with the alternative.
Dash indicates the facility is not required.
NGLW = newly generated liquid waste

Table 3-2. Summary of key attributes of the waste processing alternatives.

Alternatives	Product waste volume	Primary treatment technology	Product waste disposal	Transportation	Indefinite or road-ready storage[a]
No Action Alternative	None[b]	None	Untreated waste remains at INEEL	None	Untreated mixed transuranic waste and mixed HLW calcine stored indefinitely in Tank Farm and bin sets, respectively
Continued Current Operations Alternative	110 m^3 RH TRU waste (from tank heels)	Calcine mixed transuranic waste/SBW Grout mixed transuranic waste/NGLW[c] and tank heel waste	RH TRU waste to WIPP	280 RH TRU containers[d] to WIPP	Mixed HLW and mixed transuranic waste/SBW calcine stored indefinitely in bin sets
Separations Alternative					
<u>Full Separations Option</u>	470 m^3 vitrified HLW 27,000 m^3 LLW Class A type grout	Vitrify separated HLW fraction Grout separated LLW fraction	Vitrified HLW to NGR LLW Class A type grout to: New onsite disposal facility or Tank Farm and bin sets or offsite disposal facility	780 HLW canisters[e] to NGR 25,100 LLW containers[f] to disposal facility	Vitrified HLW storage pending disposal at NGR
<u>Planning Basis Option</u>	470 m^3 vitrified HLW 30,000 m^3 LLW Class A type grout 110 m^3 RH TRU waste (from tank heels)	Calcine mixed transuranic waste/SBW Vitrify separated HLW fraction Grout separated LLW fraction Grout mixed transuranic waste/NGLW[c] and tank heel waste	Vitrified HLW to NGR LLW Class A type grout to offsite disposal facility RH TRU waste to WIPP	780 HLW canisters to NGR 27,900 LLW containers to disposal facility 280 RH TRU containers to WIPP	Vitrified HLW storage pending disposal at NGR
<u>Transuranic Separations Option</u>	220 m^3 RH TRU waste 22,700 m^3 LLW Class C type grout	Solidify separated TRU fraction Grout separated LLW fraction	RH TRU waste to WIPP LLW Class C type grout to: New onsite disposal facility or Tank Farm and bin sets or offsite disposal facility	560 RH TRU containers to WIPP 21,100 LLW containers to disposal facility	None

Table 3-2. Summary of key attributes of the waste processing alternatives (continued).

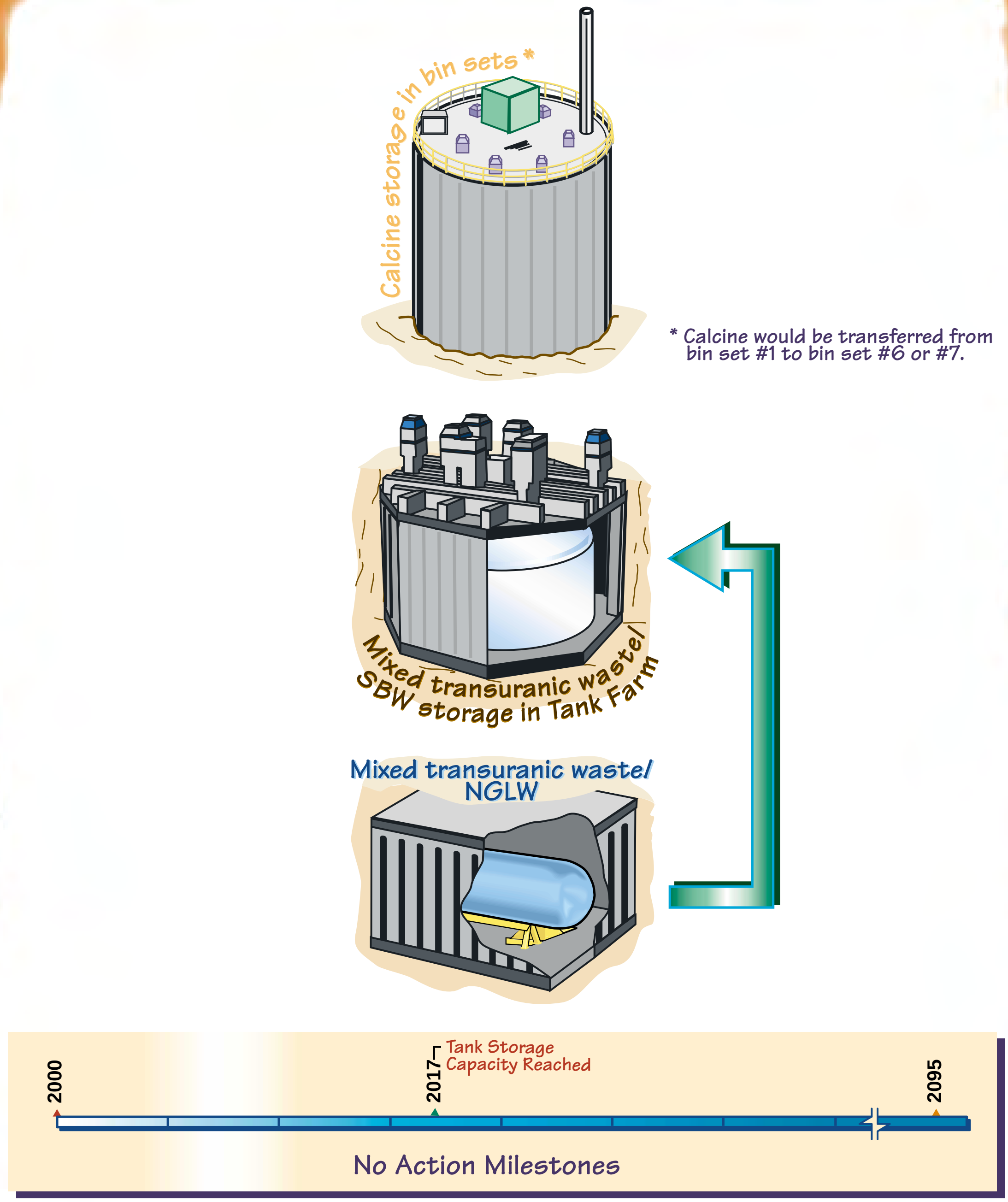
Alternatives	Product waste volume	Primary treatment technology	Product waste disposal	Transportation	Indefinite or road-ready storage[a]
Non-Separations Alternative					
Hot Isostatic Pressed Waste Option	3,400 m^3 HIP HLW 110 m^3 RH TRU waste (from tank heels)	HIP calcined HLW and mixed transuranic waste/SBW Grout mixed transuranic waste/NGLW[c] and tank heel waste	HIP HLW to NGR RH TRU waste to WIPP	5,700 HLW canisters to NGR 280 RH TRU containers to WIPP	HIP HLW storage pending disposal at NGR
Direct Cement Waste Option	13,000 m^3 cemented HLW 110 m^3 RH TRU waste (from tank heels)	Hydroceramic cement of calcined HLW and mixed transuranic waste/SBW Grout mixed transuranic waste/NGLW[c] and tank heel waste	Cemented HLW to NGR RH TRU waste to WIPP	18,000 HLW canisters to NGR 280 RH TRU containers to WIPP	Cemented HLW storage pending disposal at NGR
Early Vitrification Option	8,500 m^3 vitrified HLW 360 m^3 RH TRU waste (from mixed transuranic waste)	Vitrify calcine Vitrify mixed transuranic waste	Vitrified HLW to NGR RH TRU waste to WIPP	11,700 HLW canisters to NGR 900 RH TRU containers to WIPP	Vitrified HLW storage pending disposal at NGR
Minimum INEEL Processing Alternative					
At INEEL	7,500 m^3 CH TRU waste from mixed transuranic waste	CsIX and grout mixed transuranic waste	CH TRU waste to WIPP Vitrified LLW to new onsite disposal facility or an offsite commercial disposal facility Vitrified HLW to NGR	37,500 CH TRU containers[g] to WIPP 625 HLW canisters[h] to NGR 5,500 LLW containers[i] to disposal facility 3,700 HLW canisters containing calcine to Hanford	Vitrified HLW storage pending disposal at NGR

Table 3-2. Summary of key attributes of the waste processing alternatives (continued).

Alternatives	Product waste volume	Primary treatment technology	Product waste disposal	Transportation	Indefinite or road-ready storage[a]
At Hanford	14,400 m^3 vitrified LLW fraction from calcine 730 m^3 vitrified HLW fraction from calcine	Vitrify separated LLW fraction and HLW fraction	Vitrified LLW fraction returned to INEEL Vitrified HLW fraction returned to INEEL	5,550 LLW containers to INEEL 625 HLW canisters to INEEL	None

a. Chapter 5 presents annualized impacts for these storage activities through the period of institutional control.
b. The No Action Alternative would not produce a waste form suitable for disposal. The 800,000 gallons of concentrated mixed transuranic waste/SBW and 4,200 cubic meters of mixed HLW would remain untreated.
c. For purposes of analysis, mixed transuranic waste/NGLW grout was assumed to be managed as low-level (process) waste.
d. RH TRU waste containers are assumed to be WIPP half-containers with a capacity of 0.4 cubic meter. For purposes of analysis, all options were assumed to use the WIPP half-containers for packaging RH TRU waste.
e. INEEL HLW canisters are assumed to be similar to those used at the Savannah River Site Defense Waste Processing Facility (2 feet in diameter and 10 feet long).
f. INEEL LLW containers are assumed to be concrete cylinders with a capacity of approximately 1 cubic meter.
g. CH TRU waste containers are assumed to be 55-gallon drums (0.2 cubic meters).
h. Hanford HLW canisters are assumed to be similar to those used for the Tank Waste Remediation System (2 feet in diameter and 15 feet long).
i. Hanford LLW containers are assumed to be 4 feet x 4 feet x 6 feet steel boxes with a usable capacity of 2.6 cubic meters.

CH = contact-handled; CsIX = cesium ion exchange; HIP = Hot Isostatic Pressed; LLW = low-level waste; NGLW = newly generated liquid waste; NGR = national geologic repository; RH = remote-handled; TRU = transuranic; WIPP = Waste Isolation Pilot Plant.



LEGEND

SBW Mixed transuranic waste/ sodium-bearing waste

NGLW Mixed transuranic waste/ newly generated liquid waste

FIGURE 3-1.
No Action Alternative.

New Waste Calcining Facility

The New Waste Calcining Facility (CPP-659) includes several treatment systems: Calciner, Debris Treatment and Containment Storage Building, and HEPA Filter Leach System.

The calciner provides pretreatment of mixed HLW and mixed transuranic waste/SBW by calcination, resulting in conversion of the liquid waste to a solid granular form. Before calcination, the liquid waste is processed through the High-Level Liquid Waste Evaporator (also housed in Building CPP-659) for volume reduction and concentration, which makes the waste more amenable to calcination. Calcination of mixed transuranic waste/SBW may involve the addition of aluminum nitrate or other additives (approximately three volumes of aluminum nitrate per volume of SBW) to prevent the sodium and potassium nitrates in the waste from clogging the calcine bed at the current operating temperature. Operation of the calciner at elevated temperature (600°C versus 500°C) may reduce the need for these large amounts of inert additives, increasing the mixed transuranic waste/SBW processing rate and reducing the volume of calcine produced. Calcination does not meet the applicable RCRA treatment standards for the INTEC waste and is considered an interim treatment step to stabilize the waste in a solid form pending its final treatment.

The Notice of Noncompliance Consent Order requires that the calciner be placed in standby in June 2000, pending DOE's decision whether to seek a permit or close the facility. Before continuing calciner operations, upgrades to the offgas treatment system would be required to comply with the Maximum Achievable Control Technology air emissions standards. The alternatives in this EIS consider whether to continue operating the calciner and make the upgrades. Other operations at the New Waste Calcining Facility described below would continue independent of DOE's decision regarding future calciner operations.

The Debris Treatment and Containment Storage Building comprises decontamination cubicles, a spray booth, a decontamination cell, and low-level decontamination room. Several treatment technologies are currently used to treat debris in accordance with the RCRA debris treatment standards (40 CFR 268.45). These treatment technologies include water washing, chemical washing, high-pressure water and steam sprays, and ultrasonic cleaning. The Debris Treatment and Containment Storage Building will also provide treatment by liquid abrasive and/or carbon dioxide blasting and bulk washing. Liquid wastes generated by the Debris Treatment and Containment Storage Building (such as spent decontamination solution) are managed in the INTEC liquid radioactive waste treatment system.

The HEPA Filter Leach System treats contaminated high-efficiency particulate air (HEPA) filters, using chemical extraction to remove radionuclides and hazardous constituents from used HEPA filters. The system can treat both transuranic and mixed low-level filters. After leaching, the filters are packaged for disposal. If the treated filters meet the applicable performance standards, they will be disposed of as low-level waste. The leachate generated by HEPA filter leaching is managed in the INTEC liquid radioactive waste treatment system (Process Equipment Waste Evaporator, Liquid Effluent Treatment and Disposal Facility, and Tank Farm). The bottoms from the Process Equipment Waste Evaporator system are sent to the Tank Farm. The bottoms from the Liquid Effluent Treatment and Disposal Facility are recycled to the New Waste Calcining Facility or sent to the Tank Farm pending final treatment (see Figure 1-6, Current INTEC high-level waste system simplified flow diagram) (DOE 1998a).

What went into the eleven 300,000-gallon below grade tanks?

Liquid high-level waste: The highly radioactive solution remaining after uranium was extracted from dissolved spent nuclear fuel.

Liquid Sodium Bearing Waste (SBW): SBW is a term that has been used to describe liquid wastes generated in association with HLW activities, but which specifically did not come from the first step in processing where uranium is initially separated from dissolved spent nuclear fuel. Examples of activities that generated SBW include processes to purify the extracted uranium, operation of the calciner, and the decontamination of equipment and facilities associated with HLW. Because these activities, particularly decontamination, used significant quantities of sodium, the resulting liquid waste has historically been described by this characteristic. However, from a radionuclide perspective, the SBW is more appropriately classified as a transuranic waste. It is also a mixed waste because it contains hazardous materials that require additional management and regulatory considerations. Therefore, this EIS refers to SBW as mixed transuranic waste, a convention consistent with DOE Order 435.1.

Newly Generated Liquid Waste: Over the years, liquid waste from a variety of other sources has been added to the liquid HLW and mixed transuranic waste in the below-grade tanks. Sources include leachates from treating contaminated HEPA filters, decontamination liquids from INTEC operations that are not associated with HLW management activities and liquid wastes from other INEEL facilities. Because of diverse sources, these liquids have various contaminant levels and generally would be considered low-level radioactive wastes. However, the newly generated liquid is evaporated at INTEC, which concentrates any radionuclides. If transuranic radionuclides are concentrated to certain levels, then the newly generated liquid waste is more properly characterized as a transuranic waste.

Newly generated liquid waste has historically been added to the liquid mixed transuranic waste in the below-grade tanks. Consequently it has been similarly managed, calcined, and transferred to bin sets where it is combined with HLW. However, DOE has determined that by September 30, 2005, new tanks will be constructed and available to accept the newly generated liquid waste. These tanks will comply with all regulatory requirements and the liquid will be treated and disposed of according to whether it is mixed transuranic waste (level of transuranic radionuclides exceeds threshold concentrations) or mixed low-level waste (transuranics do not exceed threshold concentrations).

Facilities required for the No Action Alternative would include the bin sets, which would continue to store the mixed HLW; the Tank Farm, which would continue to store the mixed transuranic waste; the High-Level Liquid Waste Evaporator, which would continue to concentrate mixed transuranic waste/SBW; and the Process Equipment Waste Evaporator and the Liquid Effluent Treatment and Disposal Facility which would continue to evaporate mixed transuranic waste (newly generated liquid waste). The major facilities and projects required to implement the No Action Alternative are listed in Appendix C.6.

Bin set construction photos.

What Is a Tank Heel?

Tank heels are the residues that remain in the tanks after as much material as possible has been removed using existing waste transfer equipment. Waste processing activities such as calcination may recycle a portion of the waste to the tanks, resulting in increased concentrations of certain components, like mercury, in the tank heels relative to the original waste.

3.1.2 CONTINUED CURRENT OPERATIONS ALTERNATIVE

Under this alternative (Figure 3-2), current operations of all existing waste facilities and processes would continue, including the New Waste Calcining Facility, High-Level Liquid Waste Evaporator, Process Equipment Waste Evaporator, Liquid Effluent Treatment and Disposal Facility, Remote Analytical Laboratory, Tank Farm, bin sets, Coal-Fired Steam Generating Facility, and Substation. The New Waste Calcining Facility calciner would have been placed in standby in June 2000, in accordance with the Notice of Noncompliance Consent Order, then upgraded to comply with the Maximum Achievable Control Technology air emissions requirements. The upgrades would be completed by 2010. The High-Level Liquid Waste Evaporator would continue to operate to allow the pillar and panel tanks to be taken out of service in 2003. The upgraded New Waste Calcining Facility calciner would operate from 2011 through 2014 to process the remaining liquid mixed transuranic waste/SBW.

After 2014, the New Waste Calcining Facility calciner would operate as needed until the end of 2016. Beginning in 2015, the mixed transuranic waste (newly generated liquid waste) would be

Low-Level Waste Classification

The Nuclear Regulatory Commission regulations define classes of commercial low-level waste that are suitable for near surface disposal. The waste classification (Class A, B, or C) is determined by two considerations: (1) the concentration of long-lived radionuclides that present a long-term hazard (i.e., the hazard will persist beyond the period during which institutional controls, improved waste forms, and deeper disposal are effective) and (2) the concentration of short-lived radionuclides. The concentrations of specific radionuclides for the classes are identified in tables provided in 10 CFR 61.55. The alternatives in this EIS include options that would produce separated low-level fraction wastes that meet the Class A (under Full Separations, Planning Basis, and Minimum INEEL Processing) and Class C (under Transuranic Separations) definitions. Although the Nuclear Regulatory Commission classification system is not applicable to DOE waste disposal activities (which are performed in accordance with DOE Order 435.1), the EIS includes disposal options for the separated low-level waste fraction involving commercial facilities that would be subject to these requirements.

Class A waste is usually segregated from other waste classes at a disposal site because it is not required to meet the stability requirements that apply to the other classes. Class A waste is subject only to the minimum requirements in 10 CFR 61.56(a) (e.g., no cardboard packaging, little free standing liquids, no pyrophoric materials, not capable of detonation or explosive decomposition). In addition to these minimum requirements, Class B and C wastes must meet the more rigorous stability requirements in 10 CFR 61.56(b). These requirements include providing a structurally stable waste form that will maintain its dimensions and form under the expected disposal conditions. For example, the Class B or C wastes must be able to withstand the weight of overburden and compaction equipment and the presence of water without slumping, collapse, or other failure. Structural stability can be provided by the waste form itself (e.g., grout) or by placing the waste into a disposal container that provides the required stability. Class C wastes may require additional measures at the disposal facility to protect against inadvertent intrusion.

processed through a cesium ion exchange column, evaporated, and grouted for disposal. The cesium-loaded resin would be dried and stored in the bin sets. Mercury becomes concentrated in the tank heels as a result of offgas scrub from the calcining process. The waste containing mercury would be removed from the tank heels, treated, packaged, and sent to the Waste Isolation Pilot Plant for disposal.

As described for the No Action Alternative, the calcine in bin set 1 would be transferred to bin set 6 or 7 or modifications would be made to mitigate stress on bin set 1. The requirement to treat all the HLW so that it would be road ready for shipment out of Idaho by 2035 would not be met since the calcine would remain indefinitely in the bin sets.

The major facilities and projects required to implement the Continued Current Operations Alternative are listed in Appendix C.6, except for transportation projects, which are addressed in Appendix C.5.

3.1.3 SEPARATIONS ALTERNATIVE

The fundamental feature of the Separations Alternative is the use of chemical separation methods to divide the HLW into two primary final waste streams: one high-level waste fraction suitable for disposal in a geologic repository and the other low-level waste fraction suitable for near-surface disposal at the INEEL or another permitted facility. Separating the waste decreases the amount of waste that has to be shipped to a geologic repository, saving needed space and reducing disposal costs. Also, some costs and risks associated with transportation of radioactive materials to a repository would be decreased. The characteristics and classification of the high-level and low-level waste fractions would vary with the type of separations processes that are used. Because HLW would be separated into fractions, DOE would need to determine, before undertaking the separation process, whether any of the fractions are waste incidental to reprocessing that would be more appropriately managed as transuranic or low-level waste, rather than HLW. The waste streams that meet the requirements of the waste incidental to reprocessing processes, either by citation or by evaluation, are excluded from the scope of HLW. For a discussion of the waste incidental to reprocessing procedure see Section 6.3.2.2.

DOE has selected three options for implementing the Separations Alternative: Planning Basis, Full Separations, and Transuranic Separations. The Planning Basis Option closely resembles planning initiatives discussed in *Accelerating Cleanup: Paths to Closure* (DOE 1998b) and is fully consistent with settlement agreement/consent order milestones and the SNF and INEL EIS Record of Decision (60 FR 28680; June 1, 1995). This alternative is similar to the Full Separations Option discussed below but includes calcination of liquid mixed transuranic waste/SBW by 2012 followed by dissolution of the calcine for radionuclide partitioning and immobilization. The Full Separations Option provides an opportunity to directly treat the mixed HLW calcine and liquid mixed transuranic waste/SBW to their final waste forms by eliminating the intermediate processing step of calcination. This option also offers advantages of a reduced final waste form volume (because the inert additives associated with conversion of the liquid mixed transuranic waste/SBW to calcine would not be used) and decreased waste processing impacts. A third option, the Transuranic Separations Option, was included because of the uncertainty of availability of a geologic repository for disposal of INEEL HLW. This option would separate the INEEL waste into its transuranic and low-level waste fractions for disposal at the Waste Isolation Pilot Plant and a low-level waste disposal facility, respectively, eliminating the need for road-ready storage and repository disposal of HLW.

The Separations Alternative includes a small Separations Organic Incinerator for the treatment of radioactively contaminated spent organic solvents that would result from the separations process. A description of the Separations Organic Incinerator, Project 118, is in Appendix C.6.

3.1.3.1 Full Separations Option

The Full Separations Option would retrieve and dissolve the calcine and separate it into high-level and low-level waste fractions. Liquid mixed transuranic waste/SBW and tank heels flushed out of the tanks would be subjected to the same separations process. This option would use a chemical separations facility to remove cesium, transuranics, and strontium from the process stream. These constituents, termed the HLW fraction, account for most of the radioactivity and long-lived radioactive characteristics of HLW and mixed transuranic waste/SBW. The HLW fraction then would be vitrified, packaged in Savannah River Site-type stainless steel canisters, and stored onsite (road ready) until shipped to a geologic repository.

The process stream remaining after separating out the HLW fraction would be low-level waste. After some pretreatment, the low-level waste fraction would be solidified into a grout in a grouting facility. The concentrations of radioactivity in the grout would result in its classification as a Class A type low-level waste, which is suitable for disposal in a near-surface landfill.

Figure 3-3 illustrates the Full Separations Option. Although not depicted on the figure, the High-Level Liquid Waste Evaporator, Liquid

Effluent Treatment and Disposal Facility, and Process Equipment Waste Evaporator would continue to operate to reduce the volume of mixed transuranic waste/SBW and enable DOE to cease use of the pillar and panel tanks in 2003.

DOE has analyzed three potential methods for disposing of the low-level waste Class A type grout: (1) in the empty vessels of the closed Tank Farm and bin sets (see Section 3.2.1), (2) in a new INEEL Low-Activity Waste Disposal Facility, and (3) in an offsite low-level waste disposal facility. DOE acknowledges that the *DOE Idaho Waste Management Program Technical and Strategic Plan* (DOE/ID-10664) indicates that the Radioactive Waste Management Complex is scheduled to close the active pit for contact-handled low-level waste in 2006 and for remote-handled low-level waste in 2008. The Waste Management Programmatic EIS record of decision, when issued, will provide a path forward for low-level waste disposal, with the exception of waste destined for a CERCLA soil repository. For purposes of analysis, this alternative assumes that a new INEEL facility for disposal of low-level waste known as the Low-Activity Waste Disposal Facility would be located approximately 2,000 feet east of the INTEC Coal-Fired Steam Generating Facility. The actual location would depend on further site evaluations and National Environmental Policy Act analysis.

For purposes of the transportation analysis, DOE used the commercial radioactive waste disposal site operated by Envirocare of Utah, Inc., located 80 miles west of Salt Lake City. However, this disposal operation is currently not licensed to accept INTEC low-level waste, and the inclusion of this facility in this EIS is for illustrative purposes only.

Transportation for this alternative includes shipping vitrified HLW to a geologic repository and potentially shipping the low-level waste Class A type grout to an offsite facility. In addition, DOE has analyzed in Section 5.2.9, the impacts of several stand-alone projects involving transportation of solidified HLW fraction to DOE's Hanford Site in Richland, Washington and return of vitrified HLW to INEEL, to offer DOE decisionmakers the flexibility to select Hanford as an offsite location for vitrification (see Section 3.1.5). The Hanford options are not considered part of the base Full Separations Option.

The major facilities and projects required to implement the Full Separations Option, including the variations in implementation, are listed in Appendix C.6, except for transportation projects that are addressed in Appendix C.5. Figure 3-4 depicts INTEC as it currently exists. Figure 3-5 shows a similar view of INTEC but includes facilities that would be added under the Full Separations Option.

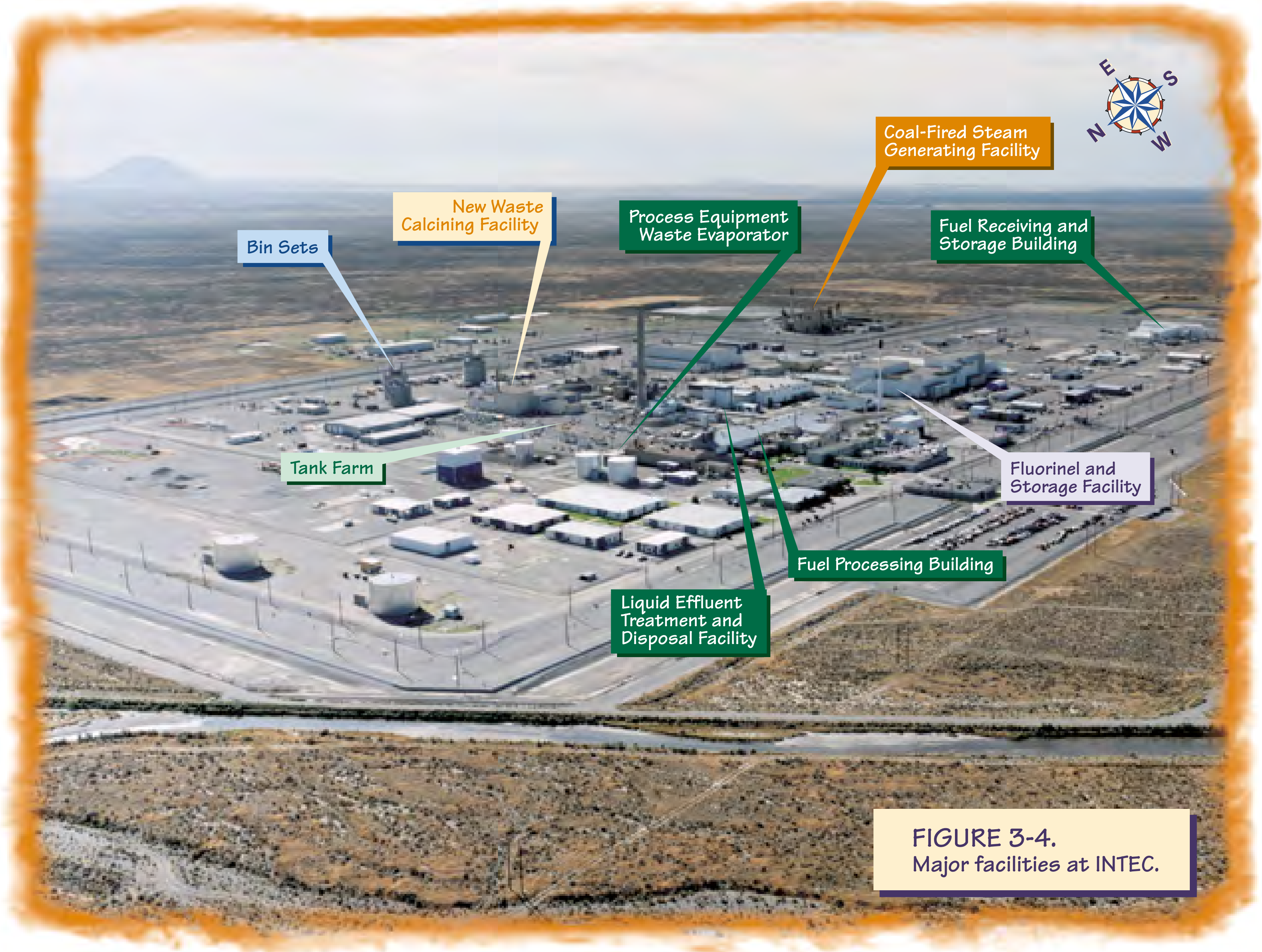
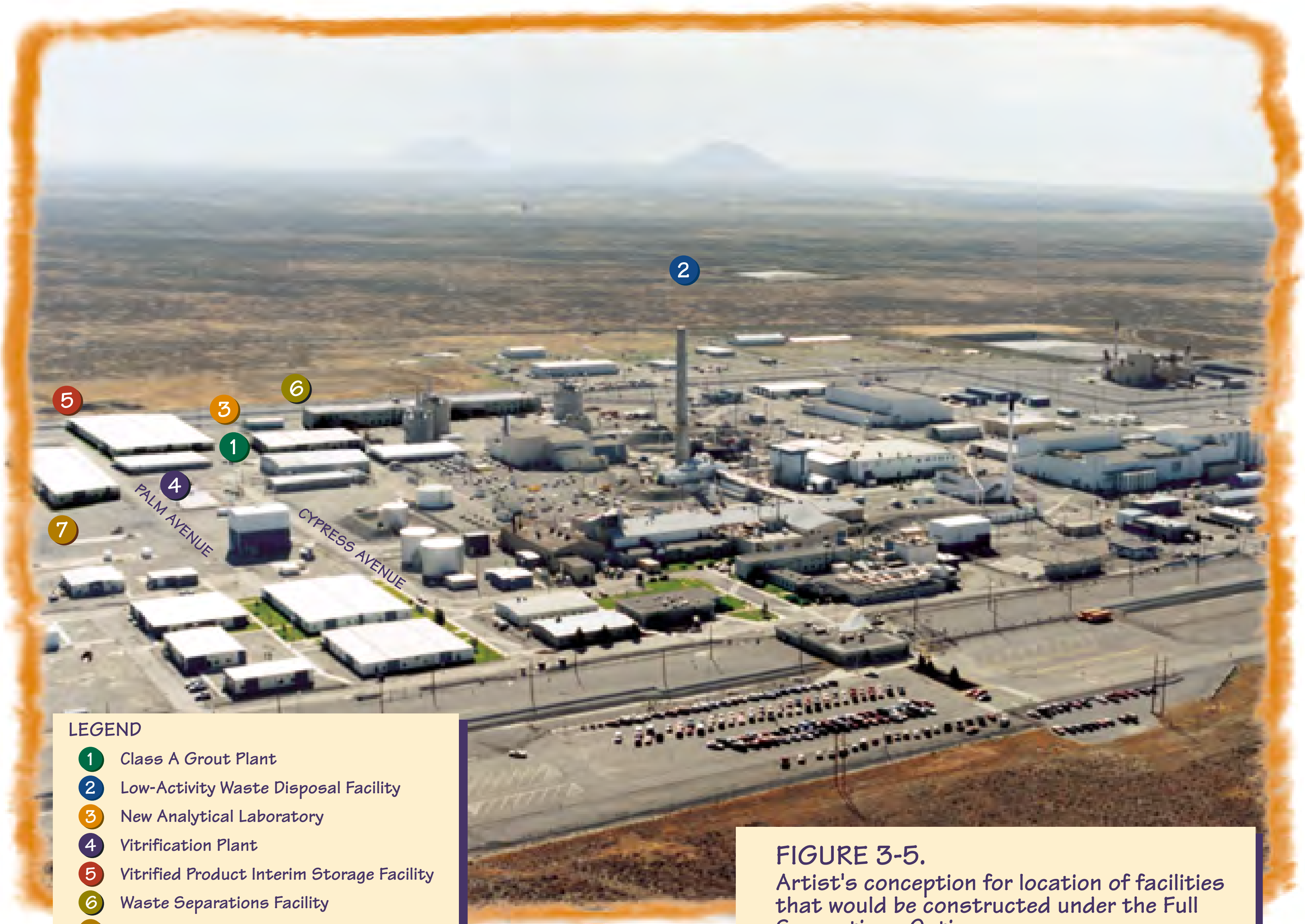


FIGURE 3-4.
Major facilities at INTEC.



LEGEND

1. Class A Grout Plant
2. Low-Activity Waste Disposal Facility
3. New Analytical Laboratory
4. Vitrification Plant
5. Vitrified Product Interim Storage Facility
6. Waste Separations Facility
7. Waste Treatment Pilot Plant

FIGURE 3-5.
Artist's conception for location of facilities that would be constructed under the Full Separations Option.

3.1.3.2 Planning Basis Option

The Planning Basis Option is similar to the Full Separations Option, the primary difference being that the liquid mixed transuranic waste/SBW would not be processed (separated) directly but would be calcined in the New Waste Calcining Facility. The calciner would continue to operate in high temperature mode until June 2000, as required by the Notice of Noncompliance Consent Order with the State of Idaho. At that time, DOE would declare its intent to seek a RCRA permit to operate the calciner and proceed to file the necessary documents with the State and conduct any testing or data gathering that might be required. In addition, the calciner would be upgraded to comply with the Maximum Achievable Control Technology air emission requirements. Following upgrades, the calciner would be restarted to treat the liquid mixed transuranic waste/SBW. The mixed transuranic calcine would be added to the mixed HLW calcine already in the bin sets and later retrieved for dissolution and separation. This option would use a chemical separations facility to remove cesium, transuranic, and strontium, as in the Full Separations Option. These constituents, termed the mixed HLW fraction, account for most of the radioactivity and long-lived radioactive characteristics found in the HLW calcine and liquid mixed transuranic waste. The HLW fraction would then be vitri-

Waste Fractions - What are they?

Plans for managing HLW at several DOE sites include processes that separate the waste into fractions. The advantage of this approach is that the volume of waste needing to be disposed of in a geologic repository can be substantially decreased, thereby saving valuable repository space and reducing costs associated with disposal.

Generally, HLW separation technologies isolate key radionuclides, which because of high radioactivity levels or long radioactive half-lives should be disposed of in a geologic repository. Separated waste destined for a repository is referred to as the HLW fraction or transuranic fraction, depending on the kinds of radionuclides present. If this fraction includes sufficient fission products, such as cesium and strontium, which result in high radioactivity levels, and contains sufficient long-lived transuranic (heavier than uranium) radionuclides, then it is properly classified as HLW and should be disposed of at a geologic repository. If this fraction contains only the long-lived transuranic radionuclides in concentrations greater than 100 nanocuries per gram, then it is properly classified as transuranic waste and, provided other acceptance criteria are met, could be disposed of at the Waste Isolation Pilot Plant, a geologic repository in New Mexico.

The waste remaining after the HLW or transuranic waste fractions have been removed is the low-level waste fraction. It does not contain radioactive fission products and long-lived radionuclides in sufficient concentrations to warrant isolation in a geologic repository. Instead, near-surface disposal facilities are appropriate for this type of waste, provided performance assessment requirements and regulatory standards are met. In this EIS, the radioactivity in low-level waste fractions would not exceed Class C concentration limits established by the Nuclear Regulatory Commission for commercial low-level waste disposal facilities (10 CFR 61).

In order for a fraction to be classified as transuranic or low-level waste, DOE must follow an evaluation process (DOE M 435.1-1 Chapter II). See Chapter 1 Text Box: "What is Waste Incidental to Reprocessing" and Section 6.3.2.2 for further discussion of this process.

Transuranic waste delivery to Waste Isolation Pilot Plant in New Mexico.

fied, packaged in Savannah River Site-type stainless steel canisters and stored onsite until shipped to a geologic repository.

The process stream remaining after separating out the HLW fraction would be managed as a low-level waste, provided DOE determines through an evaluation process that it is waste incidental to reprocessing (DOE M 435.1-1, Chapter II). The low-level waste would then be solidified in a grouting facility. Concentrations of radioactivity in the grout would result in its classification as a Class A type low-level waste, which is suitable for disposal in a near-surface landfill. Under this alternative, the low-level waste Class A type grout would be transported to a disposal facility outside of Idaho. For purposes of the transportation analysis, DOE used the commercial radioactive waste disposal site operated by Envirocare of Utah, Inc., located 80 miles west of Salt Lake City. However, this disposal operation is currently not licensed to accept INTEC low-level waste and the inclusion of this facility in this EIS is for illustrative purposes only.

Mercury becomes concentrated in the tank heels as a result of offgas scrub from the calcining process. The waste containing mercury would be removed from the tank heels, treated, packaged and sent to the Waste Isolation Pilot Plant for disposal.

DOE devised the Planning Basis Option to reflect the major commitments made through agreement with the State of Idaho, prior Records of Decision, and existing DOE plans, such as those in *Accelerating Cleanup: Paths to Closure* (DOE 1998b). This implies that calcining of the liquid mixed transuranic waste/SBW would be completed by 2012, as agreed to in the Settlement Agreement/Consent Order. However, the baseline schedule reevaluation prepared for this EIS estimates that a more realistic calcine completion date would be 2014. In order to meet the 2012 date, a number of processes would have to be accelerated. First, funding would have to be available beginning in fiscal year 2000, so that conceptual design can begin for upgrades to meet Maximum Achievable Control Technology requirements. Second, assuming 75 percent operating efficiency, the calciner would have to be able to resume processing liquid mixed transuranic waste/SBW by 2010 if the 2012 deadline is to be met. Delays in obtaining the RCRA permit or some other interruption could also stress an already tight and optimistic schedule.

The Settlement Agreement/Consent Orders states: "In the event any required NEPA analysis results in the selection after October 16, 1995, of an action which conflicts with any action identified in this Agreement, DOE or the Navy may request a modification of this Agreement to conform the action in the Agreement to that selected action. Approval of such modification shall not be unreasonably withheld."

Figure 3-6 illustrates the Planning Basis Option. Although not depicted on the figure, the High-Level Liquid Waste Evaporator, Liquid Effluent Treatment and Disposal Facility, and Process Equipment Waste Evaporator would continue to operate to reduce the volume of mixed transuranic waste/SBW and enable DOE to cease use of the pillar and panel tanks in 2003.

Transportation for this alternative includes shipping vitrified HLW to a geologic repository and shipping the low-level waste Class A type grout to an offsite facility.

The major facilities and projects required to implement the Planning Basis Option are listed in Appendix C.6, except for transportation projects, which are addressed in Appendix C.5. Figure 3-7 locates the facilities at the INTEC (see Figure 3-4 for comparison).

LEGEND

1. Class A Grout Plant
2. New Analytical Laboratory
3. Vitrification Plant
4. Vitrified Product Interim Storage Facility
5. Waste Separations Facility
6. Waste Treatment Pilot Plant
7. Newly Generated Liquid Waste Treatment Facility

FIGURE 3-7.
Artist's conception for location of facilities that would be constructed under the Planning Basis Option.

3.1.4 NON-SEPARATIONS ALTERNATIVE

The Non-Separations Alternative would not separate the waste into high-level and low-level fractions, but would process all the waste into an immobilized HLW form by the year 2035 for subsequent shipment to a geologic repository. The three options considered in the Non-Separations Alternative are: (1) Hot Isostatic Pressed Waste Option, (2) Direct Cement Waste Option, and (3) Early Vitrification Option. With the exception of the Early Vitrification Option, all liquid mixed transuranic waste/SBW would be calcined before the end of 2014 in the New Waste Calcining Facility with the high-temperature and Maximum Achievable Control Technology upgrades. In the Early Vitrification Option, the liquid mixed transuranic waste/SBW would be retrieved from the Tank Farm and sent directly to a vitrification facility, bypassing calcination.

The three options would use different technologies to treat the INEEL waste to produce an immobilized waste form.

- The Hot Isostatic Pressed Waste Option uses a treatment method that has been studied at INEEL for several years. Like vitrification, it is a high temperature process. The mixed transuranic waste/SBW would be calcined, then a combination of high temperature and pressure is used to immobilize the mixed HLW and mixed transuranic waste calcine. The hot isostatic press technology differs from vitrification in that waste is treated in individual containers rather than melted in batches and then containerized and allowed to harden.
- The Direct Cement Waste Option uses a non-thermal process to immobilize the mixed HLW and mixed transuranic waste calcine. The calcine is blended with additives (i.e., clay, slag, and caustic soda), poured into canisters, and cured. The material is then baked to remove any free water prior to sealing the containers. Although heat is used in the curing and water removal processes, the temperatures involved (around 250ºC) are much lower than those associated with vitrification or hot isostatic press. The resulting waste form is structurally sound but of considerably greater volume than the waste forms produced under the other options.
- The Early Vitrification Option would use the same technology (vitrification) as the Separations Alternative. Rather than separating the mixed HLW calcine and liquid mixed transuranic waste/SBW into high-level and low-level fractions, the two wastes would be treated separately by processing first liquid mixed transuranic waste/SBW and then mixed HLW calcine in a vitrification facility.

The hot isostatic pressed and hydroceramic cemented waste forms would not meet EPA's treatment standard for disposal of HLW. DOE would have to demonstrate that these technologies produce waste forms with equivalent long-term performance to borosilicate glass vitrification, which is planned for disposal in a HLW geologic repository. DOE would also need to conduct extensive testing and evaluation to qualify any non-vitrified waste forms under the waste acceptance criteria for a HLW geologic repository (DOE 1996a; 1999a).

Hot Isostatic Press

The hot isostatic press process was invented by researchers at Battelle Columbus Laboratories in 1955. This technology has been the subject of more than 10 years of research, development, and testing of surrogate wastes at INTEC. A potential application of this technology to the INEEL calcine is described below.

The calcine would be mixed with amorphous silica and titanium powder and poured into special cans. The calcine mixture would be heated at moderate temperature (about 650°C) to remove any volatile materials. The cans would then be sealed and loaded into a furnace. The furnace would operate at high temperature (about 1,050°C) and pressure (20,000 psi of argon gas) and would compress the can and its content to form a glass-ceramic product. A volume reduction of approximately 50 percent is expected. The immobilization properties of the glass-ceramic product are expected to be comparable to those of vitrified borosilicate glass.

After cooling, the hot isostatic pressed waste cans would be loaded inside standard HLW canisters for disposal in a geologic repository. To optimize loading of the HLW canisters, the cans would be designed such that, after hot isostatic pressing, they are cylindrical in shape and a size that would allow three cans to fit inside a standard HLW canister. For example, a corrugated can that would contract in length without changing in diameter could be used. Further development would be needed to optimize the can design and dimension (Russell and Taylor 1998).

The hot isostatic press technology is also being considered for treatment of the fission products and transuranic elements that would be removed from the molten salt mixture produced under several of the alternatives that DOE is considering as part of a proposal to treat and manage sodium-bonded spent nuclear fuel. These alternatives would involve electrometallurgical processing of sodium-bonded spent nuclear fuel in the Fuel Conditioning Facility at Argonne National Laboratory-West (DOE 1999b).

For all options, the treatment process would consist of waste retrieval and immobilization to produce a glass-ceramic, cement, or glass form. The immobilized waste would be stored in a road-ready condition at an INEEL storage facility before shipment to a geologic repository. The High-Level Liquid Waste Evaporator, the Liquid Effluent Treatment and Disposal Facility, and the Process Equipment Waste Evaporator would continue to operate to allow the pillar and panel tanks to be taken out of service in 2003. The following sections describe the three options of the Non-Separations Alternative.

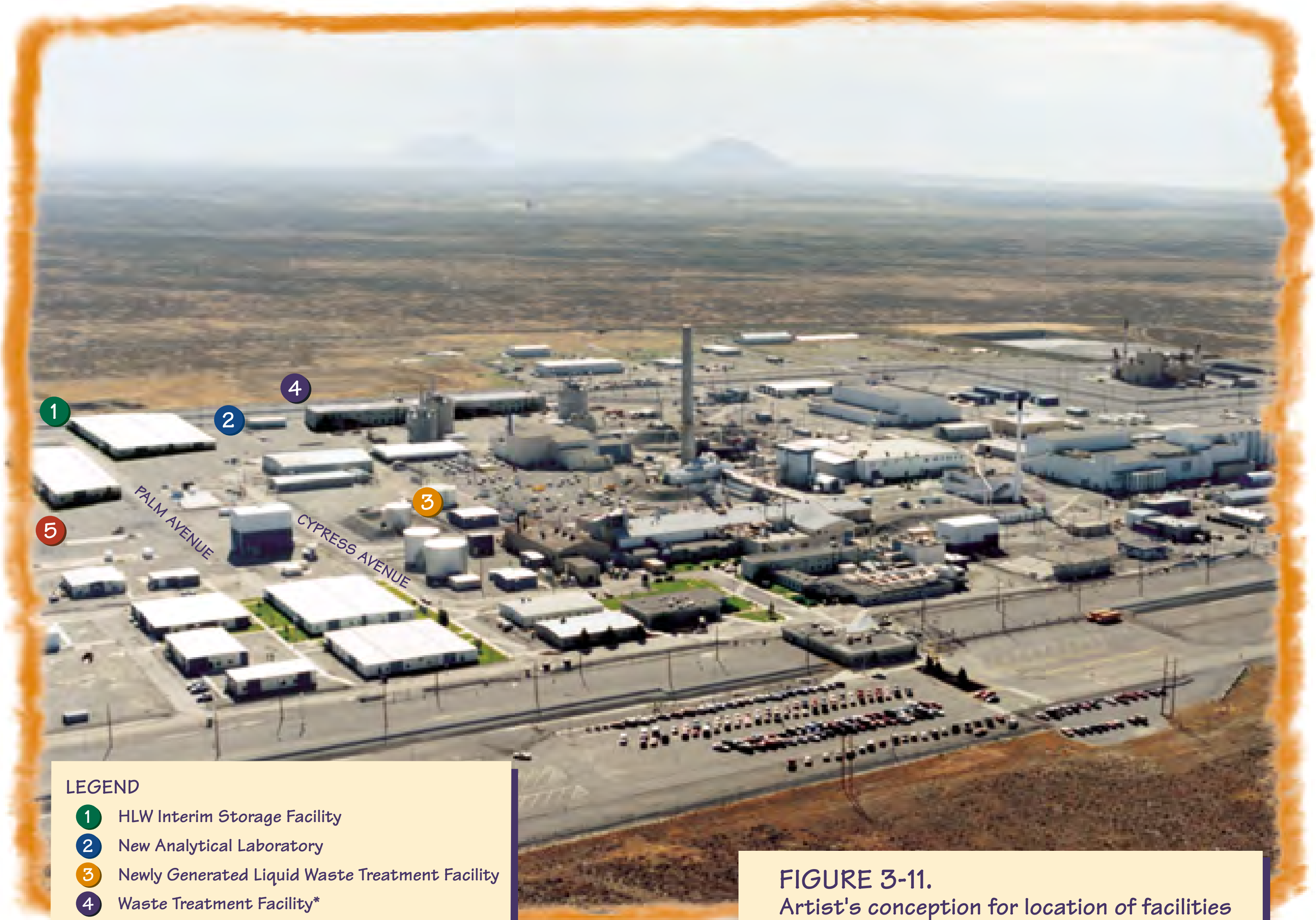
3.1.4.1 Hot Isostatic Pressed Waste Option

Under the Hot Isostatic Pressed Waste Option, all of the existing mixed transuranic waste/SBW stored at the Tank Farm would be calcined by the end of 2014 and added to the blended HLW calcine presently stored in the bin sets. The calcine then would be mixed with amorphous silica and titanium powder and subjected to high temperature and pressure in special cans to form a glass-ceramic product. The final product would be packaged in Savannah River Site-type stainless steel canisters for road-ready storage and subsequent disposal in a geologic repository. For the final waste form, this option would require a determination of equivalent treatment from the U.S. Environmental Protection Agency as discussed in Section 6.3.2.3.

The Hot Isostatic Pressed Waste process would convert the calcine to a glass-ceramic waste form with a waste volume reduction of about 50 percent. After cooling, a disposal canister would be filled with three Hot Isostatic Pressed Waste cans, welded closed, and place in an INEEL interim storage facility. Mercury is removed from the offgas system and amalgamated and disposed of as low-level waste.

Figure 3-10 illustrates the Hot Isostatic Pressed Waste Option. Beginning in 2015, the mixed transuranic waste (newly generated liquid wastes) would be processed through an ion exchange column, evaporated, and grouted for disposal at INEEL or offsite. Mercury becomes concentrated in the tank heels as a result of offgas scrub from the calcining process. The waste containing mercury would be removed from the tank heels, treated, packaged, and sent to the Waste Isolation Pilot Plant for disposal.

The major facilities and projects required to implement the Hot Isostatic Pressed Waste Option are listed in Appendix C.6, except for transportation projects, which are addressed in Appendix C.5. Figure 3-11 locates the facilities at INTEC (see Figure 3-4 for comparison).



LEGEND

1. HLW Interim Storage Facility
2. New Analytical Laboratory
3. Newly Generated Liquid Waste Treatment Facility
4. Waste Treatment Facility*
5. Waste Treatment Pilot Plant

* Hot Isostatic Press Facility, Cement Facility, Early Vitrification Facility.

FIGURE 3-11.
Artist's conception for location of facilities that would be constructed under the Non-Separations Alternative.

3.1.4.2 Direct Cement Waste Option

Under the Direct Cement Waste Option all of the existing liquid mixed transuranic waste/SBW stored at the Tank Farm would be calcined at the New Waste Calcining Facility by the end of 2014 and added to the mixed HLW calcine presently stored in the bin sets. Beginning in 2015 the calcine would be mixed with clay, blast furnace slag, caustic soda, and water and would be poured into Savannah River Site-type stainless-steel canisters. The grout would be cured at elevated temperature and pressure. The cementitious waste form (a hydroceramic) produced under this option requires a determination of equivalent treatment from the U.S. Environmental Protection Agency as described in Section 6.3.2.3. Figure 3-12 details the Direct Cement Waste Option.

Beginning in 2015, the mixed transuranic waste (newly generated liquid wastes) would be processed through an ion exchange column, evaporated, and grouted for disposal at INEEL or offsite. Mercury becomes concentrated in the tank heels as a result of offgas scrub from the calcining process. The waste containing mercury would be removed from the tank heels, treated, packaged, and sent to the Waste Isolation Pilot Plant for disposal.

The major facilities and projects necessary to implement the Direct Cement Waste Option are listed in Appendix C.6, except for transportation

Coal-Fired Steam Generating Facility.

projects, which are addressed in Appendix C.5. Figure 3-11 locates the facilities at INTEC (see Figure 3-4 for comparison).

3.1.4.3 Early Vitrification Option

This option would require the construction of a vitrification facility to process the mixed transuranic waste (SBW, newly generated liquid waste, and tank heels) from the INTEC Tank Farm and the mixed HLW calcine stored in the bin sets into a borosilicate glass suitable for disposal in a geologic repository. The glass produced from vitrifying the liquid wastes would be remote-handled transuranic waste that would be disposed of at the Waste Isolation Pilot Plant. The glass produced from vitrifying the calcine would be classified as HLW that would be disposed of at a geologic repository.

Liquid waste would be blended with glass frit to form a slurry that is fed to the melter at the Early Vitrification Facility. The calcine would be blended with another type of glass frit and fed to the melter in a dry state. The liquid waste and calcine would be treated in separate vitrification operations. The liquid waste would be processed from early 2015 through 2016 and glass from the liquid waste would be poured into standard transuranic waste remote-handled containers for disposal at Waste Isolation Pilot Plant. The HLW calcine would be processed from 2016 through 2035 and glass from the HLW calcine would be poured into Savannah River Site-type stainless steel canisters.

Figure 3-13 details the Early Vitrification Option. Elemental mercury from the offgas scrubbing system would be amalgamated and packaged for disposal as low-level waste. Soluble mercury (less than 260 mg/kg) from the offgas system would be precipitated, evaporated, and grouted for disposal as low-level waste.

The major facilities and projects required to implement the Early Vitrification Option are listed in Appendix C.6, except for transportation projects, which are addressed in Appendix C.5. Figure 3-11 locates the facilities at INTEC (see Figure 3-4 for comparison).

3.1.5 MINIMUM INEEL PROCESSING ALTERNATIVE

DOE has included analysis of an off-INEEL processing location for HLW in this EIS in order to ensure that a full range of reasonable treatment, storage and transportation alternatives has been considered. Treating INEEL HLW at Hanford (e.g., because of economies of scale, avoiding the cost for two major facilities, etc.) is a reasonable alternative in the context of the National Environmental Policy Act.

The Minimum INEEL Processing Alternative represents the minimum amount of HLW processing at INEEL that would still satisfy the purpose and need described in Chapter 2. Sufficient information is not available for DOE to make a decision on selection of this alternative. This alternative is being evaluated at a programmatic level now to help determine whether it is prudent to wait until the alternative can be evaluated in more detail. If treatment at Hanford looks promising, DOE could decide, based on this EIS, to defer decisions on new waste immobilization facilities at INEEL until more information is available, based on Hanford Phase I operating experience and Hanford Phase II conceptual design, for example.

The Minimum INEEL Processing Alternative could substantially reduce the amount of onsite construction, handling, and processing of HLW at INEEL. The alternative includes transport of HLW calcine to Hanford followed by a return of treated HLW and low-level waste to INEEL for storage and disposal, respectively. It provides an opportunity to evaluate the use of comparable DOE or privatized waste treatment facilities in the region. The Hanford Site was selected for this analysis based on the alternative selection process described in DOE (1999c).

While the Hanford Site has been identified as a potential location for treatment of INEEL HLW, DOE recognizes that the ability to make an early decision involving processing INEEL HLW at Hanford is limited. The Hanford Site is in the early stages of acquiring facilities to treat and immobilize its HLW. DOE has awarded a phased contract to privatize certain portions of the Tank Waste Remediation System project at the Hanford Site. Phase I of that work consists of two parts; IA and IB. Phase IA was completed in 1998 and included preparing conceptual designs, environmental and regulatory reports, and other activities associated with the planning process for the construction and operation of facilities to treat the Hanford tank wastes (DOE 1998c).

Phase IB will consist of two parts, B-1 and B-2. Part B-1 began in August 1998 and includes a 24-month design phase during which technology scale-up, regulatory, permitting, and financing issues, and the safety basis for operations will be addressed. In the year 2000, DOE will decide whether to proceed with the construction and operations of Hanford Phase I treatment facilities (Part B-2). Part B-2 would include waste feed management, pretreatment (e.g., sludge washing and radionuclide separations), and immobilization of HLW and low-activity waste. Current plans are for the Phase I facilities to operate from 2006 through 2018 and process about 10 percent of the total mass (25 percent of the total radioactivity) of the Hanford site tank waste (DOE 1998d). The Phase I facilities would not be designed to accommodate HLW from off-site sources.

Assuming the Hanford Phase I is successful, the Phase I facilities could be expanded, or additional facilities could be built for a Phase II treatment option capable of processing most of the Hanford tank wastes and, potentially, the INEEL HLW calcine. DOE will be in a better position to analyze the technical feasibility and cost effectiveness of processing INEEL HLW calcine in Hanford facilities after the Hanford Phase IB facilities have operating experience.

Since a decision on proceeding with conceptual design of the Phase II Hanford vitrification facilities is well in the future, DOE cannot determine at this time whether treating INEEL HLW calcine in Hanford facilities is technically feasible or cost effective. Even if processing of INEEL HLW at the Hanford Site were feasible, DOE would have to consider the potential regulatory implications and any impacts to DOE commitments regarding completion of Hanford tank waste processing. If DOE decides to pursue the Minimum INEEL Processing Alternative, additional National Environmental Policy Act documentation would be prepared in due course on alternatives associated with treatment of INEEL HLW calcine at the Hanford Site.

Under this alternative, DOE could retrieve and transport the HLW calcine to a packaging facility, where it would be placed into shipping containers. The containers would then be shipped to DOE's Hanford Site in Richland, Washington, where the HLW calcine would be separated into high-activity and low-activity fractions. Each fraction would be vitrified.

For purposes of analysis, DOE assumes the vitrified HLW and low-level waste are returned to INEEL. (Alternatively, the vitrified wastes could be shipped directly to appropriate offsite facilities rather than returning to INEEL.) The vitrified HLW would be stored in a road-ready condition until transported to a geologic repository. The vitrified low-level waste would be disposed of in an INEEL facility or shipped to an offsite low-level waste disposal facility. Operation of subsidiary waste treatment facilities is the same as discussed in Section 3.2.1.

The liquid mixed transuranic waste (SBW, newly generated liquid waste, and tank heels) would be retrieved, filtered, and transported to a treatment facility, where it would be processed through an ion exchange column to remove cesium. The loaded ion exchange resin would be temporarily stored at INEEL, dried and containerized, and transported to the Hanford Site for vitrification. After cesium removal, the liquid wastes would be fed to a grouting process. The grout would be packaged in 55-gallon drums and transported to the Waste Isolation Pilot Plant for disposal as contact-handled transuranic waste. As discussed in Section 3.3.6, DOE does not currently consider shipment of mixed transuranic waste (SBW or newly generated liquid waste) to the Hanford Site for treatment to be a reasonable alternative.

There are two scenarios for shipping INEEL's HLW calcine to the Hanford Site. The first scenario is to ship the calcine to the Hanford Site on a just-in-time basis, over a three-year period starting in 2028 (or later). The calcine would be shipped to the Hanford Site at the rate it can be introduced directly to the treatment process, so that construction of canister storage buildings would not be necessary. A second scenario is to ship calcine during the years 2012 through 2025, which would require the Hanford Site to build up to three canister storage buildings for interim storage of the INEEL HLW calcine prior to treatment. Chapter 5 presents the environmental consequences at INEEL and Hanford of these scenarios, including transportation.

In Section 3.1.3.1, DOE describes three methods for disposing of the grouted low-level waste fraction: (1) in a new INEEL Low-Activity Waste Disposal Facility; (2) in an offsite low-level waste disposal facility; and (3) in the Tank Farm and bin sets. The vitrified low-level waste fraction returned from Hanford would not be suitable for disposal in the Tank Farm and bin sets. Therefore, only the remaining two disposal methods are analyzed for the Minimum INEEL Processing Alternative.

Figure 3-14 shows the Minimum INEEL Processing Alternative. The major facilities and projects required to implement the Minimum INEEL Processing Alternative are listed in Appendix C.6, except for the transportation projects, which are addressed in Appendix C.5. Appendix C.8 describes the Hanford Site and the activities that would be performed there treating INEEL waste. Figure 3-15 shows the facilities at INTEC (see Figure 3-4 for comparison).

LEGEND

1. Calcine Packaging Facility
2. Low-Activity Waste Disposal Facility
3. New Analytical Laboratory
4. SBW and NGLW Treatment Facility
5. Vitrified Product Interim Storage Facility
6. Waste Treatment Pilot Plant

FIGURE 3-15.
Artist's conception for location of facilities that would be constructed under the Minimum INEEL Processing Alternative.

3.2 Facility Disposition Alternatives

The waste processing alternatives described in Section 3.1 do not include any specific facility disposition options except for those cases where facility disposition is an integral part of implementation of the option (e.g., disposal of low-level waste Class A or Class C type grout in the Tank Farm and bin sets). However, DOE intends to make decisions regarding disposition of HLW facilities (including existing facilities and facilities that would be constructed under the waste processing alternatives).

Existing HLW facilities would be dispositioned under all waste processing alternatives. The facility disposition alternatives are modular in nature and can be integrated with any waste processing alternative or option. However, each waste processing alternative would result in the construction (and the need for ultimate disposition) of a different number of facilities (as described in the following section). Table 3-3 identifies the major facilities that would be constructed for each waste processing alternative.

The facility disposition analysis must consider disposition of currently existing HLW facilities and HLW facilities that would be constructed under the waste processing alternatives. Because most INEEL HLW facilities contain RCRA wastes, the facility disposition alternatives analyzed in this EIS are consistent with RCRA closure requirements. Section 5.3 describes the impacts to the environment of facility disposition alternatives.

3.2.1 DESCRIPTION OF FACILITY DISPOSITION ALTERNATIVES

RCRA closure regulations require removal or decontamination of all hazardous waste residues and contaminated containment system components, equipment, structures, and soils during closure. The "remove or decontaminate" standard can be achieved by reducing the amount of residual contamination to levels that are (1) below detection or indistinguishable from background concentrations or (2) at concentrations below levels that may pose an unacceptable

Facility Disposition

Facility disposition would include activities performed under multiple regulatory programs to address INTEC facilities that no longer have a mission and must be placed in a condition consistent with future land use decisions and end-state planning for the INEEL. Some of the activities that would be encompassed by the facility disposition alternatives include:

Closure – Removal, decontamination, or encapsulation of hazardous and radiological contaminants from regulated facilities in accordance with applicable regulatory requirements.

Deactivation – Removal of potentially hazardous (non-waste) materials from the process vessels and transport systems, de-energizing power supplies, disconnecting or reloading utilities, and other actions to place the facility in an interim state that requires minimal surveillance and maintenance.

Decommissioning – Decontamination of facilities that have been deactivated. This may include demolition of the facility and removal of the rubble from the site or entombment by means such as collapsing the aboveground portions of the structure into its below-grade levels and capping the contaminated rubble in place or constructing containment structures around the facility.

The facility disposition activities are intended to reach an end state where the contamination has been removed, contained, or reduced such that the level of risk associated with the residual contamination is no longer considered a threat to human health or the environment. At that time, DOE could either reuse the facilities for new missions or transfer control of the facilities to others.

Table 3-3. Major INTEC facilities[a] or activities required for each waste processing alternative.

	Alternative/Option								
	No Action	Continued Current Operations	Full Separations	Planning Basis	Transuranic Separations	Hot Isostatic Pressed Waste	Direct Cement Waste	Early Vitrification	Minimum INEEL Processing
Calcine SBW including New Waste Calcining Facility Upgrades	–	●	–	●	–	●	●	–	–
Newly Generated Liquid Waste and Tank Farm Heel Waste Management	–	●	–	●	–	●	●	–	–
Full Separations	–	–	●	●	–	–	–	–	–
Vitrification Plant	–	–	●	●	–	–	–	–	–
Class A Grout Plant	–	–	●	●	–	–	–	–	–
New Analytical Laboratory	–	–	●	●	●	●	●	●	●
Interim Storage of Vitrified Waste	–	–	●	●	–	–	–	–	●
Packaging and Loading Vitrified HLW at INTEC for Shipment to a Geologic Repository	–	–	●	●	–	–	–	–	●
Class A Grout Disposal in new INEEL Low-Activity Waste Disposal Facility	–	–	●	–	●	–	–	–	●[b]
Class A Grout Packaging and Shipping to new INEEL Low-Activity Waste Disposal Facility	–	–	●	–	–	–	–	–	–
Class A Grout Packaging and Loading for Offsite Disposal	–	–	●	●	–	–	–	–	●
Packaging and Loading Remote-Handled Transuranic Waste at INTEC for Shipment to WIPP	–	–	–	–	●	–	–	–	–
Transuranic Separations	–	–	–	–	●	–	–	–	–
Class C Grout Plant	–	–	–	–	●	–	–	–	–
Class C Grout Packaging and Shipping to New INEEL Low-Activity Waste Disposal Facility	–	–	–	–	●	–	–	–	–
Class C Grout Packaging and Loading for Offsite Disposal	–	–	–	–	●	–	–	–	–
Calcine Retrieval and Transport	●[c]	●[c]	●	●	●	●	●	●	●
Mixing and Hot Isostatic Pressing	–	–	–	–	–	●	–	–	–
Hot Isostatic Pressed HLW Interim Storage	–	–	–	–	–	●	–	–	–

Table 3-3. (continued).

	Alternative/Option								
	No Action	Continued Current Operations	Full Separations	Planning Basis	Transuranic Separations	Hot Isostatic Pressed Waste	Direct Cement Waste	Early Vitrification	Minimum INEEL Processing
Packaging & Loading Hot Isostatic Pressed Waste at INTEC for Shipment to a Geologic Repository	–	–	–	–	–	●	–	–	–
Direct Cement Process	–	–	–	–	–	–	●	–	–
Unseparated Cementitious HLW Interim Storage	–	–	–	–	–	–	●	–	–
Packaging and Loading Cementitious Waste at INTEC for Shipment to a Geologic Repository	–	–	–	–	–	–	●	–	–
Packaging and Loading Vitrified SBW at INTEC for Shipment to WIPP	–	–	–	–	–	–	–	●	–
Early Vitrification with Maximum Achievable Control Technology	–	–	–	–	–	–	–	●	–
SBW and Newly Generated Liquid Waste Treatment with Cesium Ion Exchange to Contact-Handled Transuranic Grout and Low-Level Waste Grout	–	–	–	–	–	–	–	–	●
Packaging and Loading Contact-Handled Transuranic Waste for Shipment to WIPP	–	–	–	–	–	–	–	–	●
Calcine Packaging and Loading for Transport to Hanford	–	–	–	–	–	–	–	–	●
Separations Organic Incinerator	–	–	●	●	●	–	–	–	–
Waste Treatment Pilot Plant	–	–	●	●	●	●	●	●	●

a. Some of the facilities listed are not stand-alone facilities but projects that would be implemented in another facility.
b. For vitrified low-level waste fraction returned from Hanford.
c. Calcine retrieval for bin set 1 only
● indicates the facility is associated with the alternative.
Dash indicates the facility is not required
WIPP = Waste Isolation Pilot Plant.

risk to human health and the environment. The Environmental Protection Agency expects that well-designed and well-operated RCRA units (i.e., units that comply with the unit-specific minimum technical requirements) will generally be able to achieve this standard (EPA 1998).

However, based on technological, economic, and worker health risks involved, it may not be practical to remove all of the residual material from the INTEC facilities, decontaminate all equipment, and remove all surrounding contaminated soils to achieve clean closure. The RCRA regulations (40 CFR 264.197) state that if all contaminated system components, structures, and equipment cannot be adequately decontaminated, then the facilities must be closed in accordance with the closure and post-closure requirements that apply to landfills ("closed to landfill standards"). Therefore, DOE is evaluating six potential facility disposition alternatives in this EIS: (1) No Action, (2) Clean Closure, (3) Performance-Based Closure, (4) Closure to Landfill Standards, (5) Performance-Based Closure with Class A Grout Disposal, and (6) Performance-Based Closure with Class C Grout Disposal. Each of these facility disposition alternatives is briefly described below. For all closures, detailed closure plans would be developed and approved to ensure closures are performed in accordance with approved procedures and that risk to workers and the public are minimized and acceptable.

No Action – Under the No Action Alternative, DOE would not plan for disposition of its HLW facilities at INTEC. Nevertheless, over the period of analysis from 2000 to 2035, many of the facilities identified in Table 3-4 could be deactivated. This means that bulk chemicals would be removed and the facility could be deenergized. Surveillance and maintenance necessary to protect the environment and the safety and health of workers would be performed in the normal course of INTEC operation. Therefore, the No Action Alternative for facility disposition is substantially the same as No Action for waste processing. As a result, Section 5.3 does not present environmental consequences for the facility disposition No Action Alternative during the period 2000 to 2035. Future facility closures and/or dispositions which are not foreseen at this time would be covered in future National Environmental Policy Act reviews, as appropriate.

The one difference between the facility disposition and the waste processing No Action Alternatives is the long-term condition of the bin sets and Tank Farm. The calcine in the bin sets and the liquid mixed transuranic waste/SBW in the Tank Farm would have to remain in those facilities because that is the assumption underlying the No-Action Alternative. Over the period of analysis through 2035, continued storage in these two facilities would result in no activities different from those in the waste processing No Action Alternative. However, over the thousands of years beyond 2035, the materials in these facilities would migrate into the environment. To capture these long-term impacts, DOE analyzed the continued storage of calcine and liquid mixed transuranic waste/SBW. The analysis is presented in Appendix C.9, Facility Closure Modeling. The results of the analysis are reported in the water, human health, and ecology subsections of Section 5.3.

Clean Closure – Facilities would have the hazardous wastes and radiological contaminants, including contaminated equipment, removed from the site or treated so the hazardous and radiological contaminants are indistinguishable from background concentrations. Clean Closure may require total dismantlement and removal of facilities. This may include removal of all buildings, vaults, tanks, transfer piping, and contaminated soil. This alternative would require a large quantity of soil for backfilling and would also require topsoil for revegetation. Use of the facilities (or the facility sites) after Clean Closure would present no risk to workers or the public from hazardous or radiological components.

Performance-Based Closure – Closure methods would be dictated on a case-by-case basis depending on risk. For radiological and chemical hazards, performance-based closure would be in accordance with risk-based criteria. Under this alternative, most above-grade structures would be razed and most below-grade structures (tanks, vaults, and transfer piping) would be decontaminated and left in place. This alternative would require some topsoil for revegetation but would require minimal amounts of soil for backfilling. Any remaining facilities would be

Table 3-4. Facility disposition alternatives.

Facility Description	Facility Disposition Alternative: Clean Closure	Performance-Based Closure	Closure to Landfill Standards	Performance-Based Closure with Class A Grout Disposal	Performance-Based Closure with Class C Grout Disposal
Tank Farm and Related Facilities					
Tank Farm[a]	●	●	●	●	●
CPP-619 – Tank Farm Area – CPP (Waste Storage Control House)			●		
CPP-628 - Tank Farm Area – CPP (Waste Storage Control House)			●		
CPP-638 – Waste Station (WM-180) Tank Transfer Building			●		
CPP-712 – Instrument House (VES-WM-180, 181)			●		
CPP-717 – STR/SIR Waste Storage Tank Pads (A, B, C, and D) and Vessels			●		
Bin Sets and Related Facilities					
Bin sets[b]	●	●	●	●	●
CPP-639 – Blower Building/Bin Sets 1, 2, 3			●		
CPP-646 – Instrument Building for 2nd Set Calcined Solids			●		
CPP-647 – Instrument Building for 3rd Set Calcined Solids			●		
CPP-658 – Instrument Building for 4th Set Calcined Solids			●		
CPP-671 – Instrument Building for 5th Set Calcined Solids			●		
CPP-673 – Instrument Building for 6th Set Calcined Solids			●		
Process Equipment Waste Evaporator and Related Facilities					
CPP-604 – Process Equipment Waste Evaporator			●		
CPP-605 – Blower Building			●		
CPP-641 – West Side Waste Holdup	●				
CPP-649 – Atmospheric Protection Building			●		
CPP-708 – Exhaust Stack/Main Stack[c]			●		
CPP-756 – Pre-Filter Vault			●		
CPP-1618 – Liquid Effluent Treatment and Disposal Facility	●				
NA – PEWE Condensate Lines			●		
NA – PEWE Condensate Lines and Cell Floor Drain Lines			●		
Fuel Processing Building and Related Facilities					
CPP-601 – Fuel Processing Building		●	●		
CPP-627 – Remote Analytical Facility Building		●	●		
CPP-640 – Head End Process Plant		●	●		
FAST and Related Facilities					
CPP-666 – Fluorinel Dissolution Process and Fuel Storage Facility		●			
CPP-767 – Fluorinel Dissolution Process and Fuel Storage Facility Stack	●				

Table 3-4. (continued).

Facility Description	Clean Closure	Performance-Based Closure	Closure to Landfill Standards	Performance-Based Closure with Class A Grout Disposal	Performance-Based Closure with Class C Grout Disposal
	Facility Disposition Alternative				
Transport Lines Group					
NA – Process Off-gas Lines		●			
NA – High-Level Liquid Waste (Raffinate) Lines			●		
NA – Process (Dissolver) Transport Lines		●			
NA – Calcine Solids Transport Lines			●		
Other HLW Facilities					
CPP-659 – New Waste Calcining Facility[d]		●	●		
CPP-684 – Remote Analytical Laboratory		●			

a. The INTEC Tank Farm consists of underground storage tanks, concrete tank vaults, waste transfer lines, valve boxes, valves, airlift pits, cooling equipment, and several small buildings containing instrumentation and valves for the waste tanks. Includes waste storage tanks (VES-WM-180 through 190), Tank Vaults for Tanks VES-WM-180 through 186 (CPP-780 through 786), Tank Enclosure for Tanks VES-WM-187 through 190 (CPP-713), and facilities CPP-721 through 723, CPP-737 through 743, and CPP-634 through 636, and CPP-622, 623, and 632.

b. The bin sets consist of ancillary structures, instrument rooms, filter rooms, cyclone vaults, and stacks, including CSSF-1 through 7, CPP-729, CPP-732, CPP-741 through 742, CPP-744, CPP-746 through 747, CPP-760 through 761, CPP-765, CPP-791, CPP-795, and CPP-1615.

c. Includes the instrument building for Main Stack CPP-692 and waste transfer line valve boxes.

d. Includes Organic Solvent Disposal Building CPP-694.

STR = Submarine Thermal Reactor, SIR = Submarine Intermediate Reactor

PEWE = Process Equipment Waste Evaporator.

decontaminated, such that residual waste and contaminants no longer pose any unacceptable exposure (or risk) to workers or to the public. Post closure monitoring may be required on a case-by-case basis.

Closure to Landfill Standards – The facility would be closed in accordance with the state and Federal requirements for closure of landfills. Closure to landfill standards is intended to protect the health and safety of the workers and the public from releases of contaminants from the facility. Under this alternative, waste residuals within tanks, vaults, and piping would be stabilized with grout in order to minimize the release of contaminants into the environment. Once waste residues are stabilized, protection of the environment could be accomplished by installing an engineered cap, establishing a groundwater monitoring system, and providing post-closure monitoring and care of the waste containment system, depending on the type of contaminants.

Several of the waste processing options result in production of a low-level waste fraction, which would then be grouted and disposed of either in (1) a near-surface disposal facility on the INEEL, (2) the Tank Farm and bin sets, or (3) an offsite disposal facility. Disposal of this low-level waste in the Tank Farms and bin sets would occur after these facilities have been closed under the Performance-Based Closure alternative. In order to accommodate the use of the Tank Farm and bin sets for disposal of the low-level waste fraction, this EIS also will evaluate two additional facility disposition alternatives for the Tank Farm and bin sets.

Performance-Based Closure with Class A Grout Disposal – The facility would be closed as described above for the Performance-Based Closure alternative. Following completion of those activities, the Tank Farm or bin sets would be used to dispose of low-level waste Class A type grout produced under the Full Separations Option.

Performance-Based Closure with Class C Grout Disposal – The facility would be closed as described above for the Performance-Based Closure alternative. Following completion of those activities, the Tank Farm or bin sets would be used to dispose of low-level waste Class C type grout produced under the Transuranic Separations Option.

DOE has completed a comprehensive evaluation for the cleanup program at INTEC (known as Waste Area Group 3) under the requirements of CERCLA. Under this CERCLA program (Federal Facility Agreement and Consent Order), DOE, EPA, and the State of Idaho have made decisions regarding the disposition of environmental media, such as contaminated soils and water. Under this CERCLA program, DOE will continue to make decisions regarding the final state of the INTEC after all cleanup and facility closure activities have been completed. While this CERCLA program is not the subject of this EIS, decisions regarding disposition of HLW facilities are being coordinated with decisions made in the CERCLA program. Activities under the CERCLA program also contribute to the cumulative impacts presented in Section 5.4 of this EIS. Chapter 6 provides further details on the CERCLA program at INTEC.

3.2.2 PROCESS FOR IDENTIFYING CURRENT FACILITIES TO BE ANALYZED

DOE used a systematic process to identify which existing INTEC facilities would be analyzed in detail under the facility disposition alternatives in this EIS. The first step was to perform a complete inventory of all INTEC facilities (Wichmann 1998; Harrell 1999). Next, DOE identified which of these facilities are directly related to the HLW Program (i.e., HLW treatment, storage, or generation facilities). This EIS includes detailed analysis for all such facilities. DOE plans to consider this analysis, together with other factors such as mission, policy, technical considerations, and public comments in its final decision(s) about the disposition of these facilities.

DOE assumes that other INTEC facilities will have residual amounts of radioactive and chemical contaminants at closure, and has included the environmental impacts of these facilities in the cumulative analysis discussions in this EIS. However, disposition decisions about other INTEC facilities are not within the scope of this

EIS. A list of other INTEC facilities analyzed for their contributions to cumulative impacts can be found in Section 5.4.2.

For the significant HLW facilities, DOE considered which of the facility disposition alternatives would be most appropriate to analyze for each facility. The determination of the applicable disposition methods was based on the facility and residual waste characteristics. A list of the existing HLW facilities and the applicable facility disposition alternative is provided in Table 3-4.

For the Tank Farm and bin sets, which together constitute the great majority of the total inventory of residual radioactivity, DOE analyzed all five facility disposition alternatives. These facilities would be the main contributors to the residual risk at INTEC. The level of residual risk would vary with the different facility disposition alternatives for the Tank Farm and bin sets.

The residual amount of radioactive and/or chemical contaminants associated with other INTEC facilities is much less than that of the Tank Farm and bin sets. Consequently, the overall residual risk at INTEC would not change significantly due to the contribution from these other facilities. For purposes of analysis, DOE assumed a single facility disposition alternative for the other INTEC HLW facilities, except for the New Waste Calcining Facility and the Fuel Processing Building and related facilities for which two facility disposition alternatives were evaluated.

For the new HLW facilities identified in Table 3-3, DOE analyzed the Clean Closure alternative. This facility disposition assumption is based on the DOE policy (DOE Order 435.1) that new HLW facilities that would be constructed under the waste processing alternatives would be designed to facilitate a high degree of decontamination.

3.3 Alternatives Eliminated from Detailed Analysis

This section identifies those alternatives that have been eliminated from detailed analysis in this EIS and to briefly discuss why they have been eliminated [40 CFR 1502.14(a)]. Council on Environmental Quality regulations direct all agencies to use the National Environmental Policy Act process to identify and assess a reasonable range of alternatives to proposed actions that will avoid or minimize adverse effects of these actions upon the quality of the human environment [40 CFR 1500.2(e)]. The Council on Environmental Quality guidance further states that: (1) reasonable alternatives include those that are practical or feasible from a technical, economic, or common sense standpoint; (2) the number of reasonable alternatives considered in detail should represent the full spectrum of alternatives meeting the agency's purpose and need; and (3) the EIS need not discuss every unique alternative when a large number of reasonable alternatives exists.

This section seeks to consolidate the alternatives that serve the same general purpose by eliminating from detailed study those alternatives that present strong cost, schedule, regulatory, and technical maturity or feasibility constraints and offer no significant advantages over alternatives selected for detailed analysis. While cost alone is not normally a criterion for eliminating an alternative from detailed study, it is a powerful discriminator when coupled with the existence of similar but more cost-effective alternatives. Appendix B and DOE (1998e, 1999c) describe the process DOE used to identify the set of reasonable alternatives for analysis in this EIS. For the reasons discussed below, DOE has decided to eliminate the following alternatives from detailed study:

- Separations Alternative – Transuranic Separations/Class A Type Grout Option
- Non-Separations Alternative – Vitrified Waste Option
- Non-Separations Alternative – Cement-Ceramic Waste Option
- Disposal of Low-Level Waste Class A or Class C Type Grout at the Hanford Site
- Vitrification at the West Valley Demonstration Project or the Savannah River Site

- Shipment of Mixed Transuranic Waste (SBW/Newly Generated Liquid Waste) to the Hanford Site for Treatment
- Treatment of Mixed Transuranic Waste/SBW at the Advanced Mixed Waste Treatment Project

3.3.1 SEPARATIONS ALTERNATIVE TRANSURANIC SEPARATIONS/ CLASS A TYPE GROUT OPTION

This option is similar to the Full Separations Option, except the separation process under this option would result in three waste products:

- Transuranic waste
- Fission products (primarily strontium/ cesium)
- Low-Level Waste Class A type grout

In the Transuranic Separations/Class A Type Grout Option, the liquid mixed transuranic waste/SBW would be sent directly to the Separations Facility for processing into high-level and low-level waste fractions. After the mixed waste transuranic waste/SBW is processed, the calcine would be retrieved from the bin sets, dissolved, and processed in the Separations Facility. Ion exchange columns would be used to remove the cesium from the waste stream. The resulting effluent would undergo the transuranic extraction process to remove the transuranic elements for eventual shipment to the Waste Isolation Pilot Plant. Then, strontium would be removed from the transuranic extraction effluent stream via the strontium extraction process. The cesium and strontium would be combined to produce a HLW fraction that would be vitrified into borosilicate glass. The transuranic fraction would be treated to produce a solid waste, and the low-level fraction would be grouted to form low-level waste Class A type grout.

The Transuranic Separations/Class A Type Grout Option was eliminated after comparison to the Transuranic Separations Option described earlier in Section 3.1.3.3. The Transuranic Separations (Class C Type Grout) Option process would create only two primary waste streams: (1) solidified transuranic fraction for disposal at the Waste Isolation Pilot Plant and (2) a low-level waste fraction to form Class C type grout for onsite disposal. The Transuranic Separations/Class A Type Grout Option would involve more separations steps than the Transuranic Separations (Class C Type Grout) Option and would require a higher capacity Waste Separations Facility. Also, the Transuranic Separations/Class A Type Grout Option would require a separate HLW Treatment (Vitrification) Facility and a HLW Interim Storage Facility that have an estimated total cost substantially greater than the Transuranic Separations (Class C Type Grout) Option.

Thus, the Transuranic Separations (Class C Type Grout) Option is similar, has less complex separations processing, and is less costly than the Transuranic Separations/Class A Type Grout Option. Moreover, the environmental impacts of this option are expected to be bounded by the remaining two options under the Separations Alternative. For these reasons, the Transuranic Separations/Class A Type Grout Option was eliminated from further consideration in this EIS.

3.3.2 NON-SEPARATIONS ALTERNATIVE - VITRIFIED WASTE OPTION

In the Vitrified Waste Option under the Non-Separations Alternative, all the mixed transuranic waste/SBW in the Tank Farm would be calcined in the New Waste Calcining Facility. The New Waste Calcining Facility would be upgraded to comply with the Maximum Achievable Control Technology emission requirements. The calcine stored in the bin sets would be retrieved and vitrified in a Vitrification Facility to form a HLW borosilicate glass. The molten glass would be poured into canisters similar to those used by the Defense Waste Processing Facility at the Savannah River Site. These glass canisters would be stored at INEEL pending shipment to a geologic repository.

The facilities that would be constructed under the Vitrified Waste Option would include

Calcine Retrieval, High-Activity Waste Vitrification Plant (larger scale than for the Full Separations Option), HLW Interim Storage, New Waste Calcining Facility upgrade for Maximum Achievable Control Technology, and a New Analytical Laboratory.

The Early Vitrification Option described in Section 3.1.4.3 would be similar to the Vitrified Waste Option, except the Early Vitrification Option would not require calcination of the liquid mixed transuranic waste/SBW prior to its vitrification. Thus, in the Vitrified Waste Option, the additional calcine produced from mixed transuranic waste/SBW would be combined with the HLW calcine and then vitrified to produce a large number of canisters (14,000 canisters versus 11,700 canisters under the Early Vitrification Option) for disposal at a geologic repository. In the Early Vitrification Option the mixed transuranic waste/SBW would be vitrified directly without calcining to produce a transuranic waste product suitable for disposal at the Waste Isolation Pilot Plant. This early vitrification of the liquid mixed transuranic waste/SBW would allow the resulting remote-handled transuranic waste canisters to be shipped directly to the Waste Isolation Pilot Plant.

In summary, the Vitrified Waste Option would not retain the beneficial segregation of the mixed transuranic waste/SBW that would be achieved by the Early Vitrification Option. This nonsegregation would result in a larger quantity of vitrified HLW being shipped to a geologic repository for disposal with the attendant higher disposal costs. The Vitrified Waste Option would also require greater facility costs for calcining the liquid mixed transuranic waste/SBW with the Maximum Achievable Control Technology upgrades to the New Waste Calcining Facility. Therefore, this option offers no advantages over the Early Vitrification Option that otherwise contains the same treatment concepts. For these reasons, the Vitrified Waste Option was eliminated from further consideration in this EIS.

3.3.3 NON-SEPARATIONS ALTERNATIVE - CEMENT-CERAMIC WASTE OPTION

The Cement-Ceramic Waste Option under the Non-Separations Alternative is similar to the Direct Cement Option except the liquid mixed transuranic waste/SBW would not be calcined directly but would be mixed with the existing-mixed HLW calcine to form a slurry. In this option, all calcine would be retrieved and combined with the liquid mixed waste transuranic waste/SBW. The combined slurry would be recalcined in the New Waste Calcining Facility with the resulting calcine mixed into a concrete-like material. The concrete waste product would then be poured into drums, autoclaved (cured in a pressurized oven), and placed in an interim storage facility awaiting shipment to a geologic repository. An estimated 16,000 concrete canisters would be produced. This option would require a major modification to the New Waste Calcining Facility to allow slurry calcination and the upgrade for compliance with the Maximum Achievable Control Technology rule, and a Grout Facility with autoclave. The final product (concrete or ceramic) would require an equivalency determination by EPA under the RCRA land disposal restrictions.

The rationale for initially considering the Cement-Ceramic Waste Option in the EIS was the anticipated potential for significant cost savings in using a greater confinement disposal facility (such as that at the Nevada Test Site) as the final repository for the resulting product. A basis for this assumption was that the cementitious waste form of the Cement-Ceramic Waste Option and the alluvial soil at the greater confinement facility would be chemically compatible, and the cement waste form would be the least likely to migrate in the surrounding soil. However, a greater confinement facility for HLW disposal has not been studied, approved, or constructed. In addition, if INEEL were the only site disposing HLW at a greater confinement disposal facility, the INEEL could potentially bear all costs associated with the development of the repository (e.g., site characterization and performance assessments associated with U.S. Nuclear Regulatory Commission licensing and EPA certification of compliance). Therefore, it is unlikely that significant cost savings at a greater confinement facility (assuming it could be licensed) could be realized over a geologic repository, where INEEL would expect to pay only a prorated share of the development and operational costs based on its share of the waste disposed of.

Even if the Cement-Ceramic Waste Option had a high potential to reduce life cycle costs, the Direct Cement Waste Option has lower technical risk than the Cement-Ceramic Waste Option, which eliminates the need to include the Cement-Ceramic Waste Option as a discrete option. The Cement-Ceramic Waste Option is based on calcination of liquid mixed transuranic waste/SBW and calcine slurry in the New Waste Calcining Facility, which is currently configured to process a liquid feed. To reconfigure the New Waste Calcining Facility to process a liquid mixed transuranic waste/SBW and calcine slurry could present a potentially costly technical challenge. No prior research and development work has been conducted to verify the feasibility of such an operation. Thus, a significant technical risk would remain for this process. For these reasons the Cement-Ceramic Waste Option was eliminated from further consideration in this EIS.

3.3.4 DISPOSAL OF LOW-LEVEL WASTE CLASS A OR CLASS C TYPE GROUT AT THE HANFORD SITE

Each of the options under the Separations Alternative would produce a low-level waste grout. DOE initially considered the Hanford site as a representative location for disposal of this grout at a non-INEEL DOE site. However, previous evaluations of low-level waste grout disposal at Hanford have indicated that the long-term (beyond 1,000 years) impacts of low-level waste grout disposal could exceed regulatory standards for groundwater protection (WHC 1993). Hanford's current HLW management strategy (62 FR 8693; February 26, 1997) calls for vitrifying the low-level waste fraction prior to onsite disposal. It is unlikely that Hanford would be able to accept grouted INEEL low-level waste for disposal. Therefore, disposal of low-level waste grout at the Hanford Site was eliminated from further consideration in this EIS.

3.3.5 VITRIFICATION AT THE WEST VALLEY DEMONSTRATION PROJECT OR THE SAVANNAH RIVER SITE

As previously described, DOE is evaluating transportation of stabilized HLW (calcine or separated HLW fraction) to DOE's Hanford Site for vitrification, with the borosilicate glass product being shipped back to INEEL for interim storage pending shipment to a geologic repository. DOE also considered shipment of the stabilized HLW to the West Valley Demonstration Project in New York or the Savannah River Site in South Carolina for vitrification. However, the West Valley Demonstration Project Vitrification Facility is not a candidate for treatment of INEEL HLW since the facility will be shut down according to Public Law 96-368 (1980) and DOE plans to cease operations at West Valley by 2006. Therefore, the West Valley facilities would not be available at the time when the INEEL HLW was ready for processing (Murphy and Krivanek 1998).

Earlier studies concluded that chemical incompatibilities with the Savannah River Site melter would exist because of the presence of fluorides (in calcine) or phosphate (in separated HLW fraction). Significant life cycle costs would be incurred to replace equipment that is beyond design basis life or constructed of materials that are incompatible with INEEL HLW

Therefore, shipment of stabilized HLW to the West Valley Site or the Savannah River Site for vitrification was eliminated from further consideration in the EIS.

3.3.6 Shipment of Mixed Transuranic Waste (SBW/Newly Generated Liquid Waste) to the Hanford Site for Treatment

In this option, the existing liquid mixed transuranic waste/SBW would be pumped from the INTEC Tank Farm to new permitted tank storage. Mixed transuranic waste (newly generated liquid wastes), after being concentrated, would be stored in the new storage tanks with the existing liquid mixed transuranic waste/SBW. The liquid waste would remain in the new storage tanks until being sent to a new packaging facility where it would be solidified by absorption on a 90 percent silica matrix and placed into shipping containers. There would be a short period of onsite storage, until enough containers accumulate to ship to the Hanford Site for treatment. DOE has evaluated several methods for processing the mixed transuranic waste (SBW/newly generated liquid waste) at Hanford: direct vitrification, chemical dissolution followed by separations, and mechanical separation of solid and liquid material. DOE has eliminated all of these methods from further analysis in this EIS for the reasons listed below.

Direct vitrification of the mixed transuranic waste (SBW/newly generated liquid waste) at Hanford poses several technical uncertainties that would need to be overcome before it could be implemented. First, the mixed transuranic waste is acidic under the absorbed scenario, while the Hanford facilities are presently being designed and permitted for alkaline materials. Thus, this waste stream would be the only acid waste stream proposed for processing in the Hanford facilities. The Hanford facilities would require modifications to process an acid stream. Second, modifications to the offgas systems at the Hanford HLW vitrification facility would be required to address higher concentrations of contaminants such as mercury and higher level of nitrogen oxides associated with the mixed transuranic waste (SBW/newly generated liquid waste). Finally, direct vitrification of the mixed transuranic waste would result in the generation of approximately 1,500 Hanford HLW canisters, which would have an estimated disposal cost of $650 million [based on DOE (1996b)]. DOE has included for evaluation in this EIS several other methods for treatment of the mixed transuranic waste that do not result in this large disposal cost (e.g., treatment by cesium ion-exchange and grouting under the Minimum INEEL Processing Alternative).

DOE does not consider chemical dissolution of the solidified mixed transuranic waste (SBW/newly generated liquid waste) followed by separations to be a viable option because the only known dissolution agent for the absorbent material is highly concentrated hydrofluoric acid (Jacobs 1998). DOE's past experience with hydrofluoric acid dissolution processes has demonstrated it to be complex and to present health and safety risks (Jacobs 1998).

DOE does not consider mechanical separation of solid and liquid material to be a viable option. While the majority of liquid could be removed through a vacuum-extraction process, DOE's past experience in removing materials from natural or geologic matrices (e.g., soil washing studies, soil partitioning studies) indicates it would be difficult to remove enough of the transuranic material (bound with covalent bonds or trapped in pore spaces) to dispose of the absorbent as low-level waste.

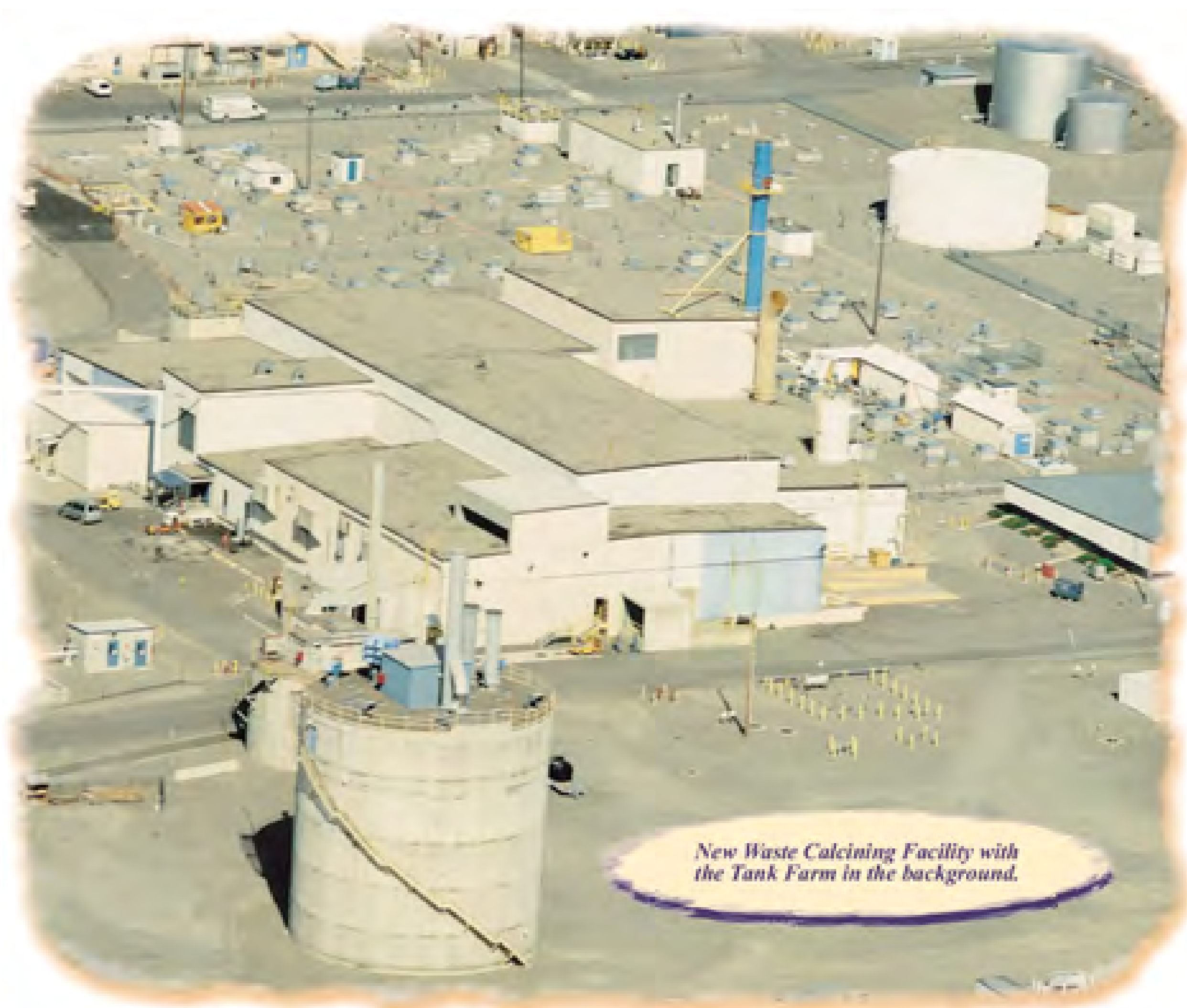
For these reasons, the option of shipment of mixed transuranic waste (SBW/newly generated liquid waste) to the Hanford Site for treatment was eliminated from further consideration in this EIS.

3.3.7 Treatment of Mixed Transuranic Waste/SBW at the Advanced Mixed Waste Treatment Project

In this option the mixed transuranic waste/SBW would be shipped to the proposed INEEL Advanced Mixed Waste Treatment Project for treatment, with the resulting waste form then being shipped to the Waste Isolation Pilot Plant for disposal. As currently envisioned, the Advanced Mixed Waste Treatment Project could treat up to 120,000 cubic meters of alpha-contaminated and transuranic wastes from INEEL or other DOE sites. The Advanced Mixed Waste Treatment Project would employ multiple treatment technologies (including supercompaction, macroencapsulation, and microencapsulation) to produce final waste forms that would be certified for disposal at the Waste Isolation Pilot Plant.

The Advanced Mixed Waste Treatment Project treatment units can accommodate contact handled wastes only. As currently designed, all wastes destined for thermal treatment at the Advanced Mixed Waste Treatment Project would be required to be in a dry solid form, as the facility is not configured to process liquid wastes. The mixed transuranic waste/SBW is a liquid highly radioactive transuranic waste. Thus, the mixed transuranic waste/SBW would require pre-treatment (i.e., cesium ion exchange) before shipment to the Advanced Mixed Waste Treatment Project.

Several modifications to the Advanced Mixed Waste Treatment Project to process liquids would be required. These modifications include liquid waste storage and feed systems and additional control systems. Modifications to accept liquid mixed transuranic waste/SBW could disrupt the ongoing Advanced Mixed Waste Treatment Project design and permitting activities, jeopardizing compliance with the Settlement Agreement/Consent Order and increasing costs for the Advanced Mixed Waste Treatment Project. In addition, because of the highly acidic nature of the mixed transuranic


New Waste Calcining Facility with the Tank Farm in the background.

waste/SBW, modifications to the Advanced Mixed Waste Treatment Project offgas system to remove the additional nitrogen oxides would be necessary.

This EIS contains an alternative (Minimum INEEL Processing) that processes the mixed transuranic waste/SBW into a waste form that is suitable for disposal at the Waste Isolation Pilot Plant. Using this non-thermal technology would allow the mixed transuranic waste/SBW to be placed into a final form acceptable for disposal using fewer pretreatment or treatment steps and generating less secondary waste than treatment at the Advanced Mixed Waste Treatment Project. Therefore, use of the Advanced Mixed Waste Treatment Project does not fulfill a regulatory or operational need that is not otherwise met by other options to be evaluated in this EIS.

For these reasons, the option of treatment of mixed transuranic waste/SBW at the Advanced Mixed Waste Treatment Project was eliminated from further consideration in this EIS.

3.4 Summary Level Comparison of Impacts

This section compares the potential environmental impacts of implementing each of the alternatives described in Sections 3.1 and 3.2. This brief comparison of impacts is presented to aid the decisionmakers and public in understanding the potential environmental consequences of proceeding with each of the alternatives under consideration.

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. Table 3-5 summarizes some of the key attributes of the alternatives and options (see Appendix C.10 for more details). Figure 3-16 shows the general timeframe for the EIS (e.g., the period of analysis and key dates) and the milestones for the alternatives and options. Table 3-6 summarizes the potential impacts of each alternative for the various environmental disciplines.

Key differences between the impacts for the alternatives and options include:

- The waste products for each waste processing alternative are summarized in Table 3-5. The type and quantity of product waste varies with the combination of pretreatment (calcination, radionuclide separations) and immobilization (vitrification, cement, ceramic) technologies that are used. The Separations Alternative and Minimum INEEL Processing Alternative (which includes separations at the Hanford Site) would produce the least HLW canisters. The Non-Separations Alternative would significantly increase the number of HLW canisters that are produced.

- Transportation related impacts would be greatest for Non-Separations Alternative due to the high number of HLW shipments to a repository. Transportation impacts would also be higher for the Transuranic Separations Option due to the greater distances associated with transport of the low-level waste Class C type grout to an offsite disposal facility (assumed to be located in Barnwell, South Carolina).

- The Separations Alternative and Minimum INEEL Processing Alternative could include construction of a Low-Activity Waste Disposal Facility near INTEC. Those alternatives would result in slightly greater land use and ecological impacts due to the construction of this facility on undeveloped land.

- Radiological air emissions would be highest for the Continued Current Operations Alternative, Planning Basis Option, Hot Isostatic Pressed Waste Option, and Direct Cement Waste

Option as a result of operation of the New Waste Calcining Facility beyond June 2000 and management of mixed transuranic waste (newly generated liquid waste and Tank Farm heel waste).

- Nonradiological air emissions would be highest for the Full Separations, Planning Basis, and Hot Isostatic Pressed Waste Options. These emissions are a result of fossil fuel consumption to meet the energy requirements (steam) of the waste processing facilities.

- The Separations Alternative would require greater construction activity. This would result in higher construction employment with corresponding health and safety impacts (lost workdays).

- Fossil fuel consumption would be highest for the Separations Alternative (Full Separations and Planning Basis Options) and options that use energy-intensive treatment technologies (Hot Isostatic Pressed Waste and Direct Cement Waste Options).

- Accident impacts (abnormal and design basis events) would be highest for the No Action and Continued Current Operations Alternatives. The bounding accident for those alternatives involves long-term storage of calcine in the bin sets. Beyond design basis event impacts would be greatest for an accident involving the vitrification processes under the Full Separations and Planning Basis Options.

The compliance status of the alternatives is addressed in Section 6.3 of the EIS.

DOE is developing a cost evaluation that it expects to complete and make available to the public before the Record of Decision for this EIS. For each alternative and option, the cost evaluation will consider capital costs for new facilities or upgrades to existing facilities, operation and maintenance costs for existing and new facilities, decontamination and decommissioning costs for new facilities and any transportation and disposal costs. This evaluation will address the total system life-cycle costs for each alternative and option. DOE will consider the results of the cost evaluation in its decisions based on this EIS.

3.5 Preferred Alternative

As of the publication of this Draft Environmental Impact Statement, DOE has not selected a preferred alternative. As a cooperating agency, the State of Idaho has not yet selected a preferred alternative.

A preferred alternative(s) will be named in the final Environmental Impact Statement after public comments on the draft EIS are considered, agency and tribal consultations are completed, and subsequent discussions are held between DOE and the State of Idaho.

Table 3-5. Summary comparison of the waste processing alternatives.

Alternatives	HLW treatment technology	Mixed transuranic waste/SBW pretreatment	Cease use of Tank Farm[a]	Product HLW	Number of shipments[b]
No Action Alternative	NA	None	Pillar & panel tanks – 2003	NA	NA
Continued Current Operations Alternative	NA	Calcination	Pillar & panel tanks – 2003 Monolithic tanks – 2014	NA	Truck – 140[c] Rail – 70[c]
Separations Alternative					
Full Separations Option	Vitrification	None	Pillar & panel tanks – 2003 Monolithic tanks – 2016	780 SRS canisters	Truck – 780 Rail – 160
Planning Basis Option	Vitrification	Calcination	Pillar & panel tanks – 2003 Monolithic tanks – 2014	780 SRS canisters	Truck – 780 Rail – 160
					Truck – 140[c] Rail – 70[c]
Transuranic Separations	NA	None	Pillar & panel tanks – 2003 Monolithic tanks – 2016	None	Truck – 280[c] Rail – 140[c]
Non-Separations Alternative					
Hot Isostatic Pressed Waste Option	Hot isostatic press[d]	Calcination	Pillar & panel tanks – 2003 Monolithic tanks – 2014	5,700 SRS canisters	Truck – 5,700 Rail – 1,100
					Truck – 140[c] Rail – 70[c]
Direct Cement Waste Option	Hydroceramic cement[d]	Calcination	Pillar & panel tanks – 2003 Monolithic tanks – 2014	18,000 SRS canisters	Truck – 18,000 Rail – 3,600
					Truck – 140[c] Rail – 70[c]
Early Vitrification Option	Vitrification	None	Pillar & panel tanks – 2003 Monolithic tanks – 2016	11,700 SRS canisters	Truck – 12,000 Rail – 2,400
					Truck – 450[c] Rail – 225[c]
Minimum INEEL Processing Alternative	Vitrification	None	Pillar & panel tanks – 2003 Monolithic tanks – 2012	625 Hanford canisters	Truck – 630 Rail – 160
					Truck – 1,300[c] Rail – 670[c]

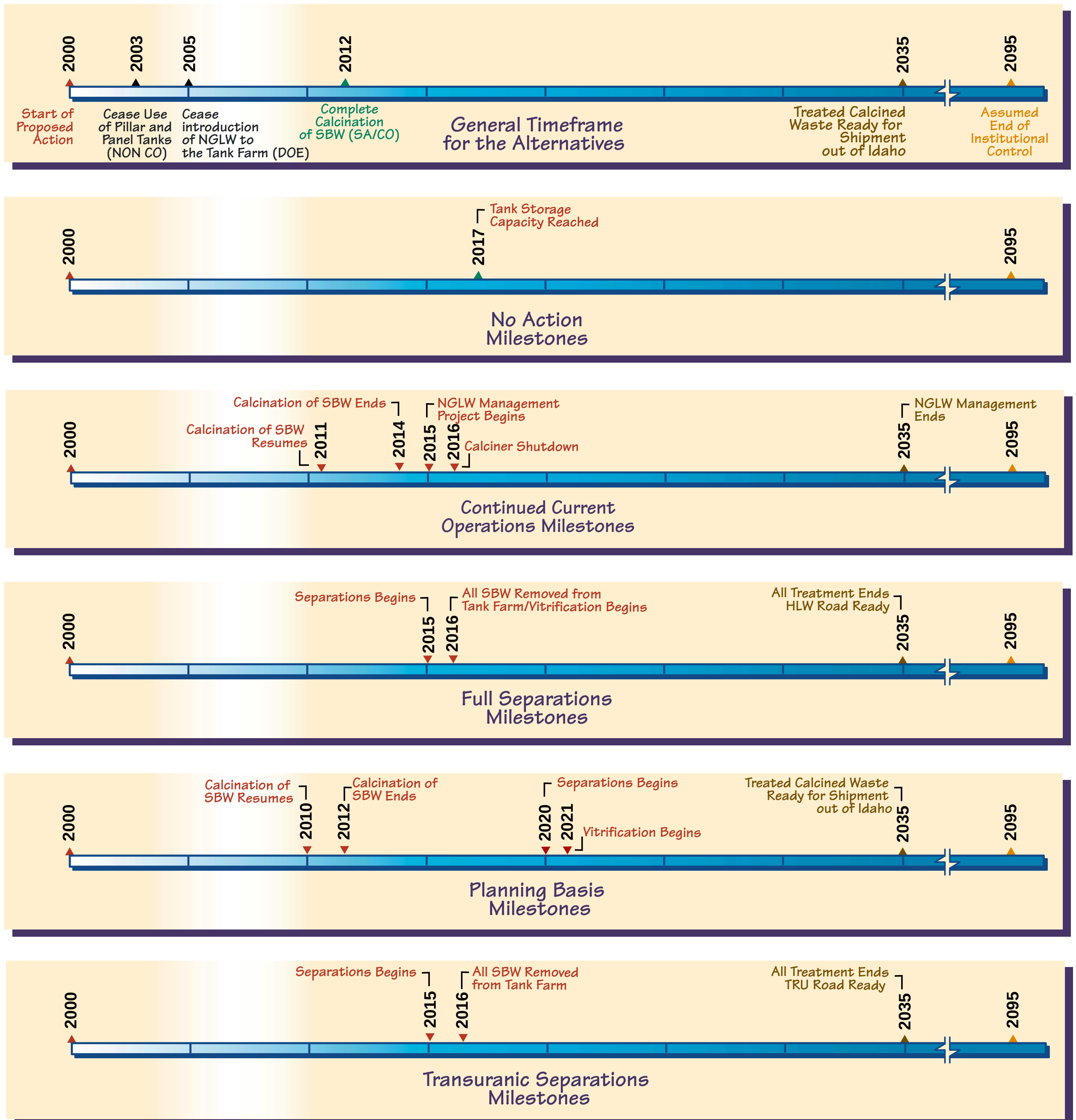
NA = not applicable, SRS = Savannah River Site

a. Refers to requirement to permanently cease use of the INTEC tanks under the Notice of Noncompliance Consent Order

b. Represents number of truck or rail shipments of HLW canisters between INEEL and a geologic repository, except where otherwise noted.

c. Represents number of transuranic waste shipments to Waste Isolation Pilot Plant.

d. Requires determination of equivalent treatment by EPA and qualification as approved waste form under repository waste acceptance criteria (DOE 1996a; 1999a).

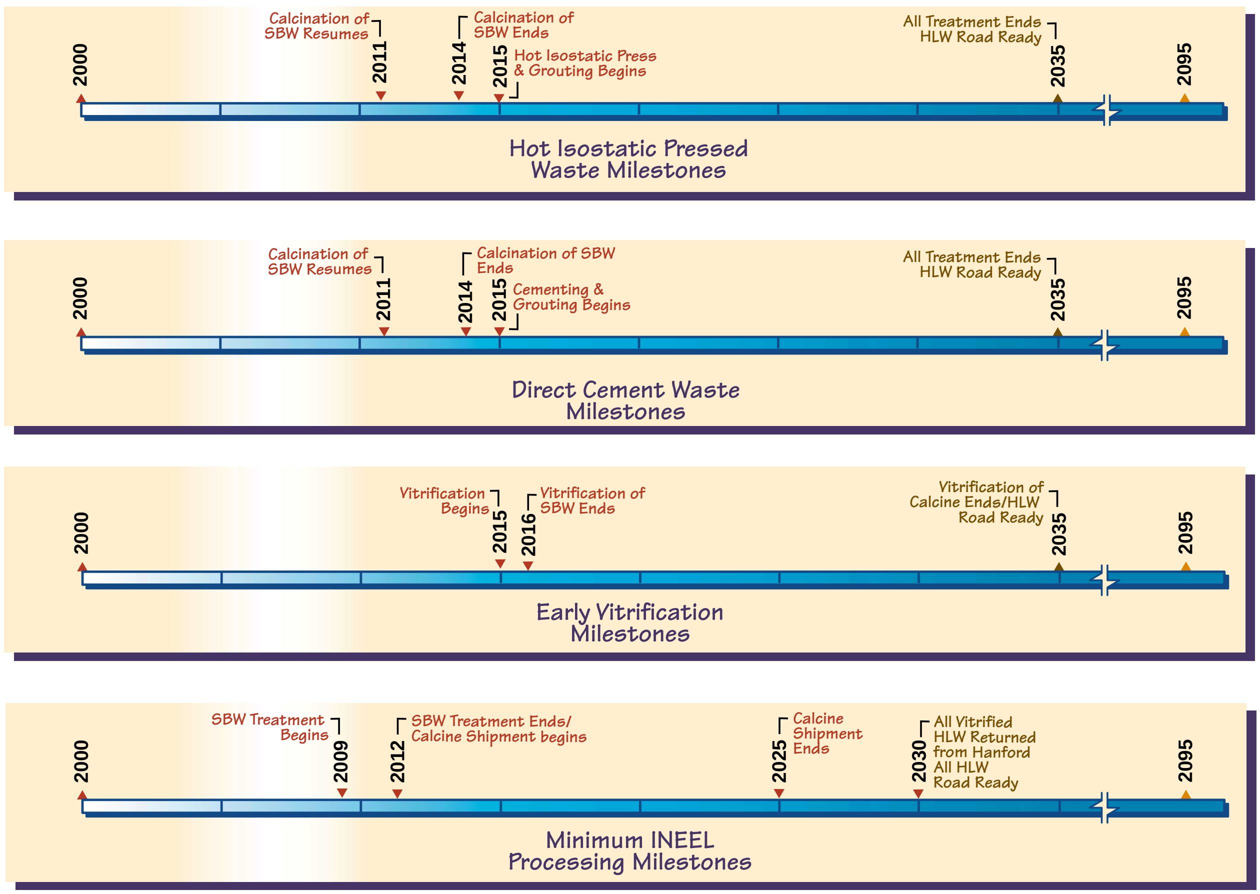


NOTE: In the event any required NEPA analysis results in the selection after October 16, 1995, of an action which conflicts with any action identified in this Agreement, DOE or the Navy may request a modification of this Agreement to confirm the action in the Agreement to that selected action. Approval of such modification shall not be unreasonable withheld.

LEGEND

SA/CO	Settlement Agreement/ Consent Order	NGLW	Mixed transuranic waste/ newly generated liquid waste
SBW	Mixed transuranic waste/ sodium-bearing waste	NON CO	Notice of Noncompliance Consent Order
TRU	Transuranic waste		

FIGURE 3-16. (1 of 2)
Time Lines



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LEGEND

SA/CO	Settlement Agreement/ Consent Order	NGLW	Mixed transuranic waste/ newly generated liquid waste
SBW	Mixed transuranic waste/ sodium-bearing waste	NON CO	Notice of Noncompliance Consent Order

FIGURE 3-16. (2 of 2)
Time Lines

4.0 Affected Environment

4.1 Introduction

Chapter 4 provides a description of the existing environment at the Idaho National Engineering and Environmental Laboratory and surrounding region. The Chapter 4 discussion emphasizes the environment that could be affected by implementing the waste processing and facilities disposition alternatives. One of the alternatives under consideration, the Minimum INEEL Processing Alternative, would involve treatment of INEEL HLW at the Hanford Site. Appendix C.8 describes the Hanford Site near Richland, Washington, focusing on the 200-East Area, where HLW would be treated under this alternative.

This chapter tiers from the SNF & INEL EIS (DOE 1995). Individual sections provide a brief discussion and, where necessary, provide updated information against which DOE may evaluate potential environmental impacts of the alternatives. Each section in this chapter supports the analysis of potential environmental consequences in Chapter 5.

Sheep from the U.S. Sheep Experimental Station on INEEL.

4.2 Land Use

This section contains a brief description of existing and planned land uses at INEEL and the surrounding area, focusing on INTEC, the proposed site of HLW management activities. Current and projected land uses are described extensively in the SNF & INEL EIS, Volume 2, Part A, Section 4.2 (DOE 1995) and the *Idaho National Engineering and Environmental Laboratory Comprehensive Facility and Land Use Plan* (DOE 1997).

4.2.1 EXISTING AND PLANNED LAND USES AT INEEL

INEEL occupies approximately 890 square miles (570,000 acres) of land in Bingham, Bonneville, Butte, Clark, and Jefferson counties in southeastern Idaho. Approximately 2 percent of this land (11,400 acres) has been developed to support INEEL facility and program operations associated with energy research and waste management activities (DOE 1995). INEEL operations are performed within the site's primary facility areas (i.e., Central Facilities Area, Test Reactor Area, INTEC, etc.), which occupy 2,032 acres. A 345,000-acre security and safety buffer zone is located around the core development area, which also accommodates environmental research and ecological and socio-cultural preservation. Approximately 6 percent of INEEL (34,000 acres) is devoted to utility rights-of-way and public roads, including Highway 20 that runs east and west and crosses the southern portion of INEEL, Highway 26 that runs southeast and northwest intersecting Highway 20, and Idaho State Highways 22, 28, and 33 that cross the northeastern part of INEEL (DOE 1995).

Up to 340,000 acres of INEEL are leased for cattle and sheep grazing (DOE 1995); grazing permits are administered by the Bureau of Land Management. However, grazing of livestock is prohibited within one-half mile of any primary facility boundary and within 2 miles of any nuclear facility. In addition, 900 acres located at the junction of Idaho State Highways 28 and 33 are used by the U.S. Sheep Experiment Station as a winter feedlot for sheep (DOE 1997). Figure 4-1 shows land use in the vicinity of the INEEL.

On July 17, 1999, the Secretary of Energy and representatives of the U.S. Fish & Wildlife Service, Bureau of Land Management, and Idaho State Fish & Game Department designated 73,263 acres of the INEEL as the Sagebrush Steppe Ecosystem Reserve. The sagebrush steppe ecosystem was listed as critically endangered across its entire range by the National Biological Service in 1995. The INEEL Sagebrush Steppe Ecosystem Reserve was designated to ensure this portion of the ecosystem receives special scientifically controlled consideration. Conservation management in this area is intended to maintain the current vegetation and provide the opportunity for study of an undisturbed sagebrush steppe ecosystem. Traditional rangeland uses i.e., livestock grazing, which currently exist in a portion of the area, will be allowed to continue under this management designation. The designated INEEL Sagebrush Ecosystem Reserve is located in the northwest portion of the area. The southern boundary of the reserve, which runs east and west along section lines, is about eleven miles north of INTEC at the closest point.

Land use at INEEL is in a state of transition. Emphasis is moving toward radioactive and hazardous waste management, environmental restoration and remedial technologies, and technology transfer, resulting in more development of INEEL within some facility areas and less development in others. DOE has projected land use scenarios at INEEL for the next 25, 50, 75, and 100 years. Future industrial development is projected to take place in the central portion of INEEL within existing major facility areas. For further review, see the *Idaho National Engineering Laboratory Long-Term Land Use Future Scenarios* (DOE 1993) and the *Idaho National Engineering and Environmental Laboratory Comprehensive Facility and Land Use Plan* (DOE 1997).

Facilities at INTEC, where activities associated with the HLW projects would be conducted, occupy approximately 250 acres. INTEC consists of more than 150 buildings. Primary facilities include storage and treatment facilities for spent nuclear fuel, mixed HLW, and mixed transuranic waste/SBW, and process development and robotics laboratories.

INTEC's original mission was to function as a one-of-a-kind processing facility for government-owned nuclear fuels from research and defense reactors. INTEC recovered uranium and rare gases from spent nuclear fuel so that these materials could be reused. Currently, INTEC operations include receipt and storage of DOE-assigned spent nuclear fuels; management of HLW prior to disposal in a repository; technology development for final disposition of spent nuclear fuel, mixed HLW, and mixed transuranic waste/SBW; and development of new waste management technologies.

Recreational uses of INEEL include public tours of general facility areas and the Experimental Breeder Reactor-I, a National Historic Landmark. Controlled hunting is also permitted on INEEL but is restricted to one-half mile inside the site boundary. These restricted hunts are intended to assist the Idaho Department of Fish and Game in reducing crop damage caused by wild game on adjacent private agricultural lands. INEEL is designated as a National Environmental Research Park, functioning as a field laboratory set aside for ecological research and evaluation of the environmental impacts from nuclear energy development.

INEEL does not lie within any of the land boundaries established by the Fort Bridger Treaty of 1868. The entire INEEL is land occupied by DOE; therefore, the provision in the Fort Bridger Treaty that allows the Shoshone-Bannock Tribes to hunt on unoccupied lands of the United States does not presently apply to any land upon which INEEL is located.

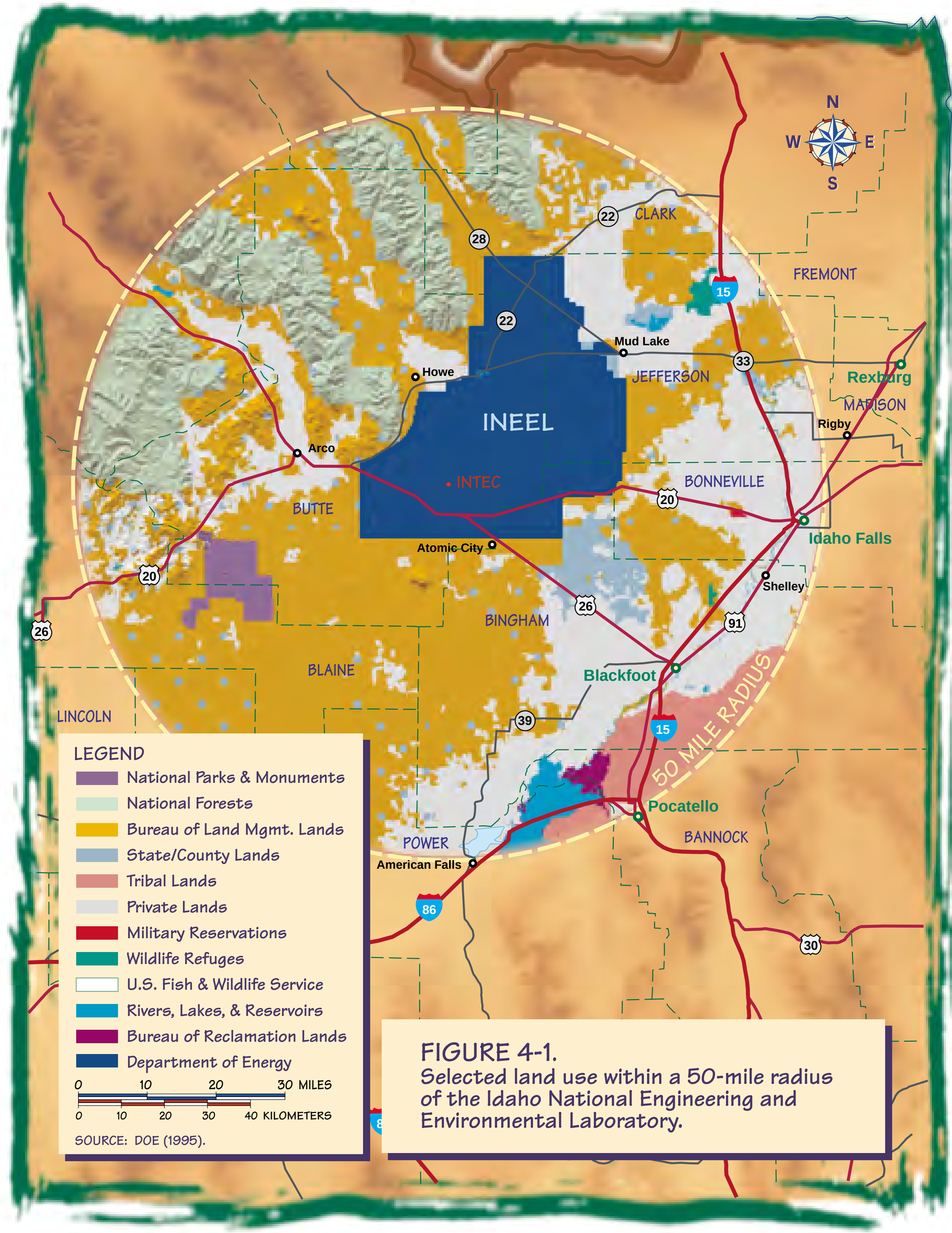


FIGURE 4-1.
Selected land use within a 50-mile radius of the Idaho National Engineering and Environmental Laboratory.

4.2.2 EXISTING AND PLANNED LAND USE IN THE SURROUNDING REGION

Approximately 75 percent of the land adjacent to INEEL is owned by the Federal government and administered by the Bureau of Land Management. Land uses on this federally-held land consist of wildlife management, mineral and energy production, grazing, and recreation. Approximately 1 percent of the adjacent land is owned by the State of Idaho. This land is also used for wildlife management, grazing, and recreation. The remaining 24 percent of the land adjacent to INEEL is privately owned and is primarily used for grazing and crop production.

Small communities and towns near INEEL boundaries include Mud Lake and Terreton to the east; Arco, Butte City, and Howe to the west; and Atomic City to the south. The larger communities of Idaho Falls, Rexburg, Rigby, Blackfoot, and Pocatello, along with the Fort Hall Indian Reservation, are located to the east and southeast of INEEL. Recreation and tourist attractions in the surrounding region include Craters of the Moon National Monument and Wilderness Area, Hell's Half Acre Wilderness Study Area, Black Canyon Wilderness Study Area, Camas National Wildlife Refuge, Market Lake Wildlife Management Area, North Lake State Wildlife Management Area, Targhee and Challis National Forests, the Snake River, as shown in Figure 4-2. Additional recreation and tourist attractions in the surrounding region include Yellowstone National Park, Grand Teton National Park, the Jackson Hole recreation complex, Sawtooth National Recreation Area, Sawtooth Wilderness Area, and Sawtooth National Forest.

Lands surrounding INEEL are subject to Federal and State planning laws and regulations governed by Federal rules and regulations requiring public involvement in their implementation. Land use planning in the State of Idaho is derived from the Local Planning Act of 1975. Currently, the State of Idaho does not have a land-use planning agency. Therefore, the Idaho legislature requires that each county adopt its own land use planning and zoning guidelines. All county plans and policies encourage development adjacent to previously developed areas in order to minimize the need to expand infrastructure and to avoid urban sprawl. Because INEEL is remotely located, INEEL and adjacent areas are not likely to experience residential and commercial development, and no new development is planned near INEEL. 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.

4.3 Socioeconomics

This section presents an overview of current socioeconomic conditions within a seven-county region of influence comprised of Bannock, Bingham, Bonneville, Butte, Clark, Jefferson, and Madison counties, and the Fort Hall Indian Reservation and Trust Lands (home of the Shoshone-Bannock Tribes). Figure 4-2 presents a map of the area showing towns and major routes in the region of influence. This section discusses population, housing, employment, income, and community services. The contents of this section are tiered from the SNF & INEL EIS, Volume 2, Part A, Section 4.13 (DOE 1995).

4.3.1 POPULATION AND HOUSING

4.3.1.1 Population

From 1960 to 1990, population growth in the region of influence paralleled statewide growth. During this period, the region of influence's population increased an average rate of approximately 1.3 percent annually, while the annual growth rate for the State was 1.4 percent (BEA 1997). From 1990 to 1995, State population growth accelerated to over 3 percent per year, and region of influence growth remained under 2 percent (DOC 1997a). Population growth for both the region of influence and the State are projected to slow after the year 2000. Table 4-1 presents population estimates for the region of influence through 1995 and projections for 2000 through 2025. Based on population trends, the region of influence population will reach almost

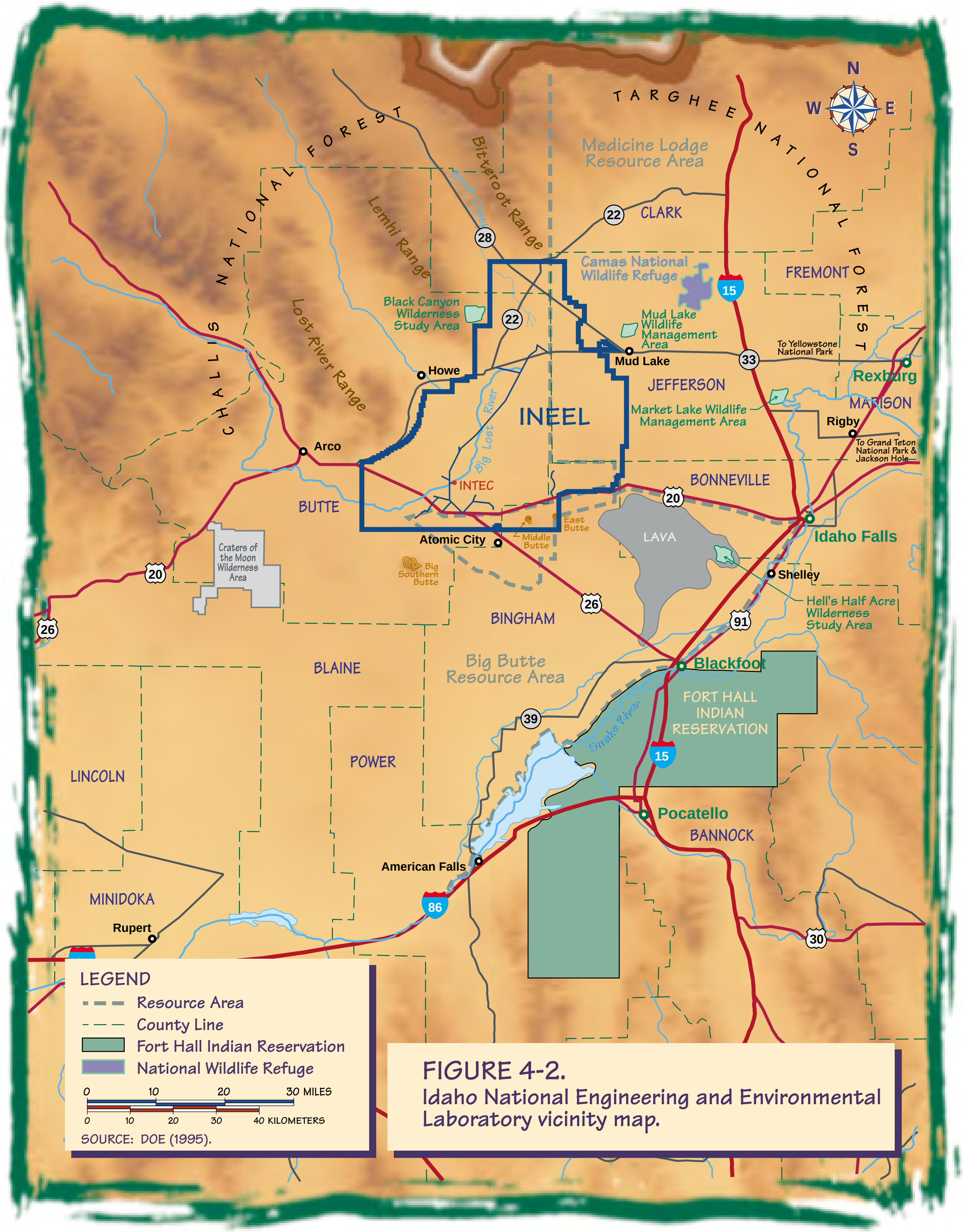


FIGURE 4-2.
Idaho National Engineering and Environmental Laboratory vicinity map.

Table 4-1. Population of the INEEL region of influence and Idaho: selected years 1980-2025.[a]

County	1980	1990	1995	2000	2005	2010	2015	2020	2025
Bannock	65,421	66,026	72,043	78,252	81,303	84,474	90,894	96, 802	102,710
Bingham	36,489	37,583	40,950	44,479	46,214	48,016	51,666	55,024	58,382
Bonneville	65,980	72,207	79,230	86,059	89,415	92,902	99,963	106,460	112,958
Butte	3,342	2,918	3,097	3,364	3,495	3,631	3,907	4.161	4,415
Clark	798	762	841	913	948	985	1,060	1,129	1,198
Jefferson	15,304	16,543	18,429	20,017	20,798	21,609	23,251	24,763	26,274
Madison	19,480	23,674	23,651	25,690	26,692	27,733	29,841	31,780	33,720
Region of influence	206,814	219,713	238,241	258,774	268,865	279,350	300,582	320,119	339,657
Idaho	944,127	1,006,749	1,164,887	1,216,000	1,277,000	1,335,000	1,395,000	1,514,000	1,725,000

a. Source: DOC (1997a,b); BEA (1997).

269,000 persons by 2005 and 339,700 by 2025 (BEA 1997). DOE recognizes that a degree of uncertainly exists in these population projections because of possible variability over time in birth rates, death rates, emigration/immigration rates, and other factors in the region of influence.

Bannock and Bonneville counties have the largest populations in the region of influence, and together they accounted for almost 64 percent of the total region of influence population in 1996. Butte and Clark are the most sparsely populated counties and together contain only 1.6 percent of the total region of influence population. The largest cities in the region of influence are Pocatello (in Bannock County) and Idaho Falls (in Bonneville County), with 1996 populations of approximately 51,000 and 48,000, respectively (DOC 1997b). During 1996, INEEL employees and their families accounted for 20 percent of Bonneville County's population and composed almost 30 percent of Idaho Falls' population. INEEL employees and their families represent only 2 percent of the population of Bannock and Madison counties (DOE 1997).

4.3.1.2 Housing

There were 78,000 housing units in the region of influence during 1990, the last year for which data are available (DOC 1992). Approximately 70 percent of the units were single-family units, 17 percent were multi-family units, and 13 percent were mobile homes. Approximately 7.7 percent of the housing units were vacant, although some vacant units were used for seasonal, recreational, or other occasional purposes. Rental vacancy rates ranged from 2.8 percent in Madison County to 16.2 percent in Butte County, while owner-occupied vacancy rates ranged from 1.3 percent in Madison County to 4.6 percent in Butte County. The average rental vacancy rate in the state of Idaho was 7.3 percent, and the owner-occupied vacancy rate aver-

Table 4-2. Region of influence housing characteristics (1990).[a]

County	Total housing units	Number of owner occupied units	Owner occupied vacancy rates	Median value	Number of rental units	Rental vacancy rates	Median contract monthly rent
Bannock	25,694	16,082	2.4%	$53,300	7,330	10.3%	$237
Bingham	12,664	8,830	2.0%	$50,700	2,683	9.2%	$207
Bonneville	26,049	17,371	1.9%	$63,700	6,918	6.2%	$293
Butte	1,265	744	4.6%	$41,400	253	16.2%	$158
Clark	502	174	1.7%	$37,300	103	9.6%	$189
Jefferson	5,353	3,920	2.0%	$54,300	951	4.1%	$221
Madison	6,133	3,476	1.3%	$68,700	2,325	2.8%	$239
Region of influence	77,660	50,597	NA[b]	NA	20,563	NA	NA

a. Source: DOC (1992); does not include housing used for seasonal, recreational, or other uses.
b. NA = Not applicable.

aged 2.0 percent. About 29 percent of the occupied housing units in the region of influence were rental units, and 71 percent were homeowner units. The majority of housing units (67 percent) in the region of influence were located in Bonneville and Bannock counties, which include the cities of Idaho Falls and Pocatello (DOC 1992).

In 1990, the median value of owner-occupied housing units ranged from $37,300 in Clark County to $68,700 in Madison County, and median monthly contract rents ranged from $158 in Butte County to $293 in Bonneville County. The median value of owner-occupied housing units in Idaho was $58,200, and the median contract rent was $261 (DOC 1992). Table 4-2 shows housing characteristics for the region of influence.

4.3.2 EMPLOYMENT AND INCOME

The region of influence experienced stable growth during the 1990s. The labor force grew from 105,837 in 1990 to 130,204 in 1998, an average annual growth rate of almost 2.9 percent. Total region of influence employment grew from 100,074 in 1990 to 124,777 in 1998, an average annual growth rate of approximately 3.1 percent (BLS 1997, 1999). This growth rate was considerably higher than during the 1980s when region of influence employment grew at approximately 1.2 percent annually. Between 1990 and 1998, the labor force in the state of Idaho grew at an annual rate of 4.1 percent, and employment grew 4.2 percent annually. Historical trends in labor force, employment, and

Table 4-3. Historical trends in region of influence labor force.

County	1980	1985	1990	1995	1998
Bannock	30,488	33,684	31,342	36,310	40,407
Bingham	15,582	16,892	18,383	20,507	21,643
Bonneville	26,966	35,103	38,632	43,422	45,738
Butte	1,862	1,579	1,447	1,542	1,665
Clark	325	538	549	623	662
Jefferson	4,865	7,131	8,078	9,158	9,774
Madison	9,103	7,802	7,406	9,695	10,315
Region of influence	89,191	102,729	105,837	121,257	130,204
Idaho	429,000	466,000	492,619	600,493	653,056

Source: BLS (1997, 1999).

Table 4-4. Historical trends in region of influence employment.

County	1980	1985	1990	1995	1998
Bannock	28,207	31,064	29,051	34,183	38,470
Bingham	14,419	15,534	17,320	19,363	20,586
Bonneville	25,432	33,267	37,127	41,563	44,110
Butte	1,780	1,491	1,381	1,479	1,598
Clark	295	511	533	596	638
Jefferson	4,480	6,600	7,633	8,685	9,348
Madison	8,683	7,366	7,029	9,373	10,027
Region of influence	83,296	95,833	100,074	115,242	124,777
Idaho	395,000	429,000	463,484	568,138	620,217

Source: BLS (1997, 1999).

Table 4-5. Historical trends in region of influence unemployment rates.

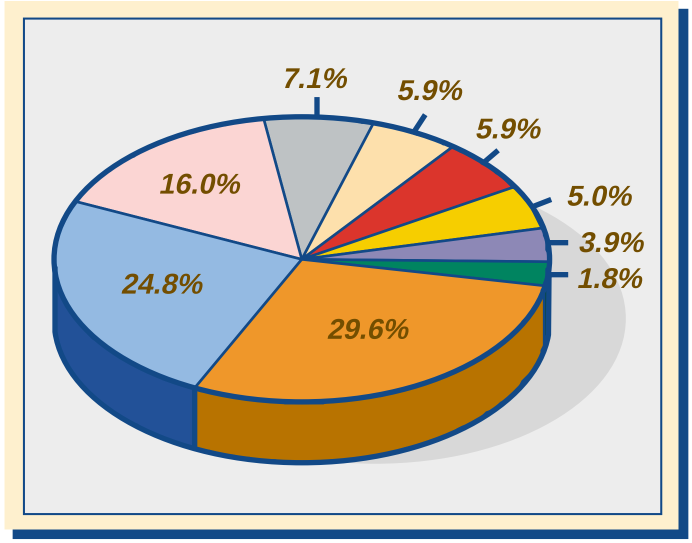
County	1980	1985	1990	1995	1998
Bannock	7.5%	7.8%	7.3%	5.9%	4.8%
Bingham	7.5%	8.0%	5.8%	5.6%	4.9%
Bonneville	5.7%	5.2%	3.9%	4.3%	3.6%
Butte	4.4%	5.6%	4.6%	4.1%	4.0%
Clark	9.2%	5.0%	2.9%	4.3%	3.8%
Jefferson	7.9%	7.4%	5.5%	5.2%	4.4%
Madison	4.6%	5.6%	5.1%	3.3%	2.8%
Region of influence	6.6%	6.7%	5.4%	5.0%	4.0%
Idaho	7.9%	7.9%	5.9%	5.4%	5.0%

Source: BLS (1997, 1999).

unemployment are shown in Tables 4-3, 4-4, and 4-5, respectively.

The region of influence unemployment rate was 4.0 percent in 1998, the lowest level in over a decade and lower than the average rate of 5.0 percent in Idaho. Unemployment rates within the region of influence ranged from 2.8 percent in Madison County to 4.9 percent in Bingham County (BLS 1997, 1999). The INEEL region of influence is rural in character, with an economy that has historically been based on natural resources and agriculture. Consistent with most regions of the country, economic growth over the past several decades has been in nonagricultural sectors. Although farming and agricultural services remain important to the region of influence economy, these sectors provided less than 8 percent of jobs in the region of influence in 1995. Three sectors - service, government, and retail and wholesale trade - are the largest sources of region of influence employment. Together, these sectors generated approximately 70 percent of the jobs in the region of influence in 1995. Manufacturing and construction are also important sectors and together accounted for about 13 percent of the region of influence employment in 1995 (BEA 1997). Sector employment in the state of Idaho is similar. Overall in the state, three sectors - service, government, and retail and wholesale trade - are the largest employers, providing 62 percent of employment. Manufacturing and construction together account for 19 percent of employment. Figure 4-3 presents employment levels for the major sectors for the region of influence.

INEEL exerts a major influence on the regional economy. During 1998, INEEL provided an average of 8,100 jobs, almost 7 percent of the total jobs in the region of influence (McCammon 1999). INEEL is the largest employer in Southeast Idaho and the second largest employer in Idaho (second to the State government) (DOE 1997). The current workforce population, however, is much lower than the approximately 12,500 employees that worked at INEEL during 1991, the peak year of recent history (McCammon 1999). Much of the employment loss was due to consolidation of contracts and reduction in defense-related activities. Employment projections indicate a stabilization of the job force at about 8,000 in Fiscal Year 2000 (McCammon 1999).



LEGEND
- Services (37,465)
- Wholesale and retail trade (31,340)
- Government (20,233) (including Federal, state, local, and military)
- Manufacturing (9,007)
- Farm (7,410)
- Construction (7,495)
- Finance, insurance, and real estate (6,332)
- Transportation and public utilities (4,981)
- Agricultural service, forestry, and other (3,289) (includes classified employees)

FIGURE 4-3.
1995 employment by sector.

Other major employers in the region of influence include Idaho State University, American Microsystems, Inc., and local school districts.

Per capita income for the region of influence was $16,550 in 1995, a 17 percent increase over the 1990 level of $14,136. Income levels within the region of influence ranged from $11,758 for Madison County to $22,444 in Clark County. The per capita income for Idaho was $18,895 in 1995 (BEA 1997).

The median household income in the region of influence ranged from $23,000 in Madison County to $30,462 in Bonneville County. The median household income in Idaho was $25,257, and the national median household income was $30,056.

4.3.3 COMMUNITY SERVICES

Public schools, law enforcement, fire protection, and medical services are important community services in the region of influence.

Seventeen public school districts and five private schools provide educational services for the approximately 57,000 school-aged children in the region of influence. Higher education in the region of influence is provided by the Idaho State University/University of Idaho Center for Higher Education, Ricks College, and the Eastern Idaho Technical College.

Law enforcement is provided by 15 county and municipal police departments that employed 373 sworn officers and 149 civilians in 1995. Idaho Falls and Pocatello supported the largest departments, each employing 82 police officers. Clark County and the Firth police department had the smallest departments, with two officers each (DOJ 1996).

The region of influence is served by 18 municipal fire districts with about 500 firefighters, of whom approximately 300 are volunteers (DOE 1995). In addition, the INEEL fire department provides round-the-clock coverage for the site. The staff includes 50 firefighters, with no less than 16 firefighters on each shift. Bingham, Bonneville, Butte, Clark, and Jefferson counties, which surround INEEL, have developed emergency plans to be implemented in the event of a radiological or hazardous materials emergency. Each emergency plan identifies facilities, including those of the INEEL, that have extremely hazardous substances and defines routes for transportation of these substances. The emergency plans also include procedures for notification and response, listings of emergency equipment and facilities, evacuation routes, and training programs.

The region of influence contains seven hospitals with a capacity of 1,012 beds that average approximately 48 percent occupancy (AHA 1995). Over 65 per-

cent of the hospital beds are in Bannock and Bonneville counties. No hospitals are located in either Clark or Jefferson counties. There are 283 physicians in the region of influence. No primary care physicians are located in Butte or Clark counties (AMA 1996).

4.3.4 PUBLIC FINANCE

INEEL families contribute to the tax base of each county within the region of influence. This tax contributions help pay for local services such as:

- Public schools
- Libraries
- Ambulance and other emergency services
- Road and bridge repairs
- Police
- Fire protection
- Recreational opportunities
- Waste disposal

Based on the latest information available, INEEL employees tax support to southeastern Idaho counties is presented on Table 4-6.

In 1998, INEEL contracts paid $1.4 million to the State of Idaho in Idaho sales taxes and an additional $0.9 million in Idaho franchise tax.

4.4 Cultural Resources

4.4.1 CULTURAL RESOURCE MANAGEMENT AND CONSULTATION AT INEEL

Cultural resources at INEEL include archaeological and historic resources, such as prehistoric camp sites and historic buildings and trails, as well as the plants, animals, physical locations, and other features of INEEL environment important to the culture of the Shoshone-Bannock Tribes and to national, regional and local history. Several Federal laws, which are described in Chapter 6, govern the protection of archaeological and historic resources on lands managed by Federal agencies. These and other laws also require consultations among Federal agencies, Native American tribes, the Idaho State Historic Preservation Office, and other interested parties where resources important to the tribes and others may be affected by proposed activities on Federal lands. To comply with these requirements, DOE developed a *Management Plan for Cultural Resources* (Miller 1995) that provides procedures for consultation and coordination with state and Federal agencies and the Shoshone-Bannock Tribes. DOE has also formalized its relationship with the Shoshone-Bannock Tribes in an "Agreement in Principle" (DOE 1998) that provides a formal framework

Table 4-6. INEEL tax support to southeastern Idaho counties (in millions of dollars).

Counties	Federal tax	State tax	Idaho sales tax	Property tax	Total
Bannock	5.8	2.4	1.2	0.7	10.2
Bingham	10.2	4.2	2.1	1.0	17.6
Bonneville	51.0	21.0	10.7	5.9	88.6
Butte	1.7	0.7	0.4	0.1	2.9
Custer	0.7	0.3	0.2	0.04	1.2
Jefferson	5.4	2.2	1.1	0.5	9.1
Madison	1.3	0.5	0.3	0.2	2.3

Source: DOE (1999).

for the consultation process with the Tribes. Through the NEPA review process, other interested parties are provided an opportunity to comment on activities that may impact archaeological and historic resources.

The DOE and INEEL Cultural Resources Management Office, which is staffed by contractor archaeologists and historic preservation specialists, consults regularly with representatives of the Shoshone-Bannock Tribes through meetings of the INEEL Cultural Resources Working Group. The INEEL Cultural Resources Working Group, formed in 1993, meets informally to share information, coordinate field work, and discuss cultural resource management issues at INEEL. The Cultural Resources Management Office and Tribal representatives provide expertise in compliance with historic preservation laws, archaeology, and anthropology, and the Tribal representatives bring the unique perspective of the contemporary Shoshone-Bannock culture to the management and interpretation of archaeological and historic resources at INEEL.

The archaeological and historic resources identified at INEEL represent the physical record of past cultures and provide only a partial understanding. A more complete understanding of past and present cultures can be attained by incorporating ethnographic information, historic accounts, and Native American and more recent contemporary oral histories. This approach, which is being developed by the INEEL Cultural Resources Working Group, allows the definition of cultural resources to be expanded to provide a more complete picture of the interrelationships between humans and the natural environment. This approach also provides the necessary background to understand the continuing importance of INEEL resources to the Shoshone-Bannock culture and to local communities, the state of Idaho, and the nation.

4.4.2 CURRENT STATUS OF CULTURAL RESOURCE INVENTORIES AT INEEL

Most of the cultural resource inventories completed to date at INEEL have been performed to comply with the requirements of the National Historic Preservation Act. The National Historic Preservation Act requires that, prior to implementing a project or activity, Federal agencies determine whether the project or activity could affect properties included in or eligible for inclusion in the National Register of Historic Places. This typically involves completing archaeological surveys of specific areas that would be disturbed or altered by the project or activity, and identifying and evaluating any historic properties that may also be affected. As a result, previous surveys have been concentrated near active facilities, covering approximately 7 percent of INEEL land area (Pace 1998).

Because of the high density of prehistoric sites on INEEL and the need to comply with cultural resource protection requirements in all Federal activities, DOE sponsored the development of a predictive model to assist in planning cultural resource surveys and siting new INEEL projects (Ringe 1995). The predictive model does not take the place of field surveys required under the National Historic Preservation Act, but it helps identify areas where impacts to significant archaeological resources and increased compliance costs are most likely to occur. According to the model, high densities of resources are likely to be found along the Big Lost River and Birch Creek, in the Lemhi mountains, in the Lake Terreton basin, atop buttes, within craters and caves, and in a 1.75-mile wide zone along the edge of local lava fields.

As of January 1998, 1,839 archaeological sites had been identified at INEEL. Of these, approx-

imately 94 percent were prehistoric and 6 percent were historic (i.e., representing the last 150 years). Over half the archaeological sites identified to date are potentially eligible for listing in the National Register of Historic Places. Until formal significance evaluations are completed, including archaeological testing and historic record searches, all of the archaeological sites in this inventory are considered to be potentially eligible for nomination to the National Register of Historic Places.

To gain a better understanding of the importance of INEEL's historic buildings and structures, DOE recently completed an inventory of all DOE-managed buildings on INEEL (Arrowrock Group 1998). DOE identified 217 buildings out of 516 surveyed as potentially eligible for listing in the National Register of Historic Places because of their association with Idaho's World War II activities and the nation's nuclear era, and in some cases, their design, material, and workmanship. At present, the Idaho State Historic Preservation Office is reviewing and drafting comments on the eligibility determinations (Braun 1998). Currently, the Experimental Breeder Reactor-I, the first nuclear reactor in the world to produce electric power, is the only historic property on INEEL that is listed on the National Register of Historic Places. The Experimental Breeder Reactor-I is also a National Historic Landmark (Pace 1998).

4.4.3 PALEONTOLOGICAL RESOURCES

Paleontological resources identified to date at INEEL include vertebrate and invertebrate animal, pollen, and plant fossils found in alluvial gravels along the Big Lost River, in caves and lava tubes, and in lake sediments. Twenty-four paleontological localities at INEEL have been identified in published data (Miller 1995). Recently, a horse fossil was identified in a gravel pit near the Central Facilities Area. Other vertebrate fossils have included mammoth and camel remains. These and other plant and animal fossils identified at INEEL provide information on past environmental and climatic conditions.

4.4.4 PREHISTORIC RESOURCES

4.4.4.1 Archaeological Record

Archaeological investigations completed to date in southeastern Idaho have yielded evidence indicating human use of the Eastern Snake River Plain for at least 12,000 years. Investigations at a cave approximately 2 miles from the INEEL boundary provided the earliest evidence of human occupation, which was radiocarbon-dated at 12,500 years before present (yr B.P.). Data from these and other investigations have allowed archaeologists to identify three distinct periods: the Early Prehistoric (15,000 yr to 7,500 yr B.P.), Middle Prehistoric (7,500 yr to 1,300 yr B.P.), and Late Prehistoric (1,300 yr to 150 yr B.P.). These periods are distinguished by major changes in the types of projectile points, weapons, and tools used for hunting and gathering. The archaeological record indicates that weapon technology evolved from large spear points to smaller points associated with atlatl (spear thrower) use, and finally to bow and arrow during these periods. Although the technology changes are significant, the archaeological record shows a relatively consistent lifestyle based on hunting large game and gathering plants throughout the entire span of human use (Miller 1995).

Four major cultural resource surveys conducted since 1979 in the vicinity of INTEC have identified six cultural resources within an area of approximately 600 acres surrounding the facility. Of these, three of the resources are isolated prehistoric artifacts and have been evaluated as ineligible for the National Register of Historic Places. Although the archaeological surveys indicate that the area near INTEC contains only limited evidence of prehistoric use, there is potential for Big Lost River gravels to contain buried prehistoric artifacts, as well as paleontological remains.

4.4.4.2 Early Native American Cultures

The prehistoric archaeological record does not make clear when the ancestors of the Shoshone and Bannock peoples arrived in southeastern Idaho; however, the Shoshone-Bannock Tribes believe that native people were created on the North American continent and, therefore, regard all prehistoric resources at INEEL as ancestral and important to their culture. Prehistoric sites are located throughout INEEL, and all demonstrate the importance of the area for aboriginal subsistence and survival.

The ethnographic studies completed by early anthropologists describe the seasonal migration of the Shoshone and Bannock peoples across the Eastern Snake River Plain (Miller 1995). After wintering along the Snake River Bottoms near present-day Fort Hall, groups would disperse in the spring to salmon (*tahwa agai*) fishing areas along the Snake River below Shoshone Falls and along the Lemhi River and other Salmon River tributaries, and to camas (*zoigah* or *yambi*) prairies near present-day Fairfield and Dubois. In late summer and early fall, these groups would migrate northeast and east to hunt bison (*bozhe'na*) on the plains east of the Rocky Mountains. The area now occupied by INEEL served as a travel corridor for these groups, with the Big Lost River, Big Southern Butte, and Howe Point serving as temporary camp areas providing fresh water, food, and obsidian for tool making and trade.

The Shoshone and Bannock peoples relied on the environment for all of their subsistence needs and depended on a variety of plants and animals for foods, medicines, clothing, tools, and building materials. Figure 4-4 depicts plant species of cultural importance that occur on or near INEEL and provides the Shoshone and Bannock names for each.

The importance of plants, animals, water, air, and land resources in the Eastern Snake River Plain to the Shoshone and Bannock peoples is reflected in the sacred manner in which they view the resources. According to Turner et al. (1986):

> "for those who perceive the world through the Shoshonean language and culture, the Earth is alive and sentient... the Realm of the Sacred includes all living things: plants, animals, water, and even the mud."

The reverence for all things extends even to the names of places, as stated by a Shoshone-Bannock elder (Yupe 1998), "You can't say its name around it or there will be trouble like a storm. Its name is sacred."

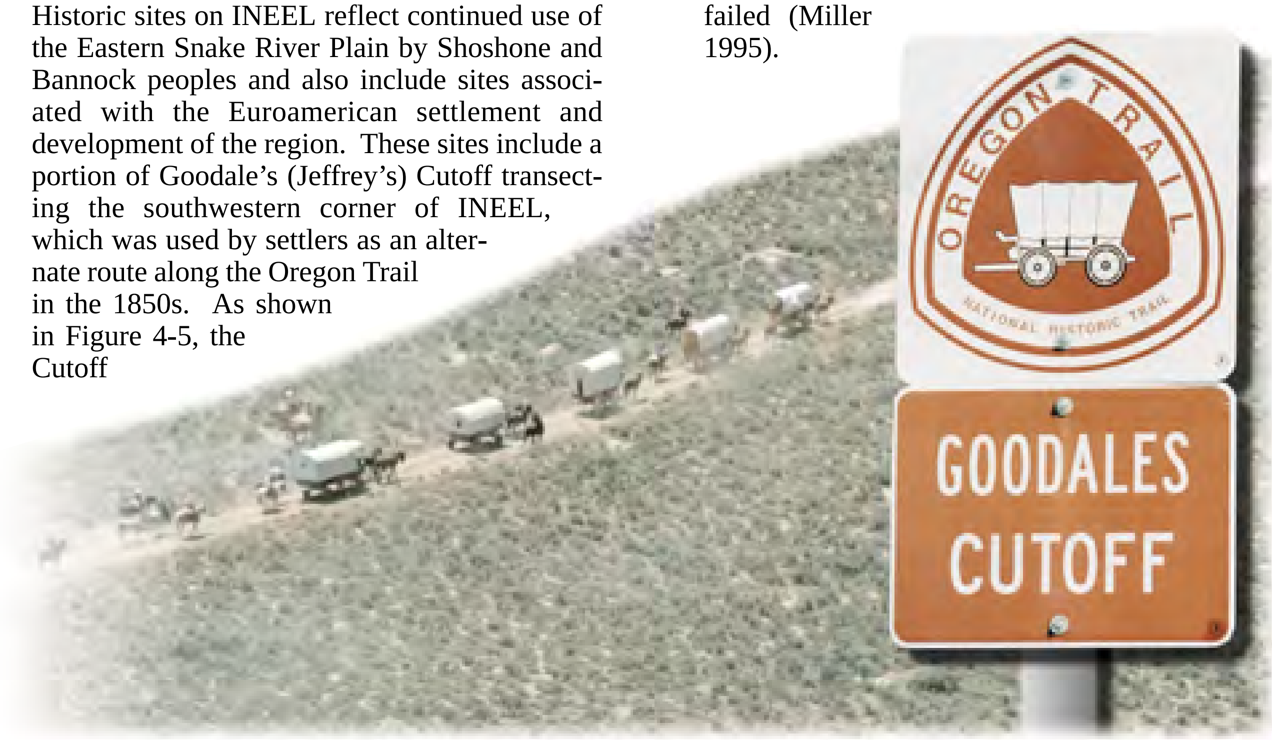
Specific places in the Eastern Snake River Plain have sacred and traditional importance to the Shoshone-Bannock people, including buttes, caves, and other natural landforms on or near INEEL. These places are not named here, to protect the resources and to respect the Shoshone-Bannock view of those resources.

4.4.5 HISTORIC RESOURCES

Historic sites on INEEL reflect continued use of the Eastern Snake River Plain by Shoshone and Bannock peoples and also include sites associated with the Euroamerican settlement and development of the region. These sites include a portion of Goodale's (Jeffrey's) Cutoff transecting the southwestern corner of INEEL, which was used by settlers as an alternate route along the Oregon Trail in the 1850s. As shown in Figure 4-5, the Cutoff and other historic trails on INEEL were also used for cattle drives and sheep drives to bring livestock from Idaho, Washington, and Oregon to shipping points in Wyoming. Many of the historic sites scattered across INEEL are remnants of camps used during cattle and sheep drives and seasonal movements to various pastures (Miller 1995).

Historic trails on INEEL became important stage and freight routes in the late 1800s to support mining boomtowns in central Idaho. Enterprising freight companies also established several new trails across INEEL. Freshwater springs at Big Southern Butte were an important stop for stage and freight lines. The completion of the Oregon short line railroad between Blackfoot and Arco in 1901 eventually made stage and freight lines obsolete (Miller 1995).

The INEEL includes historic sites associated with attempts to homestead and farm along the Big Lost River around the turn of the century. The Cary Land Act of 1894 and the Desert Reclamation Act of 1902 provided land and federal funding to develop irrigation systems in an effort to encourage homesteading. The Big Lost River Irrigation Project included a tract of land in the south-central portion of INEEL. However, the irrigation system was not able to deliver sufficient water and many of the small homesteads failed (Miller 1995).



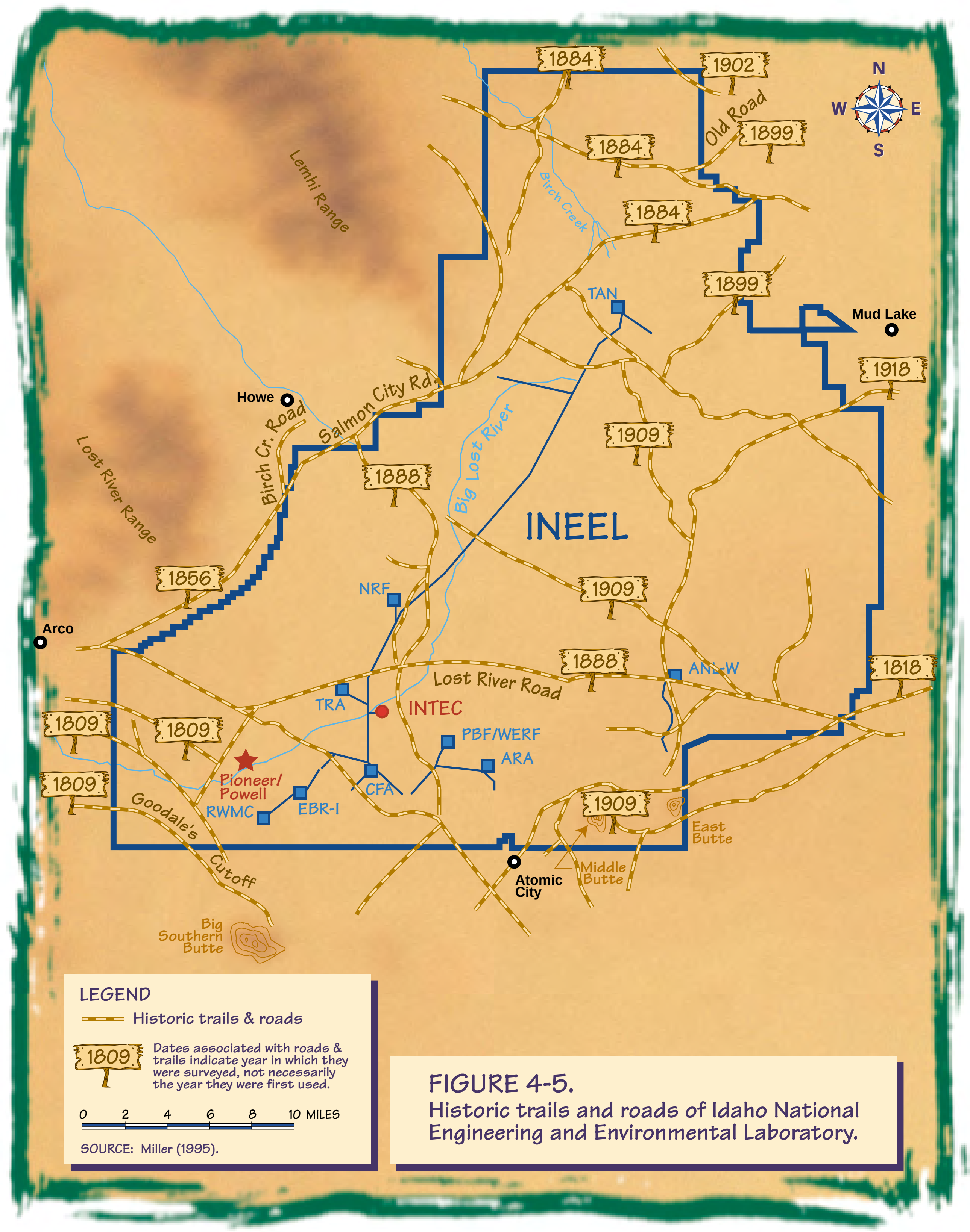


FIGURE 4-5.
Historic trails and roads of Idaho National Engineering and Environmental Laboratory.

Two historic sites near INTEC are representative of this period. One site contains a dugout shelter and a variety of domestic artifacts, and the other is a small historic dump that may be associated with the dugout shelter. Both these sites are potentially eligible for listing in the National Register of Historic Places. A third historic resource near INTEC is an isolated artifact and is considered ineligible for the National Register of Historic Places (Pace 1998).

The desert environment of INEEL saw little activity after the homestead period until World War II, when the U.S. Navy used what is now the Central Facilities Area to test-fire naval guns. INEEL lands were also used as a bombing range by the U.S. Army Air Corps during the war (Miller 1995).

In 1949, the National Reactor Testing Station, later to become INEEL, was established by the Federal government. INEEL has played a vital role in the development of nuclear power, with 52 "first of a kind" reactors constructed since 1949. Several INEEL historic sites help to document the early development of nuclear power and include the Experimental Breeder Reactor-I located near the Radioactive Waste Management Complex; the Materials Test Reactor located at the Test Reactor Area; S1W (Submarine, 1st Generation, Westinghouse), A1W (Aircraft, 1st Generation, Westinghouse), and S5G (Submarine, 5^{th} Generation, General Electric) prototype reactor plants at the Naval Reactors Facility; and many other support facilities (Miller 1995).

INTEC, originally named the Idaho Chemical Processing Plant, was one of the first four facilities constructed at INEEL in the 1950s. INTEC played a key role in the early development of processes and facilities for managing nuclear fuels and wastes. Among the "first in the world" accomplishments at INTEC include the reprocessing of highly enriched pure uranium on a production scale and solidification (calcination) of liquid HLW on both plant and production scales. Historic sites important to U.S. nuclear development at INTEC include 38 buildings potentially eligible for listing in the National Register of Historic Places. These eligibility determinations have been reviewed by the State Historic Preservation Office (Braun 1998). Table 4-7 lists INTEC buildings and structures identified as potentially eligible for listing on the National Register of Historic Places.

Six INTEC structures proposed for demolition or modification have undergone State Historic Preservation Office reviews, and all were determined to be eligible for listing in the National Register of Historic Places. These structures include the Waste Calciner Facility (CPP-633), the two monitoring stations (CPP-709 and CPP-734), the Radium-Lanthanum Process Off-Gas Blower Room (CPP-631), the Underwater Fuel Receiving and Storage Building (CPP-603), and the CPP-603 Basin Sludge Tank Control House (CPP-648). Memoranda of Agreement with the State Historic Preservation Office are in place to ensure that any adverse impacts from alteration or demolition of these facilities are mitigated (Braun 1998).

The historic archaeological record at INEEL is important to descendants of pioneers who settled in the Eastern Snake River Plain, as well as to current and former DOE and INEEL employees and their families who played a role in the development of nuclear science and technology. The role of INEEL lands and facilities in national, regional, and local history continues to influence the cultural environment in eastern Idaho communities.

4.4.6 NATIVE AMERICAN AND EUROAMERICAN INTERACTIONS

The influence of Euroamerican culture and loss of aboriginal territory and reservation land severely impacted the aboriginal subsistence cultures of the Shoshone and Bannock peoples. The Shoshone and Bannock cultures were initially affected by European colonization of the Americas through the introduction of the horse and subsequent migration of Euroamerican settlers into aboriginal territory. The horse brought profound changes to the Shoshone and Bannock cultures, including increased Plains Indian cultural influences. Settlers began establishing homesteads in the valleys of southeastern Idaho in the 1860s, increasing the conflicts with aboriginal people and providing the impetus for treaty-making by the Federal government (Murphy and Murphy 1986). The Fort Bridger Treaty of 1868 and associated Executive Orders designated the Fort Hall Reservation for mixed

Table 4-7. INTEC buildings and structures potentially eligible for listing in the National Register of Historic Places.

Building		Year built
CPP 601	Fuel Processing Building	1953
CPP 602	Laboratory and Office Building	1953
CPP 603	Fuel Receiving and Storage Building	1951
CPP 604	Waste Treatment Building	1953
CPP 605	Blower Building	1953
CPP 606	Service Building (Power House)	1953
CPP 608	Storage/Butler Building	1953
CPP 611	Pumphouse Deep Well Pump #1	1953
CPP 612	Pumphouse Deep Well Pump #2	1953
CPP 613	Substation #10	1953
CPP 616	Sewage Treatment Plant/Compressor	1953
CPP 617	Storage/Butler Building	1950s
CPP 619	Waste Control House	1955
CPP 620	Chemical Engineering Laboratory/High Bay Facility	1968
CPP 621	Chemical Storage Pumphouse	1955
CPP 627	Remote Analytical Facility/Hot Chemical Laboratory	1955
CPP 628	Tank Farm Control House	1953
CPP 630	Safety and Spectrometry	1956
CPP 631	Inactive/L-Cell Off-Gas Blower Room	1957
CPP 633	Waste Calcine Facility	1960
CPP 634	Waste Storage Pipe Manifold Building (WM-185)	1958
CPP 635	Waste Storage Pipe Manifold Building (WM-187/188)	1960
CPP 636	Waste Storage Pipe Manifold Building (WM-189/190)	1965
CPP 637	Process Improvement Facility/Office/Laboratories	1959
CPP 638	Waste Station (WM-180) Shielded Tank Transfer Building	1968
CPP 639	Instrumentation Building-Bin Set 1	1962
CPP 640	Headend Process Plant	1961
CPP 641	Westside Waste Holdup Tank Pumphouse	1961
CPP 642	Hot Waste Pumphouse and Pit	1958
CPP 646	Instrumentation Building-Bin Set 2	1966
CPP 651	Unirradiated Fuels Storage Facility[a]	1975
CPP 659	New Waste Calcining Facility and Substation #50[a]	1978
CPP 666	Fluorinel Dissolution and Fuel Storage Facility; Fluorinel Dissolution Process Facility; Fuel Storage Area[a]	1978
CPP 667	Waste Calcining Facility Office Building	1961
CPP 684	Remote Analytical Laboratory[a]	1985
CPP 691	Fuel Processing Restoration Building[a]	1993
CPP T-1, 5	Construction Management Buildings	1965
CPP TR-22, 24, 39, & 42	Offices	1960
CPP TR-43	Quality Assurance Receiving Inspection Building	1960

a. These buildings need to be reassessed by the State Historic Preservation Office.

bands of Shoshone and Bannock people. A separate reservation established for the Lemhi Shoshone was closed in 1907, and the Indians were forced to migrate across the area now occupied by INEEL to Fort Hall. The Federal government attempted to convert the traditional semi-nomadic subsistence lifestyle of the Shoshone and Bannock to one based on farming. These efforts were hampered by a lack of water, and early 20th century irrigation projects provided little relief, as they mainly benefited non-Indians (Murphy and Murphy 1986).

The original Fort Hall Reservation, consisting of 1,800,000 acres, has been reduced to approximately 544,000 acres through a series of cessions to accommodate the Union Pacific Railroad and the growing city of Pocatello. Other developments, including the flooding of portions of the Snake River Bottoms by the construction of the American Falls Reservoir, have also reduced the Shoshone-Bannock land base (Murphy and Murphy 1986).

The creation of INEEL also had an impact on the Shoshone-Bannock subsistence culture. Land withdrawals initiated by the U.S. Navy during World War II and continued by the Atomic Energy Commission during the Cold War all but eliminated Tribal access to traditional and sacred areas until recent years. In addition, development of facilities at INEEL over the past 50 years has impacted cultural resources of importance to the Tribes, including traditional and sacred areas as well as artifacts.

4.4.7 CONTEMPORARY CULTURAL PRACTICES AND RESOURCE MANAGEMENT

The efforts of the Shoshone-Bannock Tribes to maintain and revitalize their traditional culture are dependent on having continuing access to aboriginal lands, including some areas on INEEL. DOE accommodates Tribal member access to areas on INEEL for subsistence and religious uses. Tribal members continue to hunt big game, gather plant materials, and practice religious ceremonies in traditional areas that are accessible on public lands adjacent to INEEL. In this respect, INEEL continues to serve as a travel corridor for aboriginal people as it has for centuries, although traditional routes have changed due to INEEL access restrictions. DOE recognizes the unique interest the Shoshone-Bannock Tribes have in the management of INEEL resources and continues to consult with the Tribes in a government-to-government relationship.

The maintenance of pristine environmental conditions, including native plant communities and habitats, natural topography, and undisturbed vistas, is critical to continued viability of the Shoshone-Bannock culture. Contamination from past and ongoing operations at INEEL has the potential to affect plants, animals, and other resources that tribal members continue to use. Excavation and construction associated with environmental restoration and waste management activities also have the potential to disturb archaeological resources as well as plant communities and habitats. Possible impacts associated with hazardous and radioactive waste shipments from INEEL through the Fort Hall Reservation are also a concern to the Tribes. The Shoshone-Bannock Tribes will continue to monitor these potential impacts because INEEL and surrounding lands will continue to play a key role in maintaining the Shoshone-Bannock cultural identity.

The three buttes of INEEL: East Butte, Middle Butte, and Big Southern Butte.

4.5 Aesthetic and Scenic Resources

This section describes a baseline visual character of INEEL and the surrounding area, including designated scenic areas. The physical environment has been described extensively in the SNF & INEL EIS, Volume 2, Part A, Section 4.5 (DOE 1995).

4.5.1 VISUAL CHARACTER OF INEEL

INEEL is situated on the northwestern edge of the Eastern Snake River Plain. Volcanic cones, domes, and mountain ranges are visible from most areas on INEEL. Features of the natural landscape have a special importance to the Shoshone-Bannock Tribes, and some prominent features of the INEEL landscape are within the visual range of the Fort Hall Indian Reservation. The Bitterroot, Lemhi, and Lost River mountain ranges are visible to the north and west of INEEL. East Butte and Middle Butte can be seen near the southern boundary, while Circular and Antelope Buttes are visible to the northeast. Smaller volcanic buttes dot the natural landscape of INEEL, providing a striking contrast to the relatively flat ground surface. The viewscape in general consists of terrain dominated by sagebrush with an understory of grasses. Juniper is common near the buttes and foothills of the Lemhi range, while crested wheatgrass is scattered throughout INEEL.

Nine primary facility areas, which resemble commercial or industrial complexes, are located throughout INEEL (Figure 1-2). Structures generally range in height from 10 to 100 feet, with a few emission stacks and towers that reach 250

Bureau of Land Management Visual Resource Management Objectives[a]

Rating	Management objectives
Class I	The objective of this class is to preserve the existing character of the landscape. This class provides for natural ecological changes; however, it does not preclude very limited management activity. The level of change to the characteristic landscape should be very low and must not attract attention.
Class II	The objective of this class is to retain the existing character of the landscape. The level of change to the characteristic landscape should be low. Management activities may be seen but should not attract the attention of the casual observer. Any changes must repeat the basic elements of form, line, color, and texture found in the predominant natural features of the characteristic landscape.
Class III	The objective of this class is to partially retain the existing character of the landscape. The level of change to the characteristic landscape should be moderate. Management activities may attract attention but should not dominate the view of the casual observer. Changes should repeat the basic elements found in the predominant natural features of the characteristic landscape.
Class IV	The objective of this class is to provide for management activities that require major modification of the existing character of the landscape. The level of change to the characteristic landscape can be high. These management activities may dominate the view and be the major focus of viewer attention. However, every attempt should be made to minimize the impact of these activities through careful location, minimal disturbance, and repeating the basic elements.

a. BLM (1986a).

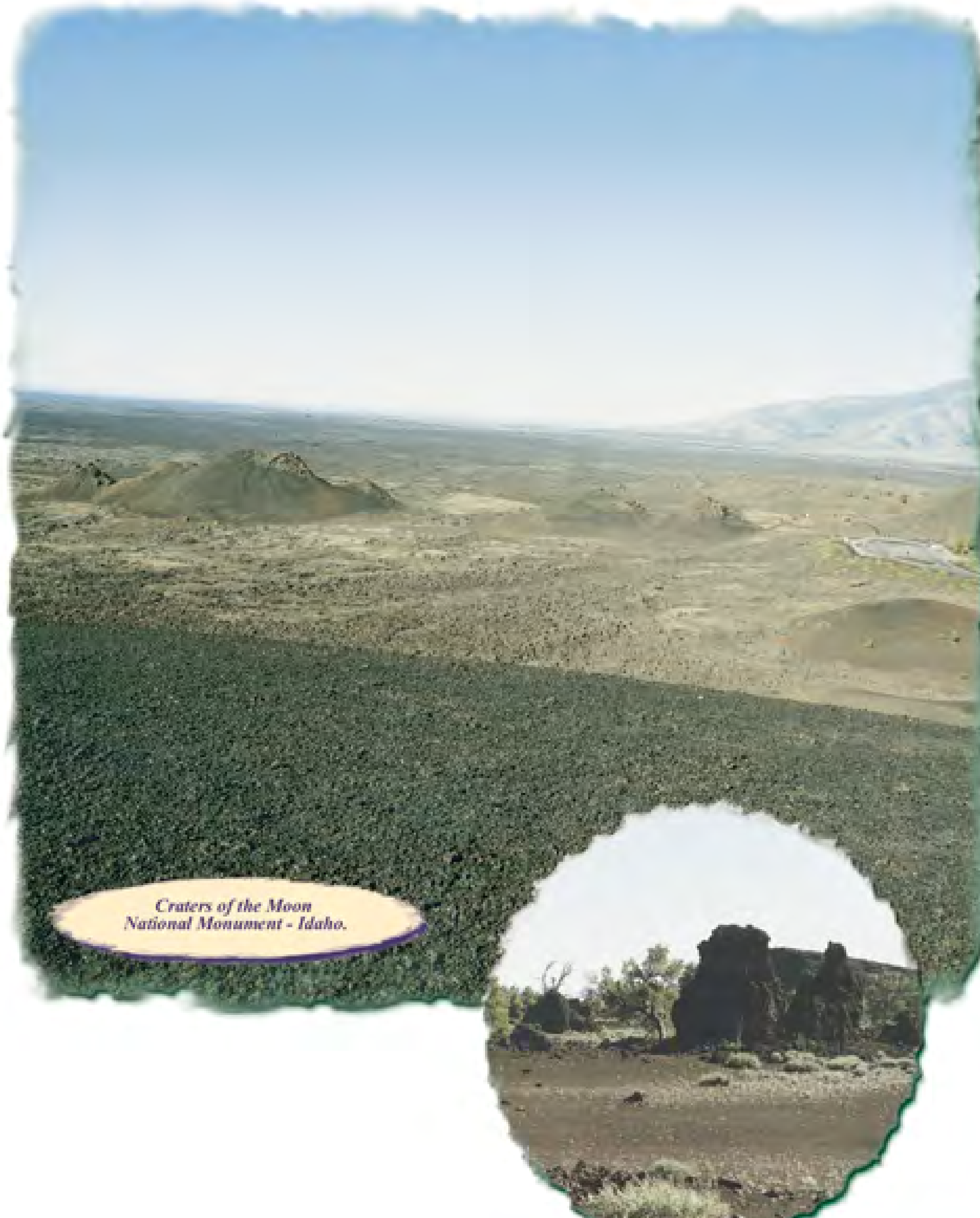
feet. Although many INEEL facilities are visible from public highways, most are located more than one-half mile from public roads.

Approximately 90 miles of public highways cross INEEL. U.S. Highway 20, which is traveled the most by the INEEL workforce, runs east to west across the southern portion of the site. U.S. Highway 26 runs southeast and northwest intersecting Highway 20, and State Highways 22, 28, and 33 cross the northeastern portion of INEEL (see Figure 4-2).

4.5.2 SCENIC AREAS

Lands within and adjacent to INEEL are subject to the Bureau of Land Management's Visual Resource Management Guidelines (BLM 1986a). Adjacent lands are designated as a visual resource Class II area, which allows for moderate industrial growth, preserving and retaining the existing character of the landscape. Lands within the boundaries of INEEL are designated as Class III and Class IV areas, allowing for partial retention of existing character and major modifications, respectively (BLM 1984).

Craters of the Moon National Monument's eastern boundary is located 26.8 miles southwest of INTEC's main stack. Craters of the Moon is located in an area designated as a Class I Wilderness Area for which minimal degradation must be maintained. Sources proposed for location near Class I areas must exercise consideration that the proposed source will not adversely impact values such as visibility and scenic views. The Bureau of Land Management is considering the Black Canyon Wilderness Study Area, located adjacent to INEEL, for Wilderness designation, which, if approved, would result in an upgrade of the Bureau of Land Management Visual Resource Management class for the area from Class II to Class I (BLM 1986b) Figure 4-2 shows these areas.


Craters of the Moon
National Monument - Idaho.

4.6 Geology and Soils

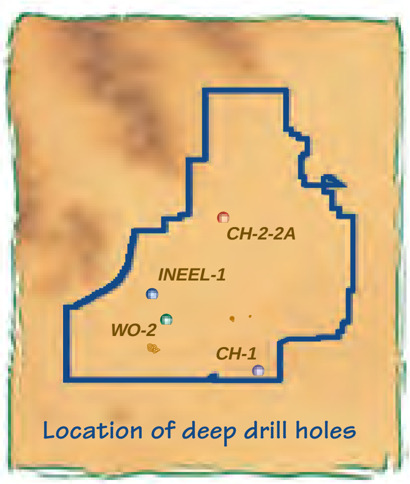
This section describes the geological, mineral resources, seismic, and volcanic characteristics of INEEL, INTEC, and surrounding areas. A more detailed description of geology at INEEL can be reviewed in the SNF & INEL EIS, Volume 2, Part A, Section 4.6 (DOE 1995).

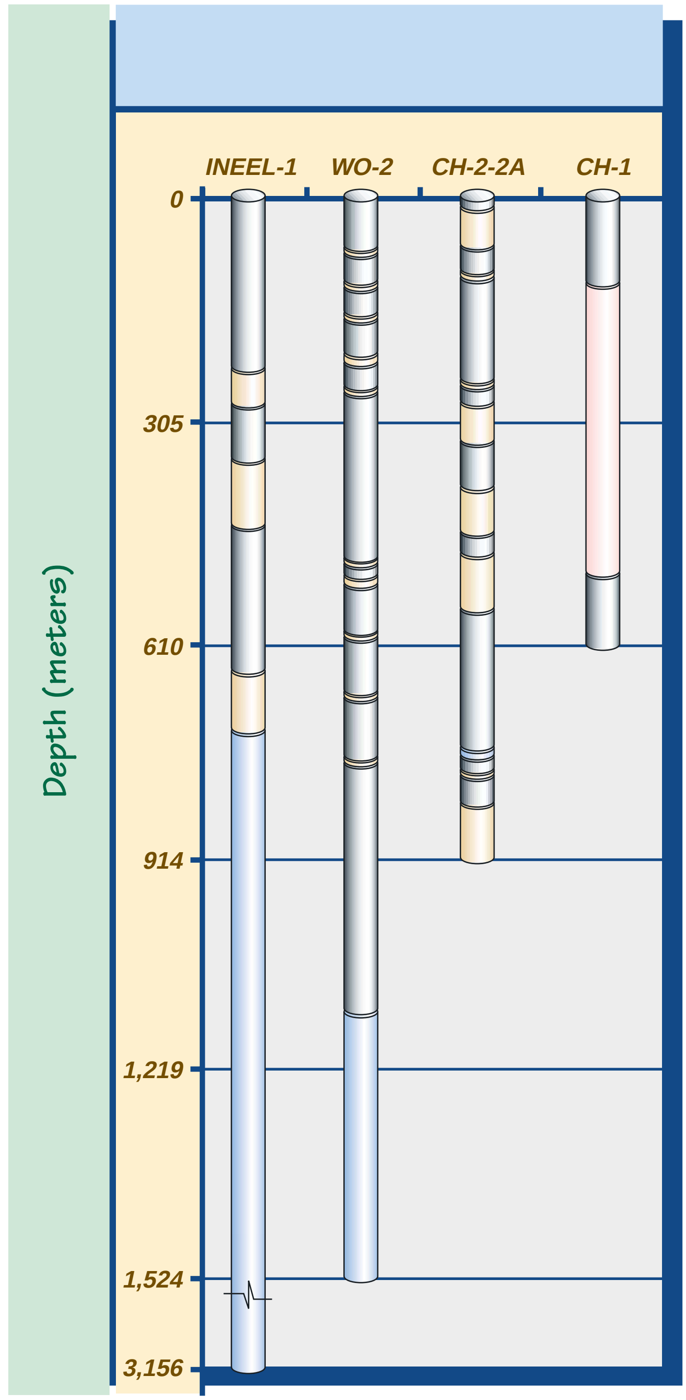
4.6.1 GENERAL GEOLOGY

INEEL occupies a relatively flat area on the northwestern edge of the Eastern Snake River Plain. Figure 4-6 shows important geological features of the INEEL area. The area consists of a broad plain that has been built up from the eruptions of multiple flows of basaltic lava, which is shown on Figure 4-7. The flows at the surface range in age from 1.2 million to 2,100 years. The Plain is bounded on the north and south by the north-to-northwest-trending mountains and valleys of the Basin and Range Provinces, 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 seismic characteristics of the Plain and the adjacent Basin and Range Province are different. Earthquakes and active faulting are associated with Basin and Range tectonic activity. The Plain, however, has historically experienced infrequent small-magnitude earthquakes (King et al. 1987; Pelton et al. 1990; Jackson et al. 1993; WCFS 1996). The major episode of Basin and Range faulting began 20 to 30 million years ago and continues today, most recently with the October 28, 1983 Borah Peak earthquake, which was located approximately 50 miles to the northwest of INEEL. The earthquake had a moment magnitude of 6.9 with a ground acceleration of 0.022 to 0.078*g* at INEEL (Jackson 1985). No significant damage occurred at the INEEL (Guenzler and Gorman 1985).

FIGURE 4-6.
Map of the Idaho National Engineering and Environmental Laboratory showing locations of volcanic rift zones.





LEGEND

- Quaternary basalt
- Major sedimentary interbed
- Quaternary rhyolite
- Tertiary rhyolite

SOURCE: Doherty (1979a,b), Doherty et al. (1979), and Hackett and Smith (1992).

FIGURE 4-7.
Lithologic logs of deep drill holes on INEEL.

Four northwest-trending volcanic rift zones are known to cut across the Plain at or near INEEL; they have been attributed to basaltic eruptions that occurred 4 million to 2,100 years ago (Hackett and Smith 1992; Hackett and Smith 1994; Kuntz et al. 1994).

INEEL surficial sediments are derived from rocks from nearby highlands. In the southern part of INEEL, the sediments are gravelly to rocky and generally shallow. The northern portion is composed mostly of unconsolidated clay, silt, and sand.

INTEC is situated adjacent to the Big Lost River in relatively flat terrain. Surface sediments are alluvial deposits of the Big Lost River composed of gravel-sand-silt mixtures 25 to 65 feet thick locally interbedded with silt and clay deposits 0 to 9.5 feet thick. The average elevation of INTEC is approximately 4,917 feet above mean sea level. Detailed stratigraphic information can be found in the *Comprehensive RI/FS for the Idaho Chemical Processing Plant OU3-13 at the INEEL - Part A RI/BRA Report* (Rodriguez et al. 1997).

In addition to routine radioactive releases to the percolation ponds, radioactive and hazardous materials have occasionally been released to surface soils at the INTEC. The Water Resources sections of Chapters 4 and 5 describe best management practices such as monitoring and spill control programs that have been implemented to prevent future releases. Soil sampling including the remedial investigation sampling in 1995, was used to support the Operable Unit 3-13 Remedial Investigation/Baseline Risk Assessment and is documented in the *Comprehensive RI/FS for the Idaho Chemical Processing Plant OU3-13 at the INEEL - Part A RI/BRA Report* (Rodriguez et al. 1997). Contaminants found in the soil at INTEC include metals, organic compounds, and radionuclides. Results from Comprehensive Environmental Response, Compensation, and Liability Act risk assessment investigations at INTEC indicate that radionuclides are the most significant soil contaminants. Table 4-8 estimates the existing radionuclide activity and mass of non-radionuclide contaminants of concern in soils at INTEC.

4.6.2 NATURAL RESOURCES

INEEL mineral resources include sand, gravel, pumice, silt, clay, and aggregate. These resources are extracted at several quarries or pits at INEEL and used for road construction and maintenance, new facility construction and maintenance, waste burial activities, and ornamental landscaping. INTEC uses mineral materials extracted from the Test Reactor Area gravel pit 1 mile west of INTEC and the Lincoln Boulevard gravel pit approximately 7 miles north of INTEC. The geologic history of the Plain makes the potential for petroleum production at INEEL very low. The potential for geothermal energy exists at INEEL; however, a study conducted in 1979 identified no economic geothermal resources (Mitchell et al. 1980).

4.6.3 SEISMIC HAZARDS

The Snake River Plain has a relatively low rate of seismicity, whereas the surrounding Basin and Range has a fairly high rate of seismicity (WCFS 1996). The primary seismic hazards from earthquakes to INEEL facilities consist of the effects from ground shaking and surface deformation (surface faulting, tilting). Other potential seismic hazards such as avalanches, landslides, mudslides, and soil liquefaction are not likely to occur at INEEL because the local geologic conditions and terrain are not conducive to these types of hazards. Based on the seismic history and the geologic conditions, earthquakes greater than moment magnitude of 5.5 and associated strong ground shaking and surface fault rupture are not likely to occur within the Plain, but have been evaluated as part of a probabilistic seismic hazard analysis (WCC 1990; WCFS 1996). However, moderate to strong ground shaking could affect INEEL from earthquakes in the Basin and Range.

Table 4-8. Estimated activity of radionuclide and mass of non-radionuclide contaminants of concern in soils at INTEC.[a, b]

Radionuclide contaminant	Total activity (curies)	Non-radionuclide contaminant	Total mass (pounds)
Americium-241	110	Arsenic	1,000
Cesium-137	30,000	Chromium	300
Cobalt-60	170	Mercury	1,400
Iodine-129	0.13		
Neptunium-237	1.4		
Total Plutonium	1200		
Strontium-90	19,000		

a. Total volume of contaminated soil is approximately 240,000 cubic yards. Depth of contaminated soils ranges from surface to nearly 50 feet.
b. Source: Data from Rodriguez et al. (1997), Table 5-42. Includes soil contamination, known releases and service waste discharges (excluding injection well discharges).

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 INEEL, and specifically at INTEC. The principal sources of earthquakes that could produce ground motion at INEEL facilities are (WCC 1990; WCFS 1996):

- Faults – The three major range-front faults northwest of INEEL (see Figure 4-6):

  – Beaverhead Fault
  – Lost River Fault
  – Lemhi Fault

- Volcanic Zones – The Volcanic Zones on and around INEEL (see Figure 4-6):

  – Arco Volcanic Rift Zone
  – Axial Volcanic Zone
  – Great Rift Volcanic Rift Zone
  – Lava Ridge-Hell's Half Acre Volcanic Rift Zone
  – Howe-East Butte Volcanic Rift Zone

  - **Source Zones –** Other regional source zones that could potentially produce earthquakes affecting INEEL:

    - Eastern Snake River Plain background seismicity
    - Northern Intermountain Seismic Belt 15 miles north northeast of INEEL
    - Northern Basin and Range adjacent to and northwest of INEEL
    - Central Basin and Range 50 miles southwest of INEEL
    - Idaho Batholith 50 miles west of INEEL
    - Yellowstone 70 miles northeast of INEEL

INEEL seismic design basis events are determined by the INEEL Natural Phenomena Committee and incorporated into the INEEL Architectural and Engineering Standards based on seismic studies (WCC 1990). New facilities and facility upgrades are designed in accordance with the requirements specified in the DOE-ID Architectural and Engineering Standards (DOE 1998), DOE Order 420.1, and *DOE Standard Natural Phenomena Hazards Design and Evaluation Criteria for Department of Energy Facilities* (DOE 1997). The mean peak ground acceleration, determined by the INEEL Natural Phenomena Committee, will be incorporated into the architectural and engineering standards. Section 5.2.14, Facility Accidents, presents the potential impacts of postulated seismic events.

4.6.4 VOLCANIC HAZARDS

Volcanic hazards include the effects of lava flows, fissures, uplift, subsidence, volcanic earthquakes, and ash flows or airborne ash deposits (Hackett and Smith 1994). Most of the basalt volcanic activity occurred from 4 million to 2,100 years ago in the INEEL area. The most recent and closest volcanic eruption occurred at the Craters of the Moon National Monument 26.8 miles southwest of INTEC's main stack (Kuntz et al. 1992). Based on probability analysis of the volcanic history in and near the south central INEEL area, the Volcanism Working Group (VWG 1990) estimated that the conditional probability that basaltic volcanism would affect a south-central INEEL location is less than once per 100,000 years or longer. The probability is associated primarily with the Axial Volcanic Zone and the Arco Volcanic Rift Zones. INTEC is located in a lesser lava flow hazard area of INEEL, more than 5 miles from the Axial Volcanic Zone and any volcanic vent younger than 400,000 years. The probability that basaltic volcanism would affect a south-central INEEL location is less than 2.5×10^{-5} (once per 40,000 years or longer. Because of the low probability of volcanic activity during the project duration, volcanism is not discussed further in this section.

4.7 Air Resources

This section describes the air resources of INEEL 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 levels of air pollutants. Emphasis is placed on changes in air resource conditions since the characterization performed to support the SNF & INEL EIS, Volume 2, Part A, Section 4.7 (DOE 1995), from which this EIS is tiered. Additional detail and background information on the material is presented in Appendix C.2, Air Resources.

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 18.8°F in winter to 64.8°F in summer, with an annual average temperature of about 42°F (DOE 1995). Temperature extremes range from a summertime maximum of 103°F to a wintertime minimum of -49°F. Annual precipitation is light, averaging 8.7 inches, with monthly extremes of 0 to 5 inches. The maximum 24-hour precipitation is 1.8 inches. The greatest short-term precipitation rates are primarily attributable to thunderstorms, which occur approximately 2 or 3 days per month during the summer. Average annual snowfall at INEEL is 27.6 inches, with extremes of 59.7 inches and 6.8 inches.

Most onsite locations experience the predominant southwest/northeast wind flow of the Eastern Snake River Plain, although terrain features near some locations cause variations from this flow regime. The wind rose diagrams in Figure 4-8 show annual wind flow. These diagrams show the frequency of wind direction (i.e., the direction from which the wind blows) and speed at three of the meteorological monitoring sites on INEEL for the period 1988 to 1992. Multi-year wind roses exhibit little variability and are representative of typical patterns. INEEL wind rose diagrams reflect the predominance of southwesterly winds that result during storm passage and from daily solar heating. Winds from this direction are frequently unstable or neutral, promote effective dispersion, and extend to a considerable depth through the atmosphere. At night, cool, stable air frequently drains down the valley in a shallow layer from the northeast toward the southwest. Under these conditions, dispersion is limited until solar heating the following day mixes the plume through the mixed depth or the height above the ground to which the plume can freely diffuse. Winds above such stable layers exhibit less variability and provide the transport environment for materials released from INEEL sources.

The highest hourly average near-ground wind speed measured onsite is 51 miles per hour from the west-southwest, with a maximum instantaneous gust of 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 were reported onsite between 1950 and 1997. 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 National Monument, which is approximately 27 miles west-southwest of INTEC, the annual average visual range is 144 miles (visual range at the time the SNF & INEL EIS analyses were performed was 97 miles) (Notar 1998).

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 sources of human origin, (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 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 Clean Air Act. INEEL activities are subject to air quality regulations and standards established under the Clean Air Act and by the State of Idaho (IDHW 1997) and to internal policies and requirements of DOE.

INEEL occupies portions of 3 counties (Butte, Jefferson, and Bingham) in east-central Idaho that are in attainment or are unclassified for all National Ambient Air Quality Standards. Parts of Bannock County (approximately 30 miles southeast of the INEEL boundary) and Power County (approximately 35 miles south of the INEEL boundary) are designated nonattainment areas for a single criteria pollutant, particulate matter (PM-10). Air quality standards and programs applicable to INEEL operations are summarized in Appendix C.2.

4.7.3 RADIOLOGICAL AIR QUALITY

The population of the Eastern Snake River Plain is exposed to environmental radiation of both natural and human origin. This section summarizes the sources and amounts of radiation exposure in this geographical region, including sources of airborne radionuclide emissions from INEEL.

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 INEEL 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 worldwide 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 about 360 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 (DOE 1997a).

INEEL operations can release radioactivity to air either directly (such as through stacks or vents) or indirectly (such as by resuspension of radioactivity from contaminated soils). Emissions from INEEL facilities include radioisotopes of 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. Table 4-9 provides a summary of the principal types of airborne radioactivity emitted during 1995 and 1996 from INEEL facilities. Releases during this period exclude calciner operations but are more conservative in that the maximally exposed individual (MEI) dose was higher.

Table 4-9. Summary of airborne radionuclide emissions (in curies) for 1995 and 1996 from facility areas at INEEL.[a,b]

	Tritium/ carbon-14		Iodines		Noble gases		Mixed fission and activation products[c]		U/Th/TRU[d]	
Area	1995	1996	1995	1996	1995	1996	1995	1996	1995	1996
Monitored sources										
Argonne National Lab – West	–[e]	8.9	–	–	10	1.0×10^{3}	7.9×10^{-7}	3.5×10^{-6}	3.1×10^{-5}	3.2×10^{-5}
Central Facilities Area	–	–	–	–	–	–	–	–	–	–
INTEC	4.4	140	9.6×10^{-3}	0.06	6.6×10^{-4}	0.03	4.3×10^{-4}	3.4×10^{-4}	1.1×10^{-6}	6.5×10^{-6}
Naval Reactors Facility	–	–	–	–	–	–	–	–	–	–
Power Burst Facility	0.04	0.04	2.7×10^{-5}	2.7×10^{-5}	–	–	–	–	–	–
RWMC[f]	–	–	–	–	–	–	–	–	–	–
Test Area North	–	–	–	–	–	–	–	–	–	–
Test Reactor Area	–	–	–	–	–	–	–	–	–	–
INEEL Total	4.4	150	9.6×10^{-3}	0.06	10	1.0×10^{3}	4.3×10^{-4}	3.4×10^{-4}	3.2×10^{-5}	3.8×10^{-5}
Other release points										
Argonne National Lab – West	0.06	0.02	–	–	–	5.1×10^{-4}	1.2×10^{-5}	7.8×10^{-6}	2.8×10^{-7}	1.3×10^{-7}
Central Facilities Area	–	–	–	–	–	–	3.1×10^{-6}	3.1×10^{-6}	1.2×10^{-5}	1.3×10^{-5}
INTEC	2.1×10^{-4}	2.1×10^{-8}	1.8×10^{-9}	1.8×10^{-9}	–	–	3.6×10^{-4}	4.3×10^{-3}	6.4×10^{-6}	2.0×10^{-6}
Naval Reactors Facility	0.86	1.3	0.01	2.4×10^{-5}	0.45	0.05	8.9×10^{-6}	3.5×10^{-4}	–	4.9×10^{-6}
Power Burst Facility	–	–	–	–	–	–	1.7×10^{-7}	5.8×10^{-7}	4.0×10^{-8}	1.5×10^{-7}
RWMC	–	–	–	–	–	–	1.4×10^{-13}	1.4×10^{-5}	–	2.0×10^{-6}
Test Area North	6.8×10^{-3}	1.4×10^{-4}	–	–	–	–	2.8×10^{-6}	4.5×10^{-6}	1.4×10^{-5}	1.3×10^{-6}
Test Reactor Area	13	13	0.01	2.9×10^{-3}	1.4×10^{3}	1.8×10^{3}	3.4	6.0	2.5×10^{-6}	9.0×10^{-6}
INEEL Total	14	14	0.01	2.9×10^{-3}	1.4×10^{3}	1.8×10^{3}	3.4	6.0	3.5×10^{-5}	3.2×10^{-5}
Fugitive sources										
Argonne National Lab – West	–	–	–	–	–	–	–	–	–	–
Central Facilities Area	6.6	5.6	–	–	–	–	1.9×10^{-5}	1.9×10^{-5}	6.6×10^{-8}	6.4×10^{-8}
INTEC	8.9×10^{-9}	8.9×10^{-9}	3.8×10^{-8}	3.8×10^{-8}	–	–	9.2×10^{-6}	1.6×10^{-6}	5.9×10^{-8}	5.7×10^{-8}
Naval Reactors Facility	–	1.3	–	2.4×10^{-5}	–	–	7.8×10^{-5}	2.8×10^{-4}	–	5.0×10^{-6}
Power Burst Facility	–	0.01	–	–	–	–	5.8×10^{-5}	5.8×10^{-5}	1.5×10^{-7}	1.5×10^{-7}
RWMC	900	700	–	–	–	–	1.4×10^{-5}	1.4×10^{-5}	9.5×10^{-9}	9.5×10^{-9}
Test Area North	0.06	0.06	–	–	–	–	3.5×10^{-6}	1.3×10^{-4}	9.4×10^{-8}	9.4×10^{-8}
Test Reactor Area	80	80	–	–	–	–	0.01	0.1	3.0×10^{-4}	2.9×10^{-4}
INEEL Total	1,000	790	3.8×10^{-8}	2.4×10^{-5}	–	–	0.01	0.1	3.0×10^{-4}	3.0×10^{-4}
Total INEEL releases										
Argonne National Lab.-West	0.06	8.9	–	–	10	1.0×10^{3}	1.3×10^{-5}	1.1×10^{-5}	3.2×10^{-5}	3.2×10^{-5}
Central Facilities Area	6.6	5.6	–	–	–	–	2.2×10^{-5}	2.2×10^{-5}	1.2×10^{-5}	1.3×10^{-5}
INTEC	4.4	140	9.6×10^{-3}	0.06	6.6×10^{-4}	0.03	8.0×10^{-4}	4.6×10^{-3}	7.5×10^{-6}	8.6×10^{-6}
Naval Reactors Facility	0.86	2.6	5.4×10^{-6}	4.8×10^{-5}	0.49	0.05	8.7×10^{-5}	6.3×10^{-4}	–	9.9×10^{-6}
Power Burst Facility	0.04	0.06	2.7×10^{-5}	2.7×10^{-5}	–	–	5.8×10^{-5}	5.9×10^{-5}	1.9×10^{-7}	3.0×10^{-7}
RWMC	900	700	–	–	–	–	1.4×10^{-5}	2.8×10^{-5}	9.5×10^{-9}	2.0×10^{-6}
Test Area North	0.07	0.06	–	–	–	–	6.2×10^{-6}	1.4×10^{-4}	1.4×10^{-5}	1.4×10^{-6}
Test Reactor Area	93	93	0.01	2.9×10^{-3}	1.4×10^{3}	1.8×10^{3}	3.4	6.1	3.0×10^{-4}	3.0×10^{-4}
INEEL Total	1.0×10^{3}	950	0.02	0.06	1.4×10^{3}	2.9×10^{3}	3.4	6.2	3.7×10^{-4}	3.7×10^{-4}

a. Source: DOE (1996, 1997b). Used 1995 and 1996 sources based on most recent years that calciner did not operate because calciner is considered an impact.
b. Emissions are representative of years, in which calcining does not occur.
c. Mixed fission and activation products that are primarily particulate in nature (e.g., cobalt-60, strontium-90, and cesium-137).
d. U/Th/TRU = Radioisotopes of heavy elements such as uranium, thorium, plutonium, americium, and neptunium.
e. – = Negligibly small or zero.
f. RWMC = Radioactive Waste Management Complex.

4.7.3.2 Existing Radiological Conditions

Monitoring and assessment activities are conducted to characterize existing radiological conditions at INEEL and the 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 in the following sections for both onsite and offsite environments.

It is important to note that characterizations of existing conditions described in this section do not take into account increases in radionuclide emissions and radiation doses that are projected to occur between the present and the time that the alternatives proposed in this EIS would be implemented. These “reasonably foreseeable increases” are assessed in combination with existing conditions and impacts associated with the proposed alternatives in Section 5.4, Cumulative Impacts.

Radiation Levels on and Around INEEL

DOE compared radiation levels monitored on and near INEEL with those monitored at distant locations to determine radiological conditions. Figure 4-9 shows the offsite dosimeter locations, as well as locations where various food products are collected for radioactivity analysis. Results from onsite and boundary community locations include contributions from background conditions and INEEL emissions. Distant locations represent background conditions beyond the influence of INEEL emissions. These data show that over the most recent 5-year period for which results are available (1992 through 1996), average radiation exposure levels for the boundary locations were no different than those at distant stations. The average annual dose measured by the Environmental Science and Research Foundation, Inc. during 1996 was 123 millirem for distant locations and 124 millirem for boundary community locations. The corresponding averages measured were 127 millirem for the distant group and 125 millirem for the boundary group. These differences are well within the range of normal variation. On INEEL, dosimeters around some facilities may show slightly elevated levels, since many are intentionally placed to monitor dose rate in areas adjacent to radioactive material storage areas or areas of known soil contamination (DOE 1997a).

Additional environmental monitoring is also conducted by the State of Idaho’s INEEL Oversight Program. The Oversight Program routinely samples the air, groundwater, soil, and milk on and around INEEL and has also established a network of stations using pressurized ion chambers for real time radiation monitoring around the site. The Oversight Program also conducts special studies in environmental monitoring as needed.

Onsite Doses

The SNF & INEL EIS (Volume 2, Section 4.7) assessed the radiation dose to workers at major INEEL facility areas that results from radionuclide emissions from INEEL facilities. For purposes of radiological assessment, such a person is referred to as a “noninvolved” worker since the worker is not directly working with the source of the exposure being assessed (such as airborne radionuclide releases from adjacent or distant facilities). The SNF & INEL EIS analysis (Section 4.7.3.2.1) indicated that a representative value for maximum dose at any onsite area resulting from existing sources and other sources expected (at the time the analysis was performed) to become operational before 1995 was 0.32 millirem per year. However, that projected dose includes contributions from activities (e.g., compacting and sizing activities at the Waste Experimental Reduction Facility) which are not expected to operate over the period covered by this EIS. An update of the maximum onsite dose is described in Appendix C.2; the revised estimate is 0.21 millirem per year. This dose is a very small fraction of the DOE-established occupational dose limit (5,000 millirem per year) and is below the National Emissions Standards for Hazardous Air Pollutants dose limit of 10 millirem per year. This limit applies to the maximally exposed member of the public (not to workers) but is the most restrictive limit for airborne releases and serves as a useful comparison.

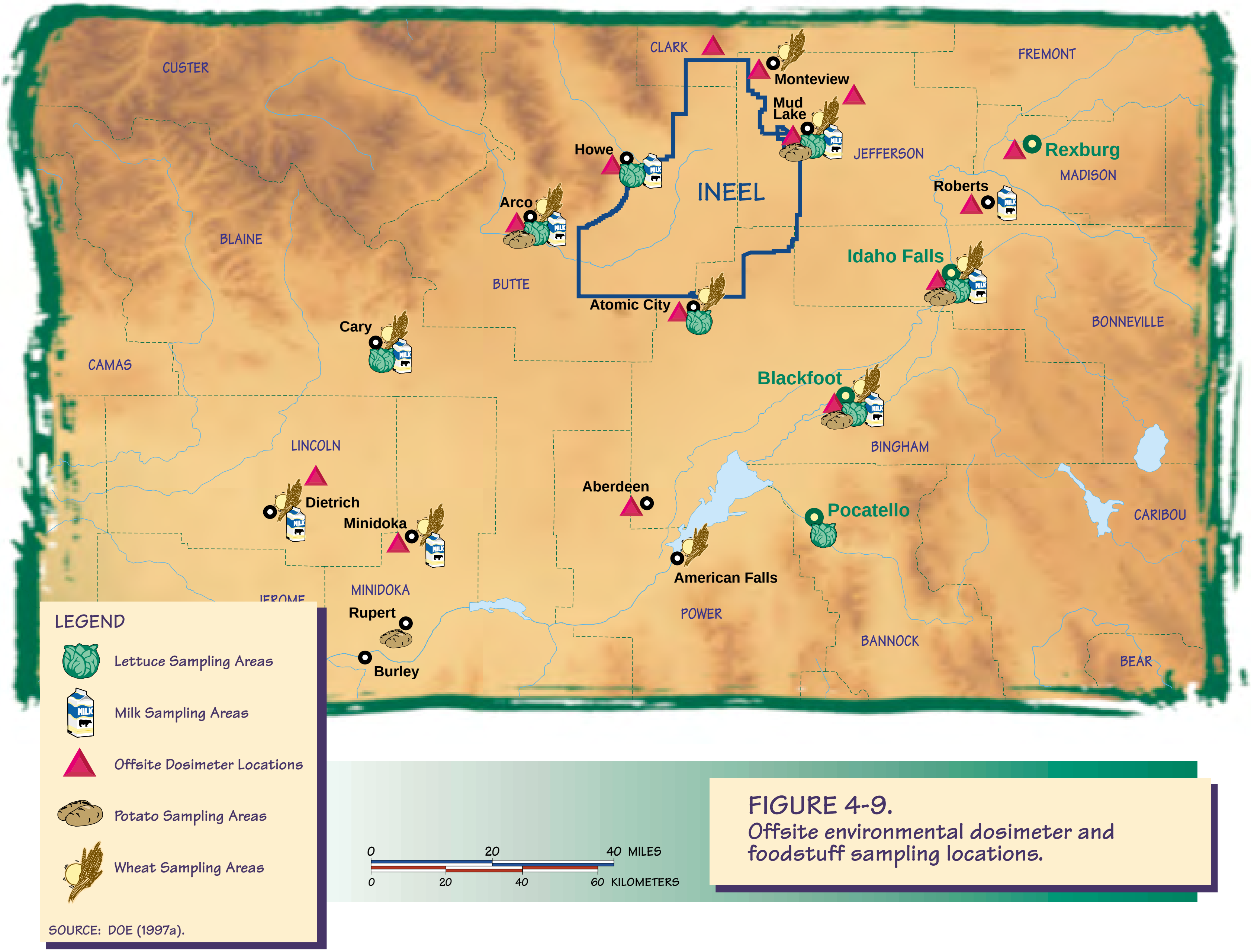


FIGURE 4-9.
Offsite environmental dosimeter and foodstuff sampling locations.

Offsite Doses

The offsite population could receive a radiation dose as a result of radiological conditions directly attributable to INEEL operations. The dose associated with radiological emissions is assessed annually to demonstrate compliance with the National Emissions Standards for Hazardous Air Pollutants. The effective annual dose equivalent to the maximally exposed individual resulting from radionuclide emissions from INEEL facilities during 1995 and 1996 has been estimated at 0.018 millirem and 0.031 millirem, respectively (DOE 1996, 1997b). These doses are well below both the Environmental Protection Agency dose limit (10 millirem per year) and the dose received from background sources (about 360 millirem per year).

The SNF & INEL EIS provides an estimate of the collective dose to the population surrounding INEEL as a result of air emissions from all facilities that were expected (at the time the analysis was performed) to become operational before June 1, 1995. The annual collective dose to the surrounding population, based on 1990 U.S. Census Bureau data, was estimated at 0.3 person-rem. This dose applies to a total population of about 120,000 people (based on 1990 U.S. Census Bureau data), resulting in an average individual dose of less than 3×10^{-3} millirem. For comparison, this population receives an annual collective dose from background sources of about 43,000 person-rem. An update of the existing population dose is described in Appendix C.2; the revised estimate is about 0.09 person-rem per year.

It should be noted that the collective dose depends not only on the types and levels of emissions, but also on the size and distribution pattern of the surrounding population. Population data were derived from the Census Bureau Tiger/Line files. When a census tract lay partly with the 50-mile INTEC radius, it was assumed that the fraction of the population within the 50-mile radius was proportional to the area within the radius. The future baseline population dose could increase even if emission rates do not change. If emission rates remained constant, the collective dose would increase by an amount that corresponds directly to the population growth rate.

Foreseeable Increases to Baseline

DOE also considered the dose contributed by other foreseeable INEEL projects (that is, projects other than those associated with waste processing alternatives or facility disposition). Estimated annual doses from foreseeable projects are documented in Appendix C.2, (Table C.2-8). The combined effects of existing and foreseeable sources result in the following annual baseline doses:

- Noninvolved worker - 0.29 millirem
- Maximum offsite individual - 0.16 millirem
- Population - 0.92 person-rem

4.7.3.3 Summary of Radiological Conditions

Radioactivity and radiation levels resulting from INEEL air emissions are very low, well within applicable standards, and negligible when compared to doses received from natural background sources. These levels apply to onsite conditions to which INEEL 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 later Section 4.11, 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 wood burning, wind-blown dust, and automobile exhaust. Many of the activities at INEEL 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 are nitrogen dioxide, sulfur dioxide, carbon monoxide, lead, ozone, and respirable particulate matter less than or equal to 10 microns in size (particles that are small enough to pass easily into the lower respiratory tract), for which National Ambient Air Quality Standards have been established. Volatile organic compounds and nitrogen oxides are assessed as precursors leading to the development of ozone. Toxic air pollutants include cancer-causing agents, such as arsenic, benzene, carbon tetrachloride, and formaldehyde, as well as substances that pose 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 INEEL facilities and activities are similar to those of other major industrial complexes.

Combustion sources such as thermal treatment processes, boilers, and emergency generators emit both criteria and toxic air pollutants. Sources such as nonthermal chemical processing operations, waste management activities (other than combustion), and research laboratories emit primarily toxic air pollutants. Waste management, construction, and related activities (such as excavation) also generate fugitive particulate matter.

The SNF & INEL EIS (Volume 2, Section 4.7) characterizes baseline emission rates for existing facilities for two separate cases. The actual emissions case represented the collective emission rates of nonradiological pollutants experienced by INEEL facilities during 1991 for criteria pollutants and 1989 for toxic air pollutants. The maximum emissions case represented a scenario in which all permitted sources at INEEL are assumed to operate in such a manner that they emit specific pollutants to the maximum extent allowed by operating permits or applicable regulations. These emissions were also adjusted to take projected increases (through June 1995) into account.

Actual INEEL-wide emissions for 1996 and 1997 are presented in DOE/ID-10594 and DOE/ID-10646, respectively (DOE 1997c; DOE 1998). Table 4-10 presents a comparison of actual criteria pollutant emissions during 1996 and 1997 with levels previously assessed in the SNF & INEL EIS under the maximum emissions case. For each criteria pollutant, the current (1996 to 1997) emission rates are less than the levels assessed in the SNF & INEL EIS. In the case of lead, the annual average emission rate for 1997 was about 80 percent of the level in the SNF & INEL EIS. For volatile organic compounds, the SNF & INEL EIS assessed levels of individual compounds but did not identify the combined emission rate. For all other criteria pollutants, the levels assessed in the SNF & INEL EIS are greater than actual 1996-1997 emission rates by a wide margin. Appendix C.2 (Table C.2-15) describes the ambient air concentrations of criteria air pollutants, including lead, which are associated with actual 1997 INEEL emissions.

It should also be noted that the New Waste Calcining Facility, which historically has been the single largest source of nitrogen dioxide emissions at the INEEL, did not operate during 1996 (DOE 1997a). In this EIS, DOE analyzes the effects of the New Waste Calcining Facility in conjunction with the specific waste processing alternatives with which this facility is associated.

DOE has also conducted a screening level risk assessment to evaluate potential adverse human health and environmental effects that could result from the continued operation of the New Waste Calcining Facility. This evaluation included the operation of the calciner, as well as related systems such as the High-Level Liquid Waste Evaporator and Liquid Effluent Treatment and Disposal Facility. The results of this evaluation demonstrate that all the potential excess cancer risk, noncarcinogenic health effects, lead exposure, and short-term air concentrations are within acceptable EPA or state limits. One compound (1,3-dinitrobenzene) evaluated in the Screening Level Ecological Risk Assessment exceeded its Ecologically-Based Screening Level (EBSL) at its maximum point. The average soil concentration for this contaminant in the area of major depositional impact was less than the EBSL. In addition, actual impacts would be significantly less because of conservatism in emissions calculations (Abbott et al. 1999).

The SNF & INEL EIS identifies 26 toxic air pollutants that were emitted from INEEL 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.) For a few toxic air pollutants, actual 1996 emissions were greater than the levels assessed in the SNF & INEL EIS. These increases were primarily attributable to decontamination and decommissioning activities.

The specific regulations governing toxic emissions from alternatives proposed in this EIS are contained in Sections 585 (for non-carcinogenic toxic air pollutants) and 586 (for carcinogens) of Rules for the Control of Air Pollution in Idaho. Unlike criteria pollutants, the toxic standards apply only to incremental increases of these pollutants, and not the sum of baseline levels and incremental increases.

Table 4-10. Comparison of recent criteria air pollutant emissions estimates for INEEL with the levels assessed under the maximum emissions case in the SNF & INEL EIS.

	SNF & INEL EIS		Actual sitewide emissions					
	Maximum baseline case		1996[a]			1997[b]		
Pollutant	Maximum hourly (kg/hr)	Annual average (kg/yr)	Actual hourly (kg/hr)	Maximum hourly (kg/hr)	Annual average (kg/yr)	Actual hourly (kg/hr)	Maximum hourly (kg/hr	Annual average (kg/yr)
Carbon monoxide	250	2,200,000	73	160	160,000	59	120	450,000
Nitrogen dioxide	780	3,000,000	220	640	220,000	420	450	820,000
Respirable particulates[c]	290	900,000	30	45	180,000	29	43	180,000
Sulfur dioxide	350	1,700,000	68	300	120,000	38	260	91,000
Lead compounds	0.8	68	0.27	1.9	1.5	0.03	0.8	560
VOCs[d]	ns[e]	ns	43	59	16,000	24	37	27,000

a. Source: (DOE 1997c).
b. Source: (DOE 1998).
c. The particle size of particulate matter emissions is assumed to be in the respirable range (less than 10 microns).
d. VOCs = volatile organic compounds, excluding methane.
e. ns = not specified; the SNF & INEL EIS (Section 4.7) evaluated emissions of specific types of VOCs from individual facilities, but did not include a total for the maximum baseline case.

4.7.4.2 Existing Conditions

The assessment of nonradiological air quality described in the SNF & INEL EIS was based on the assumption that the available monitoring data are not sufficient to allow a meaningful characterization of existing air quality and that such a characterization must rely 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 Environmental Protection Agency and the State of Idaho for regulatory compliance purposes. The methodology applied in the assessments performed for the SNF & INEL EIS is described in Appendix F-3 of that document. The remainder of this section describes the results of the assessments in the SNF & INEL EIS for air quality conditions in the affected environment (i.e., concentrations of pollutants in air within and around INEEL). Potential changes in the affected air environment resulting from changes in INEEL emission levels (compared to those at the time the assessments in the SNF & INEL EIS were performed) are also discussed.

Onsite Conditions

The SNF & INEL EIS contains an assessment of existing conditions as a result of cumulative toxic air pollutant emissions from sources located within all areas of INEEL. Criteria pollutant levels were assessed only for ambient air locations, (i.e., locations to which the general public has access.) The onsite levels were compared to occupational exposure limits established to protect workers. With one exception, the estimated onsite concentrations were estimated at levels well below the occupational standards. The exception was for maximum short-term benzene concentration, which slightly exceeded the standard at the maximum predicted location within the Central Facilities Area. Those levels result primarily from gasoline and diesel fuel storage tank emissions at the Central Facilities Area-754 Tank Farm; however, those tanks were taken out of service in 1995, and current benzene levels are estimated to be below the occupational standard for that substance.

Offsite Conditions

Estimated maximum offsite pollutant concentrations were assessed in the SNF & INEL EIS for locations along the INEEL boundary, public roads within the site boundary, and at Craters of the Moon Wilderness Area. The results for baseline criteria pollutant levels (i.e., levels associated with facilities that existed or were projected to operate before mid-1995) are presented in the SNF & INEL EIS. These results, summarized in Table 4-11, indicate that all concentrations are well within the ambient air quality standards.

In the SNF & INEL EIS, concentrations of criteria pollutants from existing INEEL sources were also compared to Prevention of Significant Deterioration criteria (called “increments”), which have been established to ensure that air quality remains good in those areas that are in compliance with ambient air quality standards (see Appendix C.2, Section C.2.2.2 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 for sulfur dioxide, respirable particulates, and nitrogen dioxide. The National Park Service establishes classifications for air quality. Separate increments are established for pristine areas, such as national parks or wilderness areas (termed Class I areas; see Section 4.5, Aesthetic and Scenic Resources, for a description of the Visual Resource Management ratings) and for the nation as a whole (Class II areas). Craters of the Moon Wilderness Area is the Class I area nearest INEEL, while the site boundary and public roads are the applicable Class II areas.

The amount of increment consumed by existing sources subject to Prevention of Significant Deterioration regulation has been updated for this EIS. Table 4-12 presents results for increment consumption at Craters of the Moon Wilderness Area Class I area, and Table 4-13 presents results for the Class II area on and around INEEL. These results represent the estimated amount of Prevention of Significant Deterioration increment consumed by the effects

Table 4-11. Ambient air concentrations of criteria pollutants from the combined effects of maximum baseline emissions and projected increases.

Pollutant	Averaging time	Maximum projected concentration ($\mu g/m^3$)[a] Site boundary	Public roads	Craters of the Moon Wilderness Area	Applicable standard[b] ($\mu g/m^3$)	Percent of standard Site boundary	Public roads	Craters of the Moon Wilderness Area
Carbon monoxide	1-hour	530	1,300	140	40,000	1	3	0.3
	8-hour	170	310	30	10,000	2	3	0.3
Nitrogen dioxide	Annual	7.3	11	0.6	100	7	11	1
Sulfur dioxide	3-hour	220	600	62	1,300	17	46	5
	24-hour	53	140	11	370	15	38	3
	Annual	2.5	6.2	0.3	80	3	8	0.4
Respirable particulates[c]	24-hour	20	35	3.2	150	13	24	2
	Annual	0.77	3.5	0.12	50	2	7	0.2
Lead	Quarterly	2.0×10^{-3}	5.0×10^{-3}	1.0×10^{-4}	1.5	0.2	0.3	0.01

a. Includes contribution from existing sources and projected increases (as described in Section 4.7.3.2).

b. All standards are primary air quality standards (designed to protect public health), except for 3-hour sulfur dioxide, which is a secondary standard (designed to protect public welfare).

c. Assumes all particulate matter emissions are of respirable size (i.e., less than 10 microns). Particulate matter concentrations do not include fugitive dust from activities such as construction. Additional standards for smaller sized particles (2.5 microns and less) have been promulgated. Current air quality levels are well within the proposed standards.

of emissions from existing INEEL sources that are subject to Prevention of Significant Deterioration regulation (based on 1996 data). The results indicate that the amount of increment consumed at the Craters of the Moon Wilderness Area Class I area by these sources does not exceed 15 percent of the allowable increment for all annual averages and 38 percent for levels assessed over shorter time periods. For the Class II area represented by public access locations on or near INEEL, the maximum consumption is 56 percent and applies to respirable particulate matter levels averaged over a worst-case 24-hour period. It should be noted that these results do not include emissions from the New Waste Calcining Facility, which is evaluated in Section 5.2.6 as part of the waste processing alternatives.

The SNF & INEL EIS assessed concentrations of toxic air pollutants and compared the results to the ambient air standards promulgated for new sources by the State of Idaho Rules for Control of Air Pollution in Idaho. These standards are increments that apply only to new or modified sources and not to existing emissions. Nevertheless, these increments were used as "reference levels" for comparing existing and projected conditions with recommendations for ensuring public health protection in association with new sources of emissions. Annual average concentrations of carcinogenic toxics were assessed for offsite locations (site boundary and Craters of the Moon Wilderness Area), while levels of noncarcinogenic toxics were assessed for locations along public roads as well as at these offsite locations.

Highest offsite concentrations of carcinogenic toxics (summarized in Table 4.7-7 of the SNF & INEL EIS) were predicted to occur at the site boundary due south of the Central Facilities Area. All carcinogenic air pollutant levels were below the reference levels. Predicted noncarcinogenic air pollutant levels (Table 4.7-8 of the SNF & INEL EIS) were also well below the reference levels (1 percent or less) at all site boundary locations. 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.

Table 4-12. Prevention of Significant Deterioration increment consumption at the Craters of the Moon Class I area by sources subject to Prevention of Significant Deterioration regulation.

Pollutant	Averaging time	Allowable PSD increment[a] ($\mu g/m^3$)	Maximum predicted concentration[b] ($\mu g/m^3$)	Percent of PSD increment consumed
Sulfur dioxide	3-hour	25	6.2	25
	24-hour	5	1.9	38
	Annual	2	0.09	4.5
Respirable particulates[c]	24-hour	8	0.7	8.8
	Annual	4	8.0×10^{-3}	0.2
Nitrogen dioxide	Annual	2.5	0.06	2.3

a. All increments specified are State of Idaho standards.
b. Includes contributions from existing sources and projected increases from planned projects, including the Advanced Mixed Waste Treatment Project. For purposes of analysis, the New Waste Calcining Facility is not treated as an existing source, but rather is evaluated in Section 5.2.6 as part of the waste processing alternatives.
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 (i.e., 10 microns or less in diameter).
PSD = Prevention of Significant Deterioration.

Table 4-13. Prevention of Significant Deterioration increment consumption at Class II areas at Idaho National Engineering and Environmental Laboratory by sources subject to Prevention of Significant Deterioration regulation.

Pollutant	Averaging time	Allowable PSD increment[a] ($\mu g/m^3$)	Maximum predicted concentration[b]: INEEL boundary	Public roads	Amount of increment consumed ($\mu g/m^3$)	Percent of PSD increment consumed[c]
Sulfur dioxide	3-hour	510	94	140	140	27
	24-hour	91	17	31	31	34
	Annual	20	1.9	2.4	2.4	12
Respirable particulates[d]	24-hour	30	8.4	17	17	56
	Annual	17	0.1	0.92	0.92	5.4
Nitrogen dioxide	Annual	25	1.5	1.6	1.6	6.3

a. All increments specified are State of Idaho standards.
b. Includes contributions from existing sources and projected increases from planned projects, including the Advanced Mixed Waste Treatment Project. For purposes of analysis, the New Waste Calcining Facility is not treated as an existing source, but rather is evaluated in Section 5.2.6 as part of the waste processing alternatives.
c. The amount of increment consumed is equal to the highest value of either the site boundary or public road locations; includes contributions from existing sources and projected increases from planned projects, including the Advanced Mixed Waste Treatment Project.
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 (i.e., 10 microns or less in diameter).
PSD = Prevention of Significant Deterioration.

4.7.4.3 Summary of Nonradiological Air Quality

The air quality on and around INEEL is good and within applicable guidelines. The area around the INEEL is either in attainment or unclassified for all National Ambient Air Quality Standards. Levels of criteria pollutants assessed in the SNF & INEL EIS were found to be well within applicable standards for the maximum emissions scenario. Changes in criteria pollutant emission rates since the assessments in the SNF & INEL EIS were performed are not of a magnitude to affect those findings. For toxic emissions, all INEEL boundary and public road levels have been found to be well below reference levels appropriate for comparison. Current emission rates for some toxic pollutants are higher than the baseline levels assessed in the SNF & INEL EIS, but resulting ambient concentrations are expected to remain below reference levels. Similarly, all toxic pollutant levels at onsite locations are expected to remain below occupational limits established for protection of workers.


Mackay Dam, started in 1909 and completed in 1930, located in Mackay, Idaho.

4.8 Water Resources

This section describes existing hydrologic conditions regionally, at INEEL, and at INTEC. It includes groundwater and surface water characteristics, such as drainage patterns, flood plains, physical characteristics, and water quality.

4.8.1 SURFACE WATER

Surface water at INEEL consists of intermittent streams and spreading areas, and manmade percolation and evaporation ponds. The following sections describe the regional and local drainage characteristics, local runoff, flood plains, and surface water quality.

4.8.1.1 Regional Drainage

INEEL is located in the Mud Lake-Lost River Basin (also known as the Pioneer Basin). Figure 4-10 shows major surface water features of this basin. This closed drainage basin includes three main streams—the Big and Little Lost Rivers and Birch Creek. These three streams drain the mountain areas to the north and west of INEEL, although most flow is diverted for irrigation in the summer months before it reaches the site boundaries. Flow that reaches INEEL infiltrates the ground surface along the length of the stream beds, in the spreading areas at the southern end of INEEL, and, if the stream flow is sufficient, in the ponding areas (playas or sinks) in the northern portion of INEEL. During dry years, there is little or no surface water flow on the INEEL. Because the Mud Lake-Lost River Basin is a closed drainage basin, water does not flow off INEEL but rather infiltrates the ground surface to recharge the aquifer or is consumed by evapotranspiration. The Big Lost River flows southeast from Mackay Dam, past Arco and onto the Snake River Plain. On INEEL, near the southwestern boundary, a diversion dam prevents flooding of downstream areas during periods of heavy runoff by diverting water to a series of natural depressions or spreading areas (DOE 1995). During periods of high flow or low irrigation demand, the Big Lost River continues northeastward past the diversion dam, passes within 200 feet of INTEC, and ends in a series of playas 15 to 20 miles northeast of INTEC, where the water infiltrates the ground surface.

Flow from Birch Creek and the Little Lost River infrequently reaches INEEL. The water in Birch

Big Lost River.

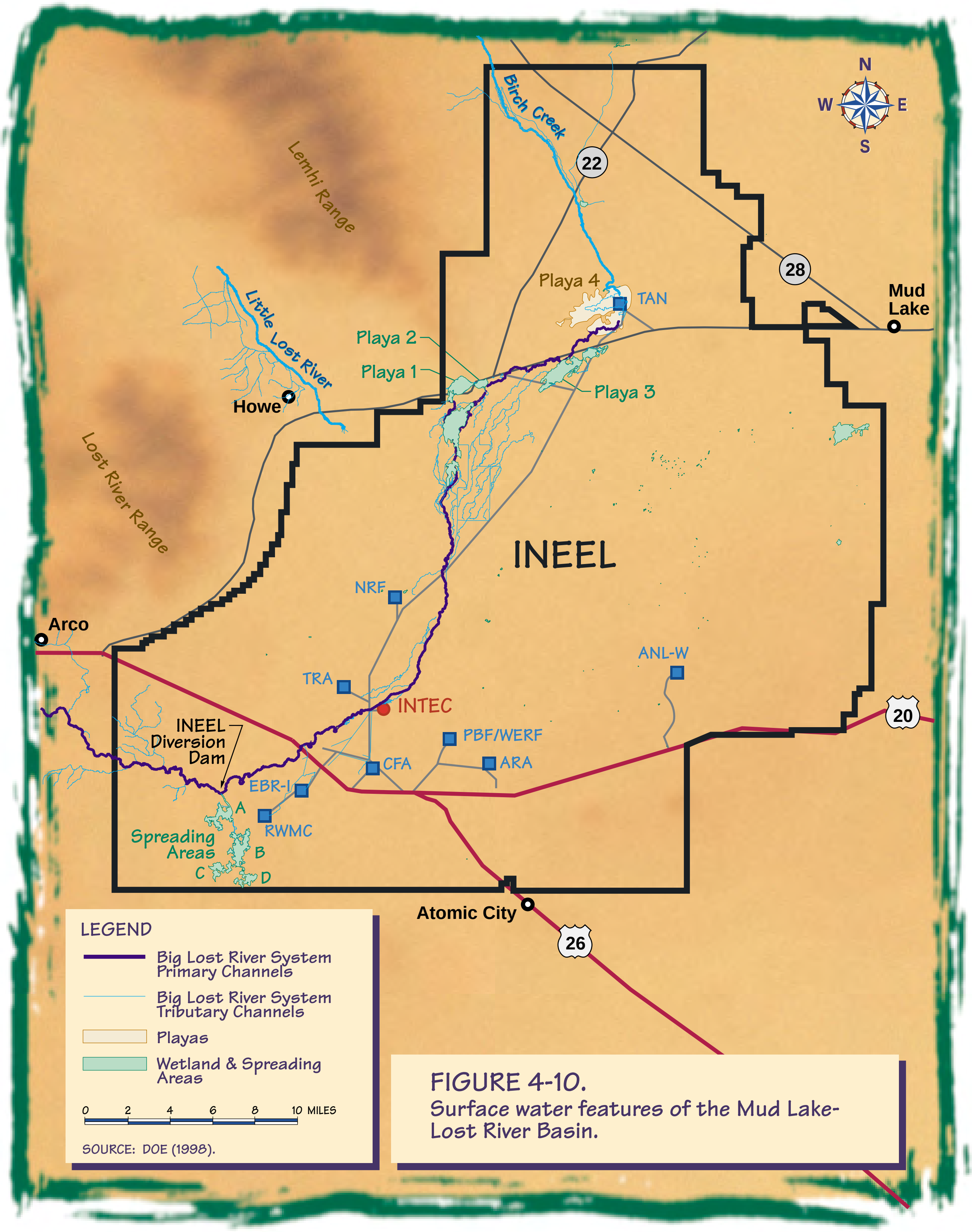


FIGURE 4-10.
Surface water features of the Mud Lake-Lost River Basin.

Creek and the Little Lost River is diverted in summer months for irrigation prior to reaching INEEL. During periods of unusually high precipitation or rapid snow melt, water from Birch Creek and the Little Lost River may enter INEEL from the northwest and infiltrate the ground, recharging the underlying aquifer.

4.8.1.2 Local Drainage

INTEC is located on an alluvial plain approximately 200 feet from the Big Lost River channel near the channel intersection with Lincoln Boulevard on INEEL. INTEC is surrounded by a stormwater drainage ditch system (DOE 1998). Stormwater runoff from most areas of INTEC flows through the ditches to an abandoned gravel pit on the northeast side of INTEC. From the gravel pit, the runoff infiltrates the ground and provides potential recharge to the Snake River Plain aquifer. The system is designed to handle a 25-year, 24-hour storm event. DOE built a secondary system around the facility to hold water if the first system overflows. Because the land is relatively flat (slopes of generally less than 1 percent) and annual precipitation is low, stormwater runoff volumes are small and are generally spread over large areas where they may evaporate or infiltrate the ground surface. Annual precipitation at INEEL averaged only 8.7 inches from 1951 through 1994. Annual net evaporation from large water surfaces in the Eastern Snake River Plain is 33 inches per year (Rodriguez et al. 1997).

Man-made surface water features at INTEC consist of two percolation ponds used for disposal of water from the service waste system, and sewage treatment lagoons and infiltration trenches for treated wastewater (Figure 4-11). Service water consists of raw water, demineralized water, treated water, and steam condensate (Rodriguez et al. 1997). The sewage treatment plant receives an average sanitary sewage flow of 42,000 gallons per day. The percolation ponds receive approximately 1.5 to 2.5 million gallons of service wastewater per day and are each approximately 4.5 acres in size (Rodriguez et al. 1997).

4.8.1.3 Flood Plains

Flood studies at INEEL examined the flooding potential at INEEL facilities due to the failure of Mackay Dam, 45 miles upstream from INEEL (Koslow and Van Haaften 1986). The U.S. Geological Survey made preliminary estimates of the 100-year flood plain along the Big Lost River (Berenbrock and Kjelstrom 1998). DOE commissioned additional studies to refine the 100-year flood plain and delineate a 500-year flood plain, including a two-dimensional model analysis and a paleohydrologic and geomorphic assessment of the flood risk along the Big Lost River (Ostenaa et al. 1999). There is no record of any historical flooding at INTEC since 1952.

As shown in Figure 4-12, flooding from a failure of Mackay Dam on the Big Lost River was evaluated for the potential impact on INEEL facilities (Koslow and Van Haaften 1986). The maximum flood evaluated was assumed to be caused by a probable maximum flood (PMF) resulting in the overtopping and rapid failure of Mackay Dam. This flood resulted in a peak surface water elevation at INTEC of 4,917 feet, with a peak flow of 66,830 cubic feet per second in the Big Lost River measured near INTEC. The average elevation at INTEC is 4,917 feet (DOE 1997). At this peak water surface elevation, portions of INTEC would be flooded, especially at the north end. Because the ground surface at INEEL and INTEC is relatively flat, floodwaters outside the banks of the Big Lost

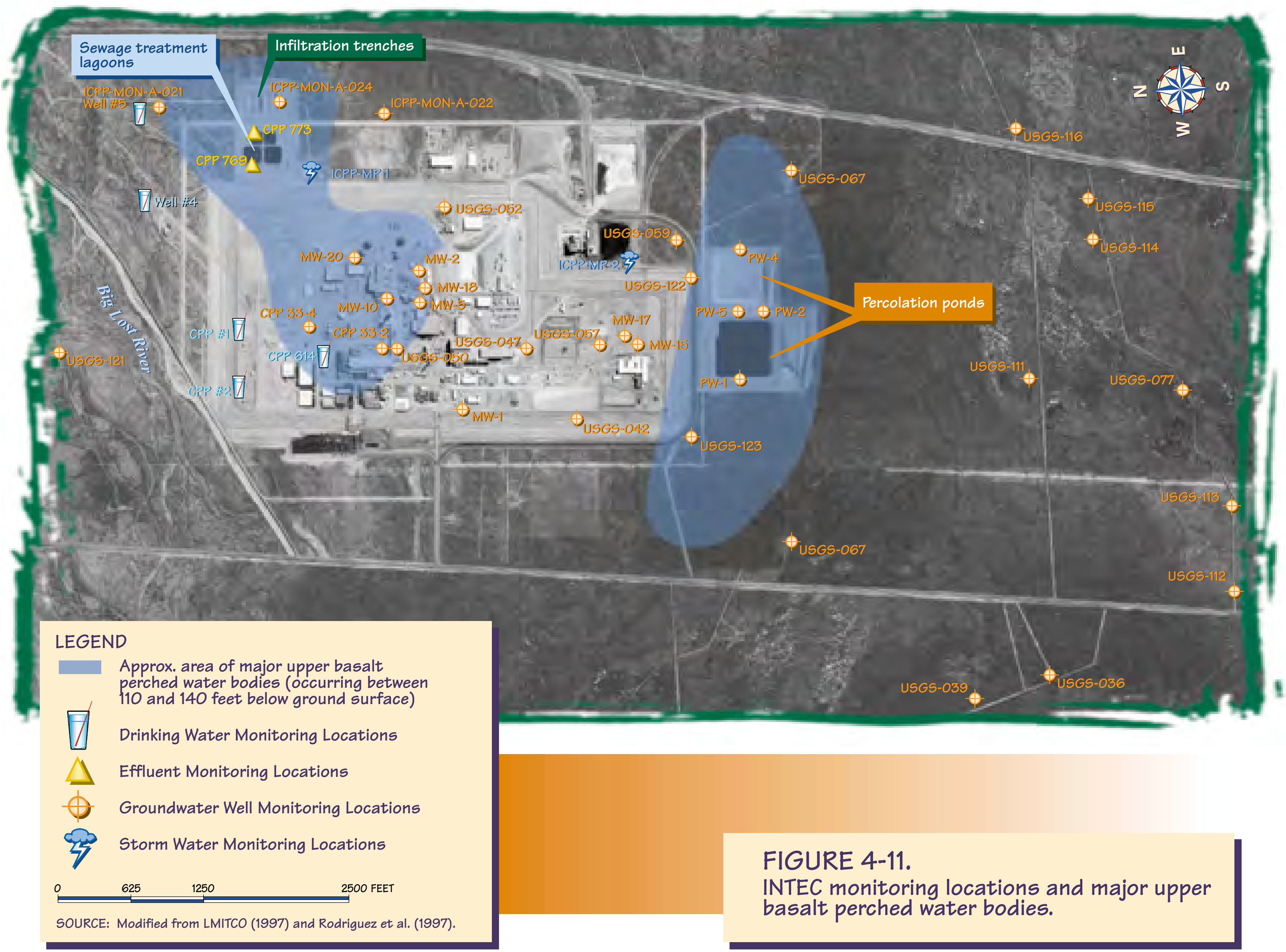


FIGURE 4-11.
INTEC monitoring locations and major upper basalt perched water bodies.

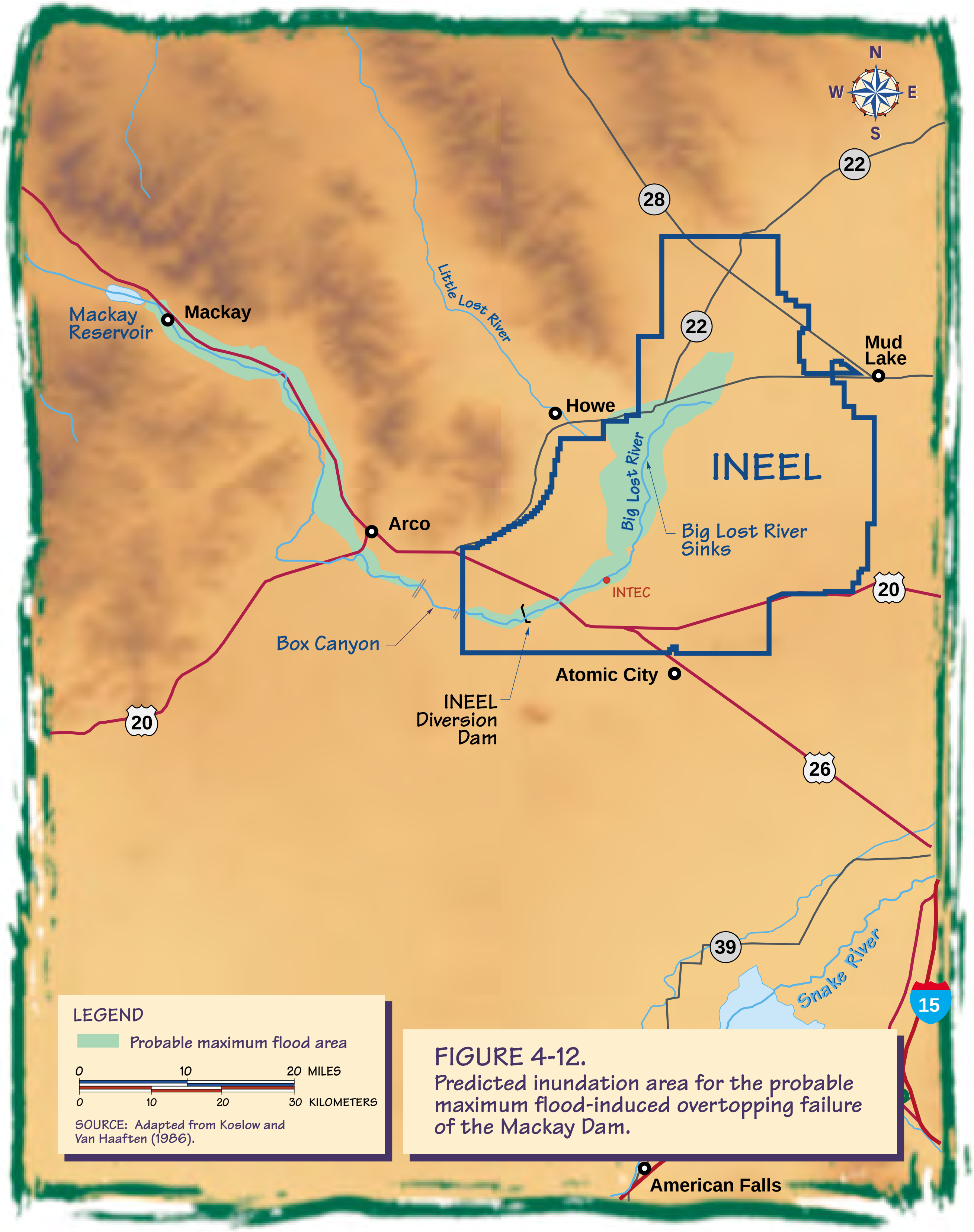


FIGURE 4-12.
Predicted inundation area for the probable maximum flood-induced overtopping failure of the Mackay Dam.

River would spread over a large area and pond in the lower lying areas. The peak water velocity in the INTEC vicinity was estimated at 2.7 feet per second. Although flood velocities are relatively slow and water depths are shallow, some facilities could be impacted. In particular, in the event of a design basis flood with sufficient magnitude and duration, it may be possible that one or more buried 300,000 gallon waste tanks could float. Another potential effect could be the failure of bin set #1. Both events are discussed in Section 5.2.7.3.

Debris bulking was not considered in the flow volumes for the probable maximum flood (PMF). Other than natural topography, the primary choke points for PMF flows are the diversion dam on the INEEL and the culverts on Lincoln Boulevard near INTEC. The PMF would quickly overtop and wash out the diversion dam so there would essentially be no effect on flows downstream of the dam. At INTEC, the PMF flow is estimated to be 66,800 cubic feet per second and the culverts are capable of passing about 1,500 cubic feet per second. Due to the relatively flat topography in the vicinity of INTEC, debris plugging at the culverts would have little effect on the PMF flood elevation at INTEC.

The 100-year floodplain was estimated in two independent studies. The first was prepared by the U.S. Geological Survey (USGS) and the second study by the U.S. Bureau of Reclamation (BOR). The USGS study was based on a one-dimensional model and used historical gaging station data along the Big Lost River to calculate results (Berenbrock and Kjelstrom 1998). The study estimates that a 100-year return period flood would produce a flow at the Arco gaging station of 7,260 cubic feet per second. This same flow volume was conservatively assumed to reach the INEEL diversion dam. The U.S. Army Corp of Engineers concluded, through structural analysis, that the diversion dam would not withstand flows in excess of 6,000 cubic feet per second without failing. Hence, the USGS study assumed that the diversion dam would fail and 6,220 cubic feet per second would continue down the Big Lost River channel where it would inundate about one third of INTEC (Figure 4-13). The remaining 1,040 cubic feet per second would be captured by the diversion channel and flow to the spreading ares.

The BOR study was based on a two-dimensional model and considered the physical evidence left by prehistoric floods as well as historical gaging station data. The BOR study resulted in an estimate for a 100-year flood of 3,270 cubic feet per second and 500-year flood of 4,086 cubic feet per second downstream of the diversion dam (Ostenaa et al. 1999). The BOR 100-year and 500-year floods are predicted to flood small portions of INTEC as shown on Figures 4-14 and 4-15. Whereas for the USGS study the diversion dam was assumed to fail, for the BOR study the diversion dam was not taken into account.

4.8.1.4 Surface Water Quality

Water quality in the Big Lost River has remained fairly constant over the period of record. Applicable drinking water quality standards for measured physical, chemical, and radioactive parameters have not been exceeded (DOE 1995). The chemical composition of the water reflects the carbonate mineral composition of the surrounding mountain ranges northwest of INEEL and the chemical composition of return irrigation water drained to the Big Lost River (Robertson et al. 1974).

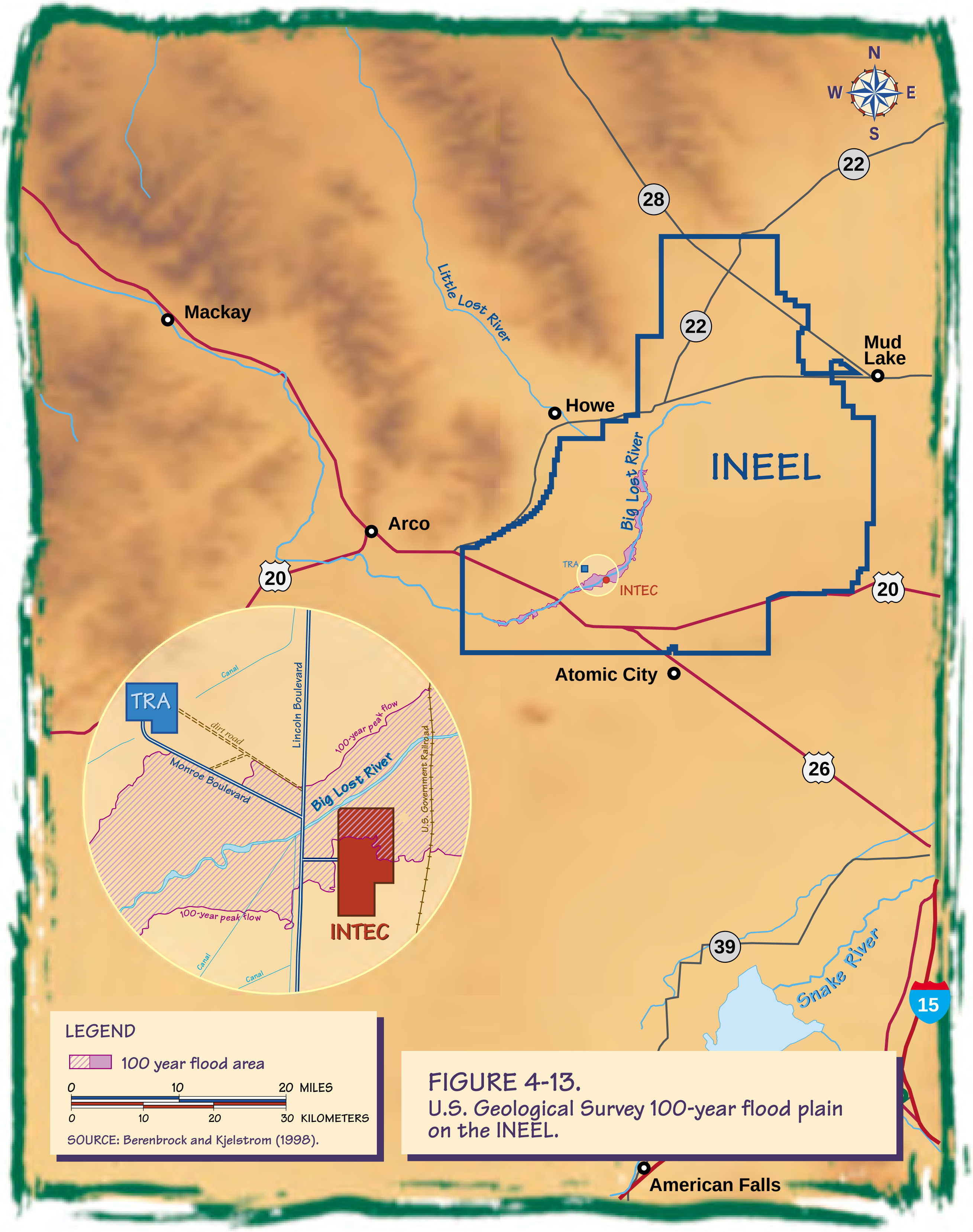


FIGURE 4-13.
U.S. Geological Survey 100-year flood plain on the INEEL.

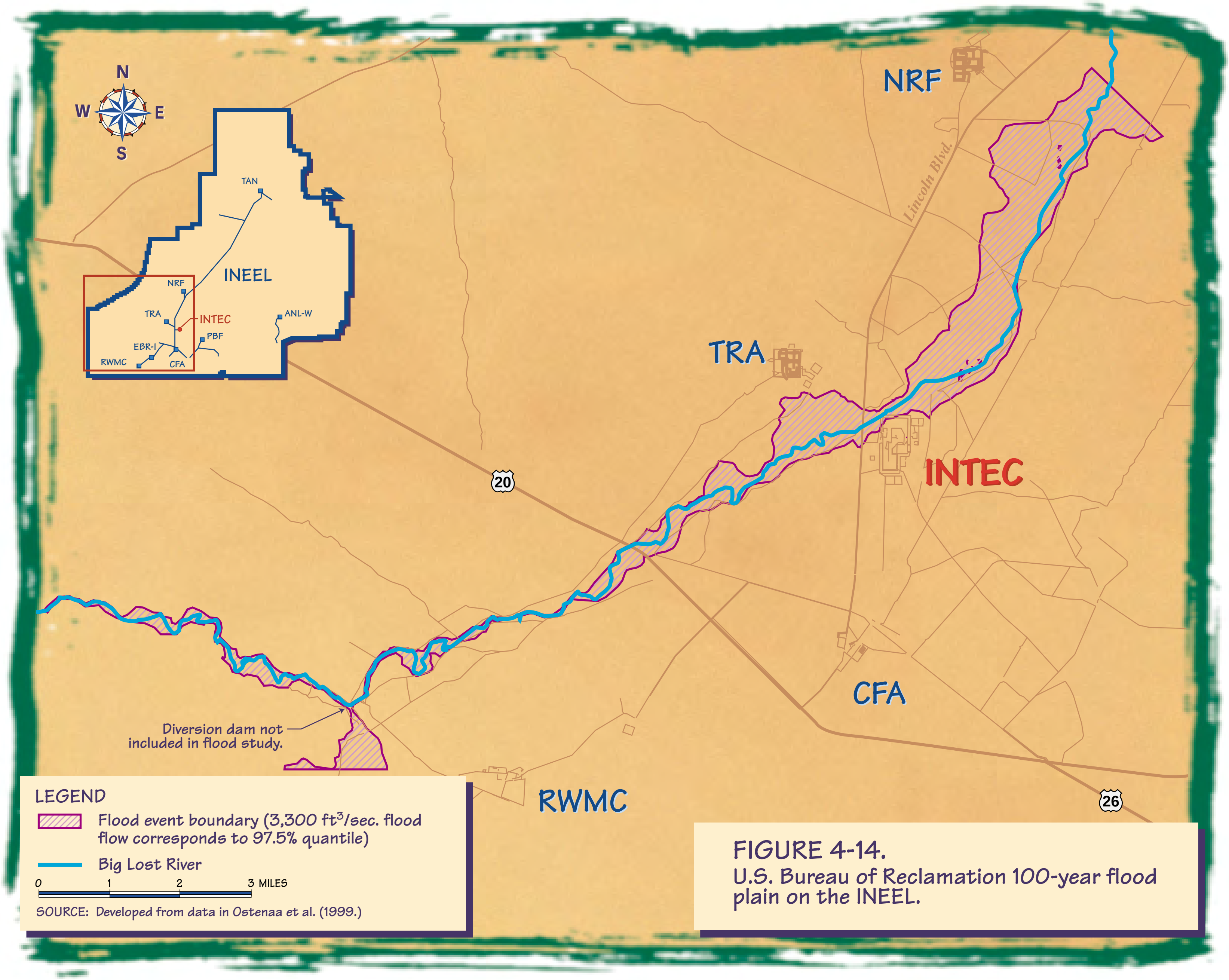


FIGURE 4-14.
U.S. Bureau of Reclamation 100-year flood plain on the INEEL.

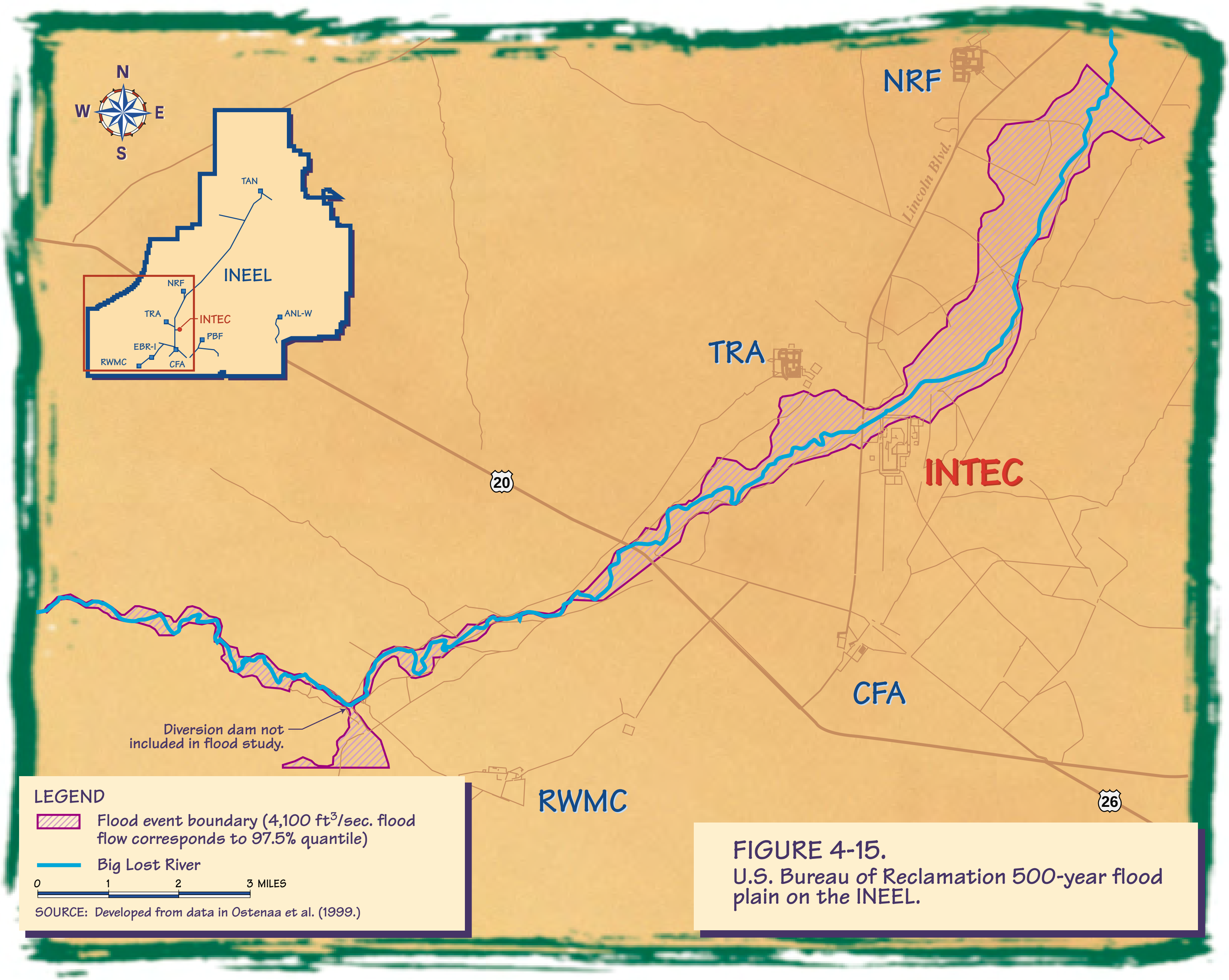


FIGURE 4-15.
U.S. Bureau of Reclamation 500-year flood plain on the INEEL.

DOE measures surface water quality at INTEC at two stormwater monitoring locations, the percolation ponds and the sewage treatment lagoons. Figure 4-11 shows monitoring locations at INTEC. The stormwater monitoring locations are at the inlet to the retention basin on the northeast side of INTEC and on the south side of a coal pile at the discharge to a ditch. The coal pile is located on the southeast side of INTEC.

DOE monitors for metals, inorganics, radiological constituents, and volatile organic compounds in stormwater (LMITCO 1997). U.S. Environmental Protection Agency-specified nonradiological benchmarks (60 FR 50826; September 29, 1995) and radiological benchmarks from the Derived Concentration Guides from DOE Order 5400.5 form the baseline values from which DOE monitors. INTEC data for 1996 indicate that contaminants are below benchmark levels. Benchmarks are the pollutant concentrations above which EPA and DOE have determined represent a level of concern. The level of concern is the concentration at which a stormwater discharge could potentially impact or contribute to water quality impairment or affect human health as a result of ingestion of water or fish.

Liquid effluents monitored at INTEC include effluent from the sewage treatment plant prior to discharge to the rapid infiltration trenches and effluent from the Service Waste System to the percolation ponds. Wastewater Land Application Permits from the State of Idaho have been issued for these discharges. Monitoring results for the percolation pond in 1996 indicate the effluent constituent concentrations are within acceptable ranges and annual flow volumes are within the limits specified in the permits (LMITCO 1997). For 1996, the sewage treatment plant effluent did not exceed the 20 mg/L total nitrogen limit, the 100 mg/L total suspended solids limit, or the flow limit specified in the permit (LMITCO 1997).

4.8.2 SUBSURFACE WATER

Subsurface water at INEEL occurs in the underlying Snake River Plain aquifer and the vadose zone (area of unsaturated soil and material above the aquifer). This section describes the regional and local hydrogeology, vadose zone hydrology, perched water, and subsurface water quality.

4.8.2.1 Regional Hydrogeology

INEEL overlies the Snake River Plain aquifer as shown in Figure 4-16. This aquifer is the major source of drinking water for southeastern Idaho and has been designated a Sole Source Aquifer by EPA. The aquifer flows to the south and southwest and covers an area of 9,611 square miles. Water storage in the aquifer is estimated at 2 billion acre-feet, and irrigation wells can yield 7,000 gallons per minute (DOE 1995). Depth to the top of the aquifer ranges from 200 feet in the northern part of INEEL to about 900 feet in the southern part (Orr and Cecil 1991). The aquifer, with estimates of thickness ranging from 250 to more than 3,000 feet (Frederick and Johnson 1996), consists of thin basaltic flows, interspersed with sedimentary layers.

The drainage area contributing to the water volume in the Snake River Plain aquifer is approximately 35,000 square miles (DOE 1995). The recharge to the aquifer is primarily from irrigation water and by valley underflow from the mountains to the north and northeast of the plain. Some recharge also occurs directly from precipitation (Rodriguez et al. 1997).

Discharge from the aquifer is primarily from springs that flow into the Snake River and pumping for irrigation. Major areas of springs and seepages from the aquifer occur in the vicinity of the American Falls Reservoir (southwest of Pocatello), and the Thousand Springs area (near Twin Falls) between Milner Dam and King Hill (Garabedian 1986).

FIGURE 4-16.
Aquifers of Idaho.

4.8.2.2 Local Hydrogeology

Groundwater directly beneath INTEC generally flows to the southwest and southeast, with some flow to the south. The local groundwater flow is complex and variable, and is influenced by recharge from the Big Lost River (when flow is present), the percolation ponds and sewage ponds, areas of low aquifer transmissivity, and possibly by pumping from the production wells. Groundwater beyond the influence of INTEC recharge sources flows to the south-southwest. The local hydraulic gradient is low, 1.2 feet per mile, compared to the regional gradient of 4 feet per mile (Rodriguez et al. 1997). In the INTEC area the hydraulic conductivity ranges over 5 orders of magnitude (0.10 to 10,000 feet/day), with an average of 1,300 feet/day (Rodriguez et al. 1997). The groundwater velocity beneath INTEC has been estimated at 10 to 25 feet per day (Barraclough et al. 1967). At various locations on and around INTEC in 1995, the depth to the Snake River Plain aquifer ranged from approximately 460 feet to 480 feet below the ground surface (Rodriguez et al. 1997). Several zones of perched water lie beneath INTEC (see Section 4.8.2.4). These zones are primarily located beneath, and extend outward from, the percolation ponds and the sewage treatment plant lagoons when the Big Lost River is dry. Additional perched water bodies and interactions occur in the northern part of INTEC during periods of flow in the Big Lost River and subsequent infiltration.

4.8.2.3 Vadose Zone Hydrology

The vadose zone extends down from the ground surface to the regional water table (the top of the Snake River Plain aquifer). In the vadose zone, the subsurface materials are generally not saturated but contain both air and water. Perched water bodies are the exception (see Section 4.8.2.4 that follows). The vadose zone at INTEC extends from the ground surface to 460 feet to 480 feet below the ground surface. This zone is important because chemical sorption to geologic materials in the vadose zone retards or immobilizes downward movement of some contaminants. During dry conditions, transport of contaminants downward towards the aquifer is very slow. Measurements taken at the INEEL Radioactive Waste Management Complex during unsaturated flow conditions indicated a downward infiltration rate ranging from 0.14 to 0.43 inches per year (Cecil et al. 1992). In another study during near-saturated flow conditions in the same area, standing water infiltrated downward 6.9 feet in less than 24 hours (Kaminsky 1991). During 1994, an infiltration study was conducted at INTEC that showed significant increase in moisture to a depth of 10 feet after 2 hours (LITCO 1995).

4.8.2.4 Perched Water

Perched water occurs in the vadose zone when sediments or dense basalt with low permeability impedes the downward flow of water to the aquifer. Historically at INTEC there have been three zones of perched water, including (1) a shallow perched water zone in the Big Lost River alluvium above the basalt, (2) an upper basalt perched water zone, and (3) a lower basalt perched water zone. Each zone is comprised of a number of smaller perched water bodies that may or may not be hydraulically connected. The perched water zones are thought to be primarily related to wastewater disposal practices at INTEC and the Big Lost River infiltration. The shallow perched water zone in the Big Lost River alluvium in the southern area of INTEC is believed to no longer exist (Rodriguez et al. 1997). Figure 4-11 shows the approximate boundary of the two bodies of water comprising the upper basalt perched water zone at INTEC.

The upper basalt perched water zone occurs between the depths of 100 to 140 feet. At the northern end of INTEC, there is a body of upper basalt perched water beneath the sewage treatment ponds on the eastern side of INTEC extending towards the west under north central INTEC. The western portion of the northern perched water body receives water from other sources including the Big Lost River, leaking fire water lines, precipitation infiltration, steam condensate dry wells, and lawn irrigation. In the southern area of INTEC, a large body of perched water in the upper basalt has resulted primarily from discharge to the percolation ponds (Rodriguez et al. 1997).

The lower basalt perched water zone occurs in the basalt between 320 to 420 feet below the ground surface. Two areas of perched water occur in the lower basalt, essentially directly beneath the upper basalt perched water previously described. The northern body of lower basalt perched water is recharged from the sources contributing to the upper perched water. The lower perched water was influenced by the failure of the injection well in the late 1960's and late 1970's that allowed injection of service waste water directly into the northern lower perched water body. The southern lower basalt perched water body is recharged from the discharge from the percolation ponds (Rodriguez et al. 1997).

4.8.2.5 Subsurface Water Quality

Subsurface water quality is monitored by the U.S. Geological Survey and the LMITCO Environmental Monitoring Program. Additionally, an extensive groundwater quality study at INTEC was completed in 1995 (Rodriguez et al. 1997). This section focuses on current groundwater conditions, with emphasis on groundwater quality in the vicinity of INTEC.

DOE performs groundwater monitoring at INTEC and the surrounding area to monitor drinking water, detect unplanned releases to groundwater, identify potential environmental problems, and ensure compliance with Federal, State of Idaho, and DOE groundwater regulations and monitoring requirements. Groundwater monitoring at INEEL is generally divided into four categories: drinking water monitoring, compliance monitoring, surveillance monitoring, and special studies. Figure 4-11 shows monitoring locations, including drinking water, perched water, and aquifer monitoring locations.

DOE monitors drinking water at INTEC to ensure compliance with Federal and State of Idaho drinking water regulations. INTEC drinking water wells are hydrologically upgradient of the INTEC facility. Measured drinking water parameters at INEEL are compared to the maximum contaminant levels established in the Safe Drinking Water Act (40 CFR 141). State regulations are in the Idaho Regulations for Public Water Systems (IDAPA 1999a). In 1996, the most recent year with published data, all drinking water samples collected at INTEC had concentrations below the maximum contaminant levels specified in Federal and State drinking water regulations (LMITCO 1997).

DOE performs compliance groundwater monitoring at INTEC to meet the requirements of the State of Idaho Wastewater Land Application Permits. The two areas monitored include wells in the vicinity of the percolation ponds and near the sewage treatment pond. The permits require compliance with the Idaho Groundwater Quality Standards in specified downgradient groundwater monitoring wells, annual discharge volume and application rates, and effluent quality limits (IDAPA 1999b). Permit variance limits were granted for total dissolved solids and chloride at the percolation pond compliance monitoring wells. The primary source of total dissolved solids and chloride in the percolation ponds is the INTEC water treatment processes. The data for 1996 indicate that no permit limits (or permit variance limits) were exceeded at the percolation ponds in 1996 (LMITCO 1997).

At the compliance well for monitoring the sewage treatment plant, maximum allowable concentrations were not exceeded. However, at a shallow well (ICPP-MON-P-024) adjacent to the sewage treatment plant, levels of total dissolved solids, chloride, and nitrogen compounds were elevated. DOE monitors this well to evaluate the effectiveness of treatment and to detect unplanned releases. Based on the information obtained from the monitoring data, DOE will alter treatment processes to optimize wastewater treatment and remove elevated nitrogen compounds (LMITCO 1997).

DOE conducts surveillance monitoring at INTEC to meet the requirements of DOE Order 5400.1. This order requires DOE facilities with contaminated (or potentially contaminated) groundwater resources to establish a groundwater monitoring program. The monitoring program is designed to determine and document the impacts of facility operations on groundwater quantity and quality and to demonstrate compliance with Federal, state, and local regulations. Table 4-14 summarizes 1996 monitoring parameters that exceeded surveillance thresholds. The surveillance thresholds are the Safe Drinking Water Act maximum contaminant levels and secondary maximum contaminant levels.

At the perched-water surveillance wells for the percolation ponds, the constituents elevated above the threshold limits include aluminum, chloride, iron, and strontium-90. The causes for the elevated aluminum and iron concentrations are unknown. The chloride concentration is consistent with historical chloride concentrations and reflects the concentration within the percolation ponds. The source of chloride is the water treatment processes. The strontium-90 concentrations are most likely residual from the historical discharges of radionuclides to the percolation ponds. Most radionuclide discharges to the percolation ponds were discontinued in 1993 when the INTEC Liquid Effluent Treatment and Disposal Facility began operations.

Surveillance monitoring at the sewage treatment plant wells indicated measurements of total coliform, iron, and strontium-90 above threshold levels. DOE suspects that the total coliform measurement is the result of cross-contamina-

Table 4-14. 1996 monitoring parameters that were exceeded for INTEC surveillance wells.[a]

Location	Exceeded parameter	Maximum 1996 concentration	Surveillance threshold[b]
PW-1[c]	chloride	258 mg/L	250 mg/L
PW-2[c]	aluminum	0.237 mg/L	0.05-0.2 mg/L
	chloride	287 mg/L	250 mg/L
	iron	1.190 mg/L	0.3 mg/L
	strontium-90	8.3 ± 3.4 pCi/L	8.0 pCi/L
PW-4[c]	chloride	294 mg/L	250 mg/L
	iron	2.250 mg/L	0.3 mg/L
PW-5[c]	chloride	259 mg/L	250 mg/L
USGS-036[d]	strontium-90	10.4 ± 4.0 pCi/L	8.0 pCi/L
USGS-039[d]	fluoride	40.6 mg/L	4.0 mg/L
USGS-057[d]	strontium-90	27.8 ± 10.2 pCi/L	8.0 pCi/L
USGS-067[d]	strontium-90	17.4 ± 3.18 pCi/L	8.0 pCi/L
	tritium	22,000 ± 2,820 pCi/L	20,000 pCi/L
ICPP-MON-A-021[e]	total coliform	20 col/100 mL	<1 col/100 mL
ICPP-MON-A-022[f]	iron	0.487 mg/L	0.3 mg/L
USGS-052[f]	strontium-90	11 ± 4.2 pCi/L	8.0 pCi/L

a. Source: LMITCO (1997).
b. Surveillance thresholds are comparison values consisting of maximum contaminant levels and secondary maximum contaminant levels (40 CFR 141).
c. INTEC percolation pond perched water surveillance well.
d. INTEC percolation pond aquifer surveillance well.
e. INTEC upgradient background well (upgradient Sewage Treatment Plant well).
f. INTEC Sewage Treatment Plant surveillance well.

tion. The source of iron is unknown. Strontium-90 concentrations are consistent with historical values (LMITCO 1997).

Constituents detected above threshold levels in surveillance wells in 1996 in the aquifer include fluoride, strontium-90, and in 1996, tritium. The fluoride levels were more than 100 times greater than the maximum concentration of fluoride in INTEC effluents (0.29 mg/L). A followup measurement in the same well by the U.S. Geological Survey in 1998 found the fluoride concentration to be 0.17 mg/L (USGS 1998). Strontium-90 and tritium values are consistent with historical values and reflect discontinued discharge practices (LMITCO 1997).

In 1995, an in-depth study of soil and groundwater contamination was conducted at INTEC (Rodriguez et al. 1997). Tables 4-15 and 4-16 show the maximum concentrations of inorganics and radionuclides in the perched water and the Snake River Plain aquifer found in this study. Locations of the wells where the maximum concentrations were found are shown in Figure 4-11. The percolation pond perched water body was not monitored as part of the study, but was previously described as part of the discussion of the surveillance monitoring program.

All perched water bodies monitored in the 1995 study had samples exceeding the nitrate/nitrite Federal and state drinking water maximum contaminant level of 10 mg/L. The highest nitrate/nitrite concentration (69.6 mg/L) was found in the northern lower perched water body. For radionuclides, the maximum gross alpha and gross beta concentrations in perched water are in the northern upper perched water body. Tritium, strontium-90, and technetium-99 were found in all perched water bodies.

For the Snake River Plain aquifer, the concentrations measured in the 1995 study are primarily related to the past disposal of waste through the INTEC injection well. The injection well was drilled to a depth of 598 feet (DOE 1993) and was routinely used for disposal of service waste water through 1984, and permanently closed by pressure grouting in 1989. An estimated 22,000 curies of radioactive contaminants were released through the injection well. Most of the radioactivity is attributed to tritium (96 percent). Americium-241, technetium-99, strontium-90, cesium-137, cobalt-60, iodine-129, and plutonium contribute the remaining radioactivity.

Figures 4-17, 4-18, and 4-19 show the 1995 distribution of tritium, strontium-90, and the 1990-1992 distribution of iodine-129 in the aquifer beneath INEEL, respectively (DOE 1997). Additionally, Table 4-17 shows the general trend of decreasing concentrations of these radionuclides over time. The combined tritium disposal to infiltration ponds at INTEC and the Test Reactor Area from 1992 to 1995 averaged 107 curies per year, compared to 910 curies per year from 1952 to 1983 (DOE 1997). The tritium plume with a concentration exceeding 500 picocuries per liter (0.5 picocuries per milliliter) decreased from an area of 45 square miles in 1988 to about 40 square miles in 1991. Since 1991, the concentration has remained nearly unchanged. However, the higher concentration lines have moved closer to their origin at INTEC and the Test Reactor Area.

Prior to 1989, strontium-90 concentrations in the Snake River Plain Aquifer were decreasing. The concentrations from 1992 to 1995 have remained fairly constant. This is due to the migration of contamination from the near surface releases into the perched water bodies and subsequently into the Snake River Plain Aquifer (Rodriguez et al. 1997). When the Big Lost River Flows, the added infiltrating water will tend to reduce the concentrations observed in the Snake River Plain Aquifer due to dilution of the perched water bodies.

Iodine-129 was discharged to the aquifer until 1984 through the injection well previously described. More than 90 percent of the iodine-129 in the aquifer is from the injection well. Smaller contributions include the percolation ponds and contaminated soils. Measurements taken in 1990-1992 indicated the presence of iodine-129 in 32 of 51 wells at INTEC. The concentrations ranged from below the detection limit to 3.82 pCi/L (Rodriguez et al. 1997). The Safe Drinking Water Act maximum contaminant level for iodine-129 is 1 pCi/L.

Table 4-15. Maximum concentrations of inorganics and radionuclides in perched water at INTEC (1995).[a]

	Maximum concentration (mg/L or pCi/L)	Well	Perched water body
Inorganics (mg/L)			
Alkalinity	290	MW-5	Northern upper
Carbonate	5.4	MW-17	Southern lower
Chloride	130	MW-17	Southern lower
Fluoride	0.36	USGS-50	Northern lower
Sulfate	62	CPP 33-4	
Total Kjeldahl Nitrogen	1.5	MW-18	Northern lower
Ammonia – N	ND		
NO_3/NO_2 – N	70	MW-1	Northern lower
Aluminum	ND	–	
Antimony	0.006	MW-17	Southern lower
Arsenic	0.005	MW-15	Northern upper
Barium	0.39	MW-5	Northern upper
Beryllium	0.00012	MW-10	Northern upper
Cadmium	ND	–	
Calcium	110	MW-1	Northern upper
Chromium	0.011	MW-18	Northern lower
Cobalt	0.001	CPP 37-4	Northern upper
Copper	0.015	MW-17	Southern lower
Iron	0.17	MW-17	Northern upper
Lead	0.002	MW-15	Northern upper
Magnesium	34.0	MW-1	Northern lower
Manganese	0.19	MW-5	Northern lower
Mercury	0.00028	USGS-50	Northern lower
Nickel	0.008	CPP 55-06	Northern upper
Potassium	25	MW-17	Northern upper
Selenium	0.004	CPP 37-4	Northern upper
Silver	0.0008	CPP 33-4	Northern upper
Sodium	76	MW-17	Southern upper
Thallium	0.005	CPP 33-2	Northern upper
Vanadium	0.007	MW-17	Southern lower
Zinc	0.07	CPP 33-2	Northern upper
Zirconium	ND	–	
Radionuclides (pCi/L)			
Gross Alpha	1,100 ± 220	MW-2	Northern upper
Gross Beta	590,000 ± 2,600	MW-2	Northern upper
Tritium	73,000 ± 700	MW-18	Northern lower
Strontium-90	320,000 + 3,000	MW-2	Northern upper
Plutonium-238	ND	–	
Plutonium-239/240	ND	–	
Americium-241	ND		
Neptunium-237	ND	–	
Iodine-129	ND	–	
Technetium-99	740 ± 6	MW-18	Northern lower
Uranium-234	12 ± 1	MW-15	
Uranium-235	ND	–	
Uranium-238	2.7 ± 0.5	MW-20	Northern upper

a. Source: Rodriguez et al. (1997).
ND = Not detected.

Table 4-16. Maximum concentrations of inorganics and radionuclides in the Snake River Plain aquifer in the vicinity of INTEC (1995).

Contaminant	Maximum concentration (mg/L or pCi/L)	Well	Maximum contaminant level[a] (mg/L or pCi/L)	Background (mg/L or pCi/L)
Inorganics (mg/L)				
Aluminum	ND	–	0.2[b]	
Antimony	0.0046	USGS-59	0.006	
Arsenic	0.011	USGS-59	0.05	
Barium	0.21	USGS-112	2	0.05 - 0.07
Beryllium	ND	–	0.004	
Cadmium	0.003	USGS-39	0.005	<0.001
Calcium	76	CPP-2	NS	
Chromium	0.039	USGS-39	0.1	0.002 -0.003
Cobalt	0.001	USGS-85	NS	
Copper	0.014	CPP-2	1.3	
Iron	0.13	USGS-123	0.3[b]	
Lead	0.018	USGS-84	0.015	<0.005
Magnesium	22	USGS-67	NS	
Manganese	0.044	USGS-122	0.05	
Mercury	0.00032	USGS-47	0.002	<0.0001
Nickel	0.005	USGS-123	0.1	
Potassium	6.80	USGS-122	NS	
Selenium	0.003	USGS-47	0.05	<0.001
Silver	0.0007	USGS-77	0.1[b]	<0.001
Sodium	77	USGS-59	NS	
Thallium	ND	–	0.002	
Vanadium	0.010	USGS-82	NS	
Zinc	0.45	USGS-115	5[b]	
Zirconium	ND	–	NS	
Radionuclides (pCi/L)				
Gross Alpha	10 ± 2	MW-18	15	0 - 3
Gross Beta	470 ± 6	MW-18	<4 mrem/yr[c]	0 - 7
Tritium	31,000 ± 500	USGS-77	20,000	0 - 40
Strontium-90	84 ± 1	MW-18	8	0
Plutonium-238	ND	–	<15	0
Plutonium-239/240	ND	–	<15	0
Americium-241	0.54 ± 0.14	USGS-42	<15	0
Neptunium-237	3.1 ± 0.3	MW-18	<15	
Iodine-129	3.8 ± 0.19[d]	USGS-113	1	0
Technetium-99	450 ± 4	MW-18	900	
Uranium-234	2.6 ± 0.8	USGS-47	–	
Uranium-235	ND	–	–	
Uranium-238	1.1 ± 0.4	USGS-123	–	
Total uranium	–	–	0.02 mg/L	0 - 0.003 mg/L

a. Maximum contaminant levels (MCL) from the Safe Drinking Water Act (40 CFR 140) and DOE Order 5400.5.
b. Secondary MCL from the Safe Drinking Water Act (40 CFR 140).
c. Beta particle/photon radioactivity shall not produce annual dose equivalent to the total body or internal organ greater than 4 millirem per year.
d. Maximum Iodine-129 concentration from 1990-1991 data reported in Rodriguez et al. (1997).
Source: Rodriguez et al. (1997); background concentrations - Knobel et al. (1992).
ND = Not detected; NS = No standard.

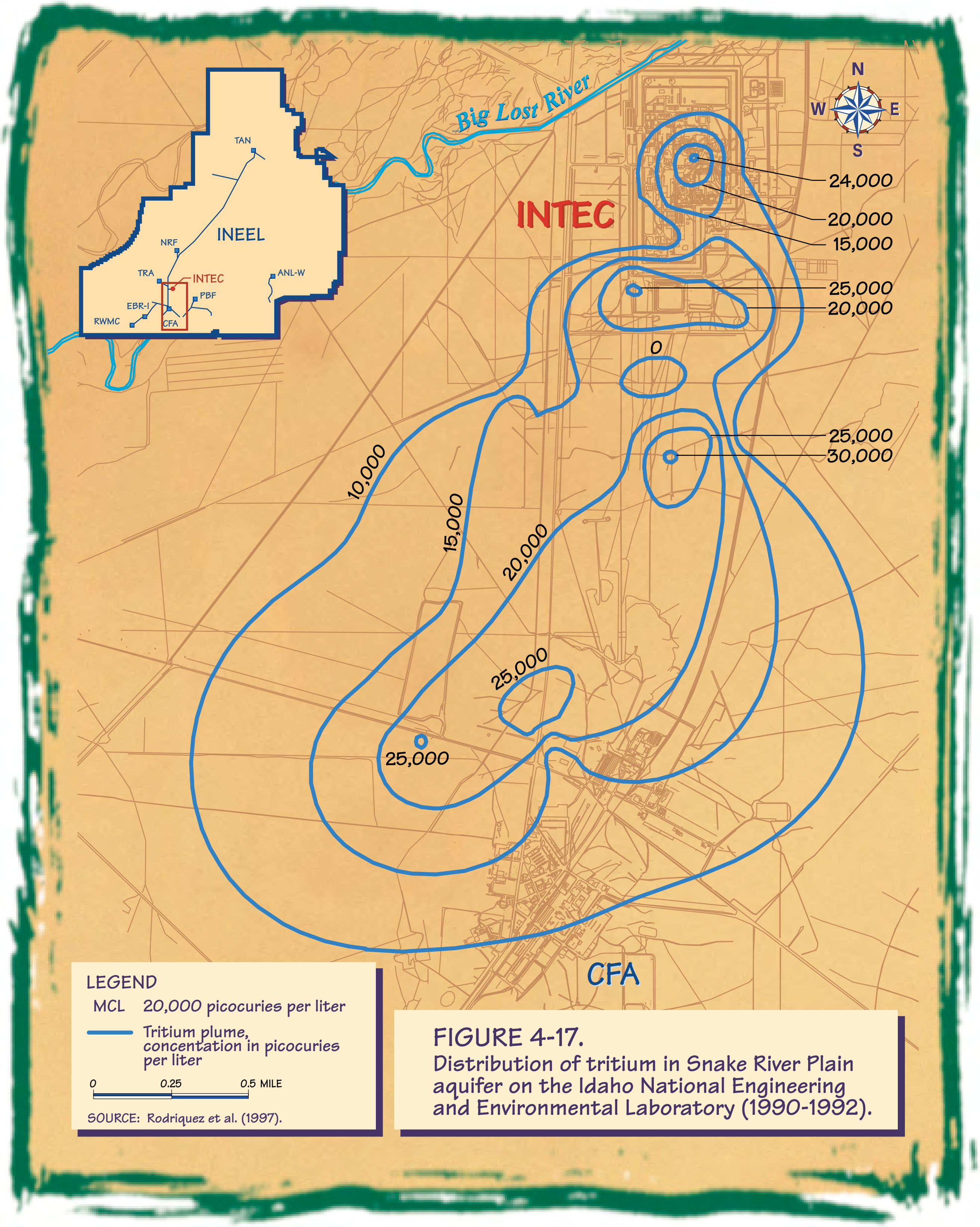


FIGURE 4-17.
Distribution of tritium in Snake River Plain aquifer on the Idaho National Engineering and Environmental Laboratory (1990-1992).

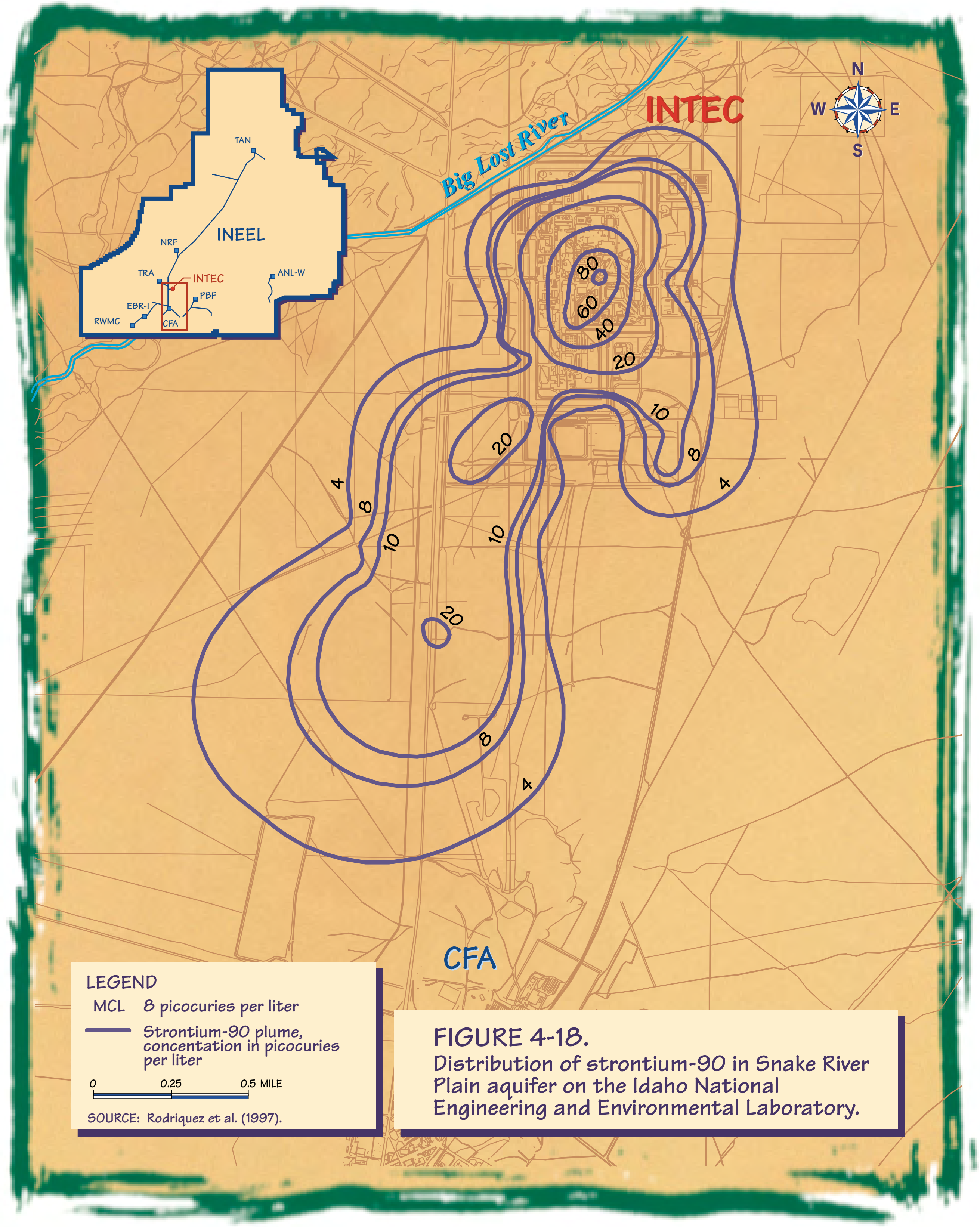


FIGURE 4-18.
Distribution of strontium-90 in Snake River Plain aquifer on the Idaho National Engineering and Environmental Laboratory.

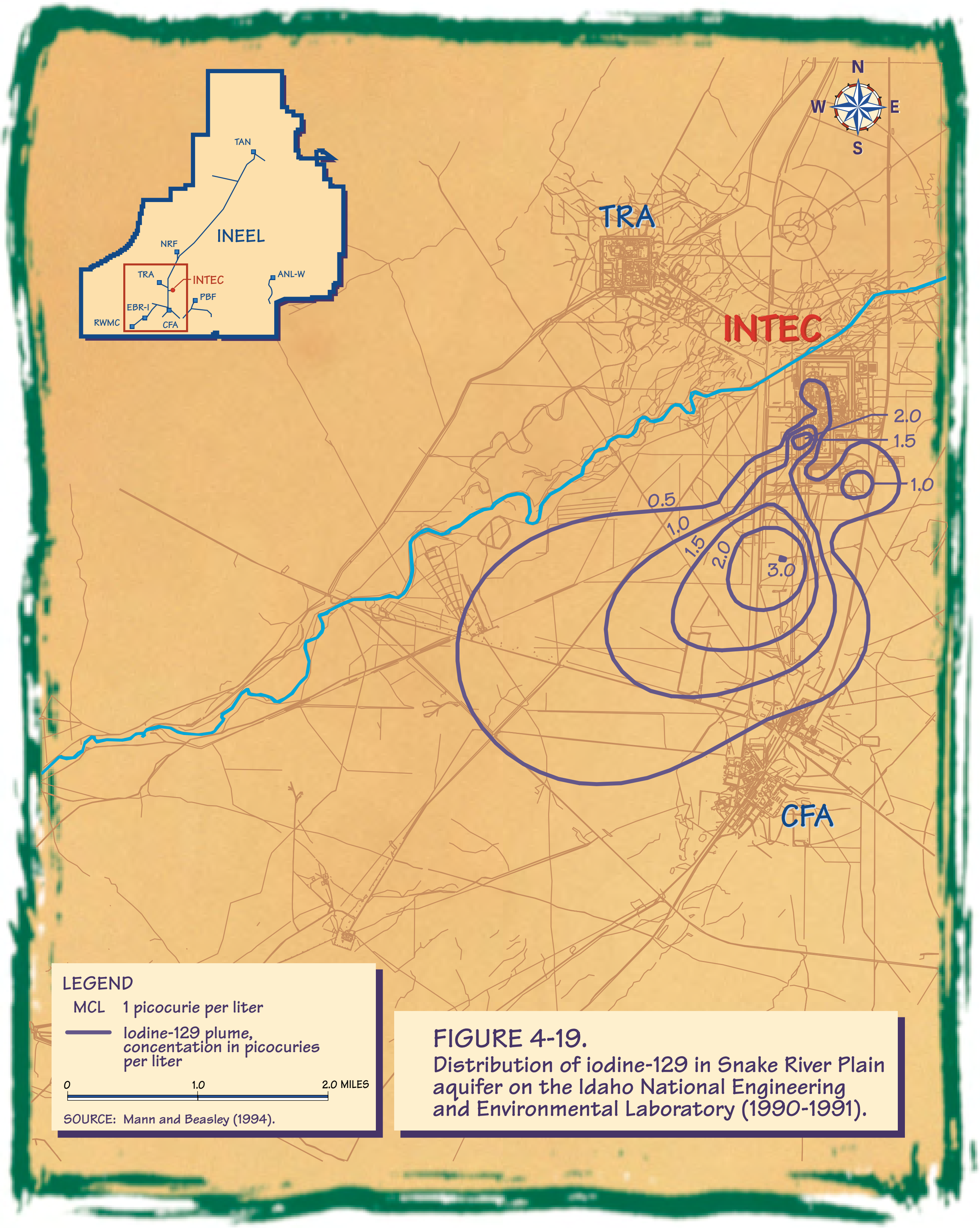


FIGURE 4-19.
Distribution of iodine-129 in Snake River Plain aquifer on the Idaho National Engineering and Environmental Laboratory (1990-1991).

Table 4-17. Trends in tritium, strontium-90, and iodine-129 in selected wells at the INEEL.

	Concentration[a] (pCi/L)		
Year	Tritium[b] (USGS-77)	Strontium-90[b] (USGS-47)	Iodine-129[c] (USGS-46)
1981	80,000 ± 800	79 ± 5	41 ± 2
1986	70,000 ± 900	56 ± 4	2.3 ± 0.3
1991	42,000 ± 900	55 ± 4	0.35 ± 0.02
1995	25,000 ± 100	47 ± 2	

a. The concentrations shown are for selected wells on the INEEL, not necessarily the maximum concentrations measured at the INEEL or at INTEC.
b. Source: Bartholomay et al. (1997).
c. Source: 1981 and 1986 data - Mann et al. (1988); 1991 data – Mann and Beasley (1994).

4.9 Ecological Resources

This section discusses the biotic resources of the INEEL including threatened, endangered, and sensitive species, and wetlands. Radioecology studies specific to INTEC are also discussed. A detailed description of INEEL ecology can be reviewed in the Ecological Resources section of Rope et al. (1993) and the SNF & INEL EIS, Volume 2, Part A, Section 4.9 (DOE 1995).

4.9.1 PLANT COMMUNITIES AND ASSOCIATIONS

INEEL lies within a cool desert ecosystem dominated by shrub-steppe vegetation. The area is relatively undisturbed, providing important habitat for species native to the region. Vegetation and habitat on INEEL can be grouped into six types: shrub-steppe, juniper woodlands, native grasslands, modified ephemeral playas, lava, and wetland-like areas. Figure 4-20 shows these areas.

More than 90 percent of INEEL falls within the shrub-steppe vegetation type. The shrub-steppe vegetation type is dominated by big sagebrush (*Artemisia tridentata*), saltbush (*Atriplex* spp.), and rabbitbrush (*Chrysothamnus* spp.). Grasses found on

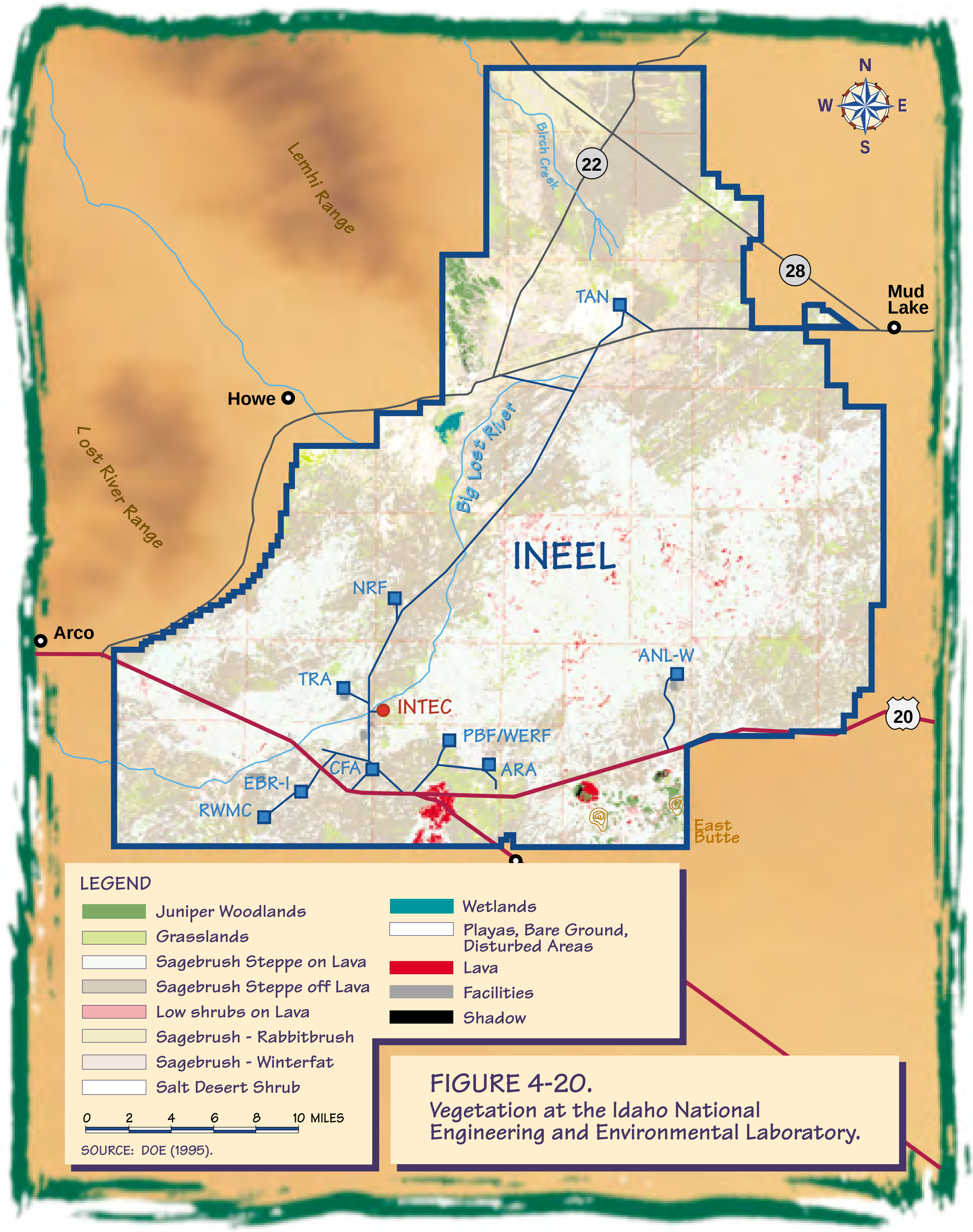


FIGURE 4-20.
Vegetation at the Idaho National Engineering and Environmental Laboratory.

INEEL include cheatgrass (*Bromus tectorum*), Indian ricegrass (*Oryzopsis hymenoides*), wheatgrass (*Agropyron* spp.), and squirreltail (*Sitanion hysterix*). Herbaceous plants or forbs such as phlox (*Phlox* spp.), wild onion (*Allium* spp.), and milkvetch (*Astragalus* spp.), weeds such as Russian thistle (*Salsola kali*), halogeton (*Halogeton glomeratus*), and various mustards occur on disturbed areas throughout the INEEL area.

Disturbed areas or areas cleared of natural vegetation (grazed areas not included) cover about 2 percent of INEEL. Vegetation in disturbed areas such as INTEC is frequently dominated by introduced annual species, including Russian thistle and cheatgrass. Introduced annuals in disturbed areas provide lower quality food and cover for wildlife than native species. Therefore, species diversity is generally lower in disturbed and developed areas and higher in undisturbed natural areas (DOE 1995).

Large wildfires in 1994, 1995, and 1996 played an important role in the vegetation cover at INEEL. Figure 4-21 shows the location of the wildfires. In July 1994, the Butte City fire burned 17,107 acres along the western boundary of INEEL (Anderson et al. 1996). In August 1995, 6,831 acres along a corridor running north and south of the Argonne National Laboratory-West facility burned (Anderson et al. 1996). The summer of 1996 produced six fires that burned a total of 36,450 acres on and adjacent to INEEL. These fires burned virtually all of the aboveground biomass, resulting in severe wind erosion and, therefore, blowing dust (Patrick and Anderson 1997).

As a result of the 1995 Argonne burn, blowing dust created problems for normal facility operations, and health and safety concerns for Argonne National Laboratory-West employees. In an effort to control the blowing dust, erosion control activities were initiated. Spring wheat was planted on about 160 acres immediately upwind of the Argonne National Laboratory-West facility to provide a cover crop. A monitoring program was implemented by the Environmental Science and Research Foundation to determine the effects of introducing a non-native plant species. Data collected

Fire Warning Signs around INEEL.

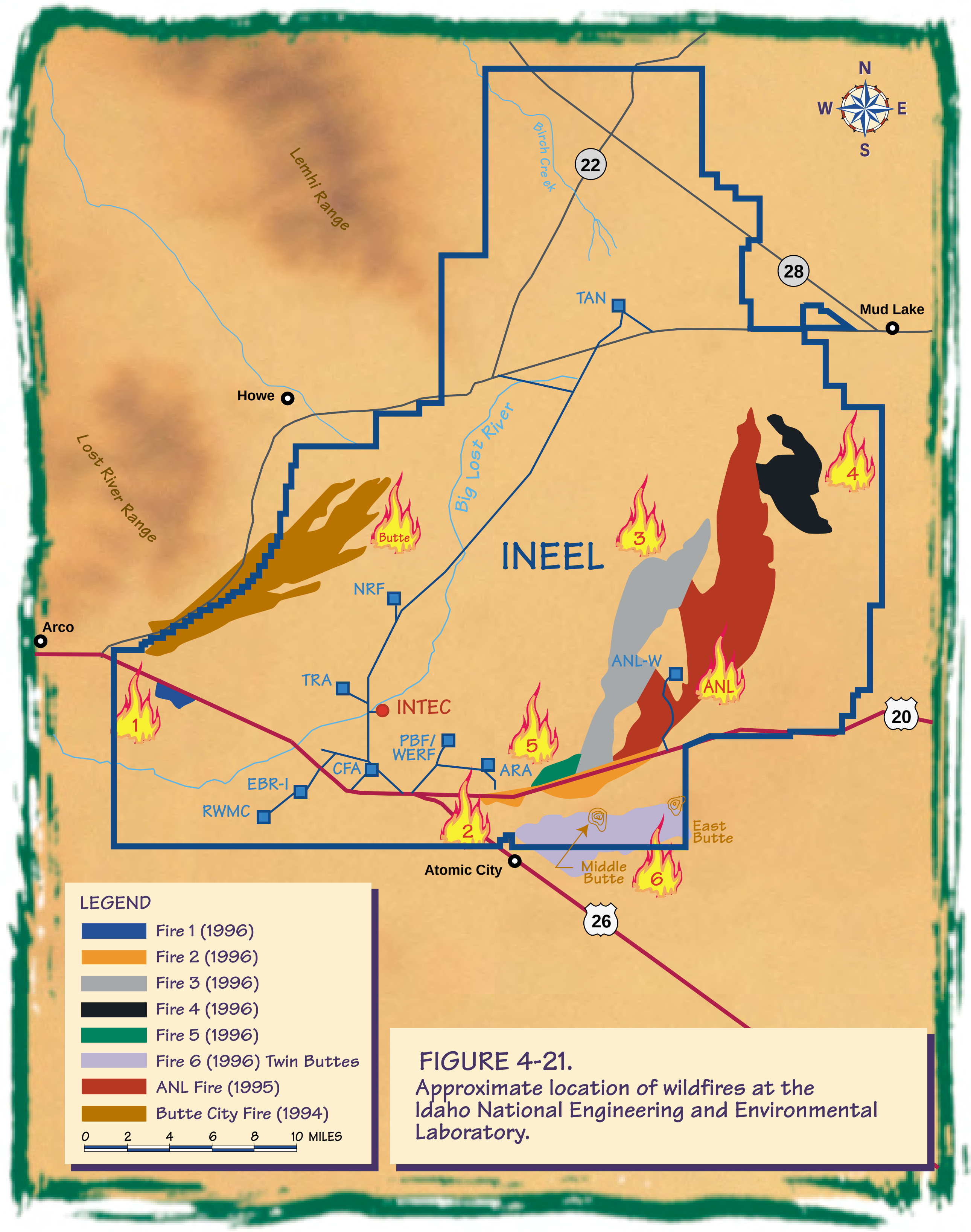


FIGURE 4-21.
Approximate location of wildfires at the Idaho National Engineering and Environmental Laboratory.

showed that the wheat planting reduced the number of native species by more than one-half. The impacts from this planting are believed to be due to the physical damage caused by the mechanical drilling of seeds and the added competition for water and nutrients from the wheat (Blew and Jones 1998).

After the fires in July of 1996, soil erosion control was again necessary. A seed mixture of crested wheatgrass (*Agropyron cristatum*), pubescent wheatgrass (*Elytrigia intermedia*), and thickspike wheatgrass (*Elymus lanceolatus*), including oats (*Avena sativa*) to serve as a crop cover, was planted in late summer on approximately 320 acres. Monitoring activities are being conducted to determine the impacts, if any, on long-term recovery of native vegetation in this area.

4.9.2 WILDLIFE

INEEL supports wildlife typical of shrub-steppe communities. Over 270 vertebrate species have been observed on INEEL, including 46 mammal, 204 bird, 10 reptile, 2 amphibian, and 9 fish species (Arthur et al. 1984; Reynolds et al. 1986). Common wildlife include small mammals (mice, ground squirrels, rabbits, and hares), pronghorn (American antelope), deer, elk, songbirds (sage sparrow and western meadowlark), sage grouse, lizards, and snakes.

INEEL provides year-round habitat for pronghorn, elk, sage grouse, and black-tailed jackrabbits. Migratory birds common on INEEL include waterfowl and raptors. Predators, such as bobcats, mountain lions, and coyotes, have also been observed in the area.

4.9.3 THREATENED, ENDANGERED, AND SENSITIVE SPECIES

Threatened and endangered species, species of concern, and other unique species known to occur within or near INEEL were identified using the Idaho Department of Fish and Game's list of *Species with Special Status in Idaho* (Idaho CDC 1997). In accordance with Section 7 of the Endangered Species Act, DOE requested a species list from the U.S. Fish and Wildlife Service. The Idaho Conservation Data Center maintains lists of species of concern for the Idaho Department of Fish and Game and the U.S. Fish and Wildlife Service.

Table 4-18 shows Federally-listed species, state-listed species, Federal and state species of special concern, and sensitive and unique plant species monitored by the Idaho Native Plant Society. None of these state- or Federally-listed species is known to occur in the INTEC area.

4.9.4 WETLANDS (OR WETLAND-LIKE AREAS)

The U.S. Fish and Wildlife Service conducted a wetland survey of most of INEEL that is depicted in the National Wetlands Inventory map. Wetlands or wetland-like areas are primarily associated with the Big Lost River, the Big Lost River spreading areas, and the Big Lost River Sinks, although smaller isolated wetland-like areas (less than 1 acre) also occur. At least one area at the Big Lost River Sinks was found to meet the criteria for jurisdictional wetlands established by the U.S. Army Corps of Engineers. Also, one potential wetland located north of the Test Reactor Area is under evaluation to determine if it meets the definition of a jurisdictional wetland. No wetlands or wetland-like areas occur within the INTEC boundary.

Table 4-18. Listed Threatened and Endangered Species, Species of Concern, and other unique species that occur, or possibly occur, on Idaho National Engineering and Environmental Laboratory.[a]

		Classification		
	Species	Federal	State	Occurrence on the INEEL
Birds	American peregrine falcon (*Falco peregrinus anatum*)	LE	E	Winter visitor
	Bald eagle *(Haliaeetus leucocephalus)*	LT	E	Winter visitor, most years
	Ferruginous hawk *(Buteo regalis)*	W	P	Widespread summer resident
	Boreal owl (*Aegolius funereus*)	W	SC	Recorded, but not confirmed
	Flammulated owl *(Otus flammeolus*)	W	SC	Recorded, but not confirmed
	Long-billed curlew *(Numenius americanus)*	SC	P	Limited summer distribution
Mammals	Gray wolf *(Canis Lupus)*	LE/XN	E	Several sightings since 1993
	Long-eared myotis *(Myotis evotis)*	W	–	Limited onsite distribution
	Townsend's big-eared bat *(Corynorhinus townsendii)*	SC	SC	Year round resident
	Pygmy rabbit *(Brachylagus idahoensis)*	W	SC	Limited onsite distribution
Plants	Ute's ladies tresses *(Spiranthes diluvialis)*	LT	INPS-GP2	Found near, but not on the INEEL
	Speal-tooth dodder *(Cuscuta denticulata)*		INPS-1	Found near, but not on INEEL
	Spreading gilia (*Ipomopsis [Gilia] polycladon*)		INPS-2	Common in western foothills
	Lemhi milkvetch *(Astragalus aquilonius)*		INPS-GP3	Limited distribution
	Winged-seed evening primrose *(Camissonia pterosperma)*		INPS-S	Rare and limited

a. Source: Idaho CDC (1997).

Federal
LT Listed Threatened
LE Listed Endangered
XN Experimental Population
SC Special Concern
W Watch

State
E Endangered
P Protected Non-game Species
SC Special Concern
INPS-1 Idaho Native Plant Society-State Priority 1
INPS-2 Idaho Native Plant Society-State Priority 2
INPS-GP2 Idaho Native Plant Society-Global Priority 2
INPS-GP3 Idaho Native Plant Society-Global Priority 3
INPS-S Idaho Native Plant Society-Sensitive

The National Wetland Inventory map identified approximately 20 potential wetlands near INEEL facilities. Most of these potential wetlands are industrial waste and sewage treatment ponds, borrow pits, and gravel pits. The term "potential" is used because it has not been determined whether they exhibit the characteristics that make them jurisdictional wetlands under the Clean Water Act. Some characteristics used to determine jurisdictional wetlands are vegetation, soil type, and period of inundation. Other potential wetlands include portions of the Big Lost River channel near INTEC and the Birch Creek Playa encompassing the Test Area North. These scattered man-made ponds and intermittent waters (see Figure 4-10) serve as a water resource for wildlife, including mammals, songbirds, and waterfowl.

4.9.5 RADIOECOLOGY

The objective of radioecology is to determine radiological effects on ecological resources, with the long-term objective of understanding environmental cycles and the potential impacts to humans and the environment. Potential radiological effects on plants and animals are measured at the population, community, or ecosystem level. Measurable results of radionuclides on plants and animals have been observed in individuals on areas adjacent to INEEL facilities, but effects have not been observed at the population, community, or ecosystem level.

The environment surrounding INTEC has been contaminated with a variety of fission products and transuranic elements. Studies of radioactive contamination have been conducted in soil, vegetation, rabbits, pronghorn, mourning doves, sage grouse, waterfowl, and in fish from the Big Lost River near INTEC (Morris 1993).

Potentially-contaminated soils in the Windblown Area, an operable unit associated with Waste Acceptance Group 3 but outside of INTEC, were sampled in 1993 as part of a Phase I radionuclide contaminated soil investigation (Rodriguez et al. 1997). The maximum concentration of cesium-137 in soil was 16.2 pCi/g, which was above the background concentration of 0.82 pCi/g. Other radionuclides (strontium-90, plutonium-238 and plutonium-239, uranium-234, and uranium-238) were reported as nondetectable or their concentrations were not significantly higher than background concentration. The Baseline Risk Assessment for the Windblown Area concluded that these contaminated soils did not pose an unacceptable risk to the ecological environment.

Iodine-129 was released during the fuel dissolution process at INTEC and was transported relatively long distances by atmospheric processes. Studies of vegetation and rabbit thyroids have reported levels of iodine-129 in excess of background concentrations out to 17 miles from INTEC. Iodine-129 has been detected above background concentrations in pronghorn tissues site-wide and as far offsite as Craters of the Moon National Monument and Monida Pass (Morris 1993).

4.10 Traffic and Transportation

This section discusses existing traffic volumes, transportation routes, transportation accidents, and waste and materials transportation at INEEL, including historical waste and materials transportation and baseline radiological exposures from waste and materials transportation. It also discusses noise levels at INEEL associated with the various modes of transportation. The information in this section has been summarized from Lehto (1993) and Anderson (1998) and is tiered from Volume 2 of the SNF & INEL EIS (DOE 1995).

4.10.1 ROADWAYS

4.10.1.1 Infrastructure – Regional and Site Systems

Table 4-19 shows the baseline traffic for several access routes based on the 1996 Rural Traffic Flow Map (State of Idaho 1996). 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." The existing regional highway system is shown in Figure 4-22. Two interstate highways serve the regional area. Interstate 15, a north-south route that connects several cities along the Snake River, is approximately 25 miles east of INEEL. Interstate 86 intersects Interstate 15 approximately 40 miles south of INEEL and provides a primary linkage from Interstate 15 to

Table 4-19. Baseline traffic for selected highway segments in the vicinity of the Idaho National Engineering and Environmental Laboratory.[a]

Route	Average daily traffic	Peak hourly traffic[b]
U.S. Highway 20—Idaho Falls to INEEL	2,100	315
U.S. Highway 20/26—INEEL to Arco	1,900	285
U.S. Highway 26—Blackfoot to INEEL	1,400	210
State Route 33—west from Mud Lake	600	90
Interstate 15—Blackfoot to Idaho Falls	11,000	1,650

a. Source: State of Idaho (1996).
b. Estimated as 15 percent of average daily traffic.

FIGURE 4-22.
Regional roadway infrastructure in southeastern Idaho.

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 INEEL. Idaho State Routes 22, 28, and 33 pass through the northern portion of INEEL, with State Route 33 providing access to the northern INEEL facilities.

The INEEL contains an onsite road system of approximately 87 miles of paved surface, including about 18 miles of paved service roads that are closed to the public (DOE 1995). 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 INEEL undergoes continuous maintenance.

4.10.1.2 Infrastructure – Idaho Falls

Approximately 4,000 DOE and DOE contractor personnel administer and support INEEL work through offices in Idaho Falls (DOE 1995). DOE shuttle vans 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, INEEL Electronic Technology Center, and DOE office buildings. It is congested during peak weekday hours, but the intersection is designed for the current traffic.

4.10.1.3 Transit Modes

Four major modes of transit use the regional highways, community streets, and INEEL roads to transport people and commodities: DOE buses and shuttle vans, DOE motor pool vehicles, commercial vehicles, and personal vehicles. Table 4-20 summarizes the baseline miles for INEEL-related traffic.

4.10.2 RAILROADS

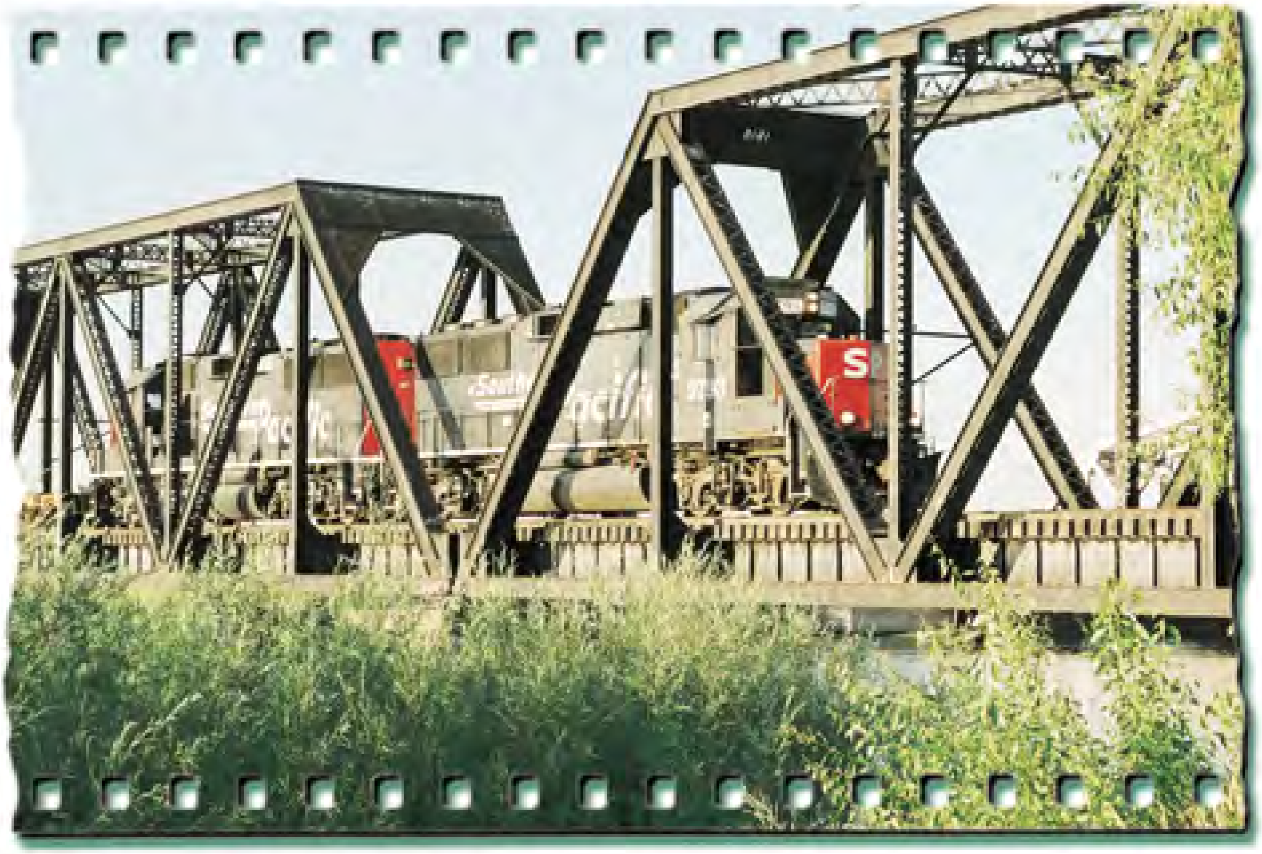
Union Pacific Railroad's main line to the Pacific Northwest follows the Snake River across southern Idaho. This line handles as many as 30 trains a day. Union Pacific Railroad has a total of 1,096 miles of track in Idaho (State of Idaho 1998). Union Pacific Railroad lines in southeastern Idaho are shown on Figure 4-22. Idaho Falls receives railroad freight service from Butte, Montana, to the north, and from Pocatello, Idaho and Salt Lake City, Utah to the south.

The Union Pacific Railroad's Blackfoot-to-Arco Branch, which crosses the southern portion of INEEL, provides rail service to INEEL. This branch connects with a DOE-owned spur line at Scoville Siding, then links with developed areas within INEEL. Rail shipments to and from INEEL usually are limited to bulk commodities, spent nuclear fuel, and radioactive waste. From 1993 through 1997, three rail shipments of nonhazardous bulk commodities were sent to the

Table 4-20. Baseline annual vehicle miles traveled for traffic related to the Idaho National Engineering and Environmental Laboratory.

Mode of travel and transportation	Vehicle miles traveled[a]
DOE buses	3,200,000
Other DOE vehicles	5,800,000
Personal vehicles on highways to INEEL	40,000,000[b]
Commercial vehicles	800,000
Total	49,800,000

a. Berry (1998); Beck (1998).
b. Based on 1,600 personal vehicles per day driven to the INEEL.



INEEL (Morris 1998). From 1993 through 1997, 128 rail shipments of spent nuclear fuel were sent to the INEEL (Beckett 1998). The Settlement Agreement/Consent Order limits the number of shipments of naval spent nuclear fuel to INEEL to 20 shipments (each Spent Nuclear Fuel cask is considered a shipment) per year from 1997 through 2035. Nineteen shipments were made in 1997 (Anderson 1998).

4.10.3 AIRPORTS AND AIR TRAFFIC

Airlines provide passenger, cargo service, and 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 airport for 1996 and 1997 were 5,069 and 5,037, respectively. The Idaho Falls and Pocatello airports collectively record nearly 9,500 landings annually (Anderson 1998).

Non-DOE air traffic over INEEL is limited to altitudes greater than 1,000 feet over buildings and populated areas, and non-DOE aircraft are not permitted to use the site. The primary air traffic over INEEL is occasional high-altitude commercial jet traffic, since DOE no longer operates helicopters at INEEL.

4.10.4 ACCIDENTS

The fatal collision rate for Idaho in 1996 was 1.8 collisions per 100 million vehicle miles, and the injury collision rate was 69 collisions per 100 million vehicle miles. The total collision rate (injury, fatal, and non-injury) for Idaho in 1996 was 180 collisions per 100 million vehicle miles (ITD 1997). These data are for all vehicles (e.g., cars and trucks). The accident rates for highway combination trucks in Idaho are listed in Table 4-21. For railroads in Idaho, the mainline accident rate is 6.4 accidents per 100 million railcar miles (Saricks and Tompkins 1999).


Pronghorn are abundant on the INEEL.

For 1997, the average motor vehicle accident rate was 15 accidents per million vehicle miles for INEEL vehicles (Berry 1998), which compares with an accident rate of 2.4 accidents per million vehicle miles for all DOE complex vehicles (Lehto 1993). No air accidents associated with INEEL have been recorded.

Collisions between wildlife and trains or motor vehicles have occurred at INEEL. Wildlife, such as pronghorn (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 large 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). Accidents involving motor vehicles and wildlife generally involve individual animals and can occur during any season.

4.10.5 TRANSPORTATION OF WASTE AND MATERIALS

Hazardous, radioactive, industrial, commercial, and recyclable wastes are transported on INEEL. Hazardous materials include commercial chemical products and hazardous wastes that are nonradioactive and are regulated and controlled based on their chemical toxicity. Table 4-22 summarizes shipments associated with INEEL for the period 1993 through 1997 based on data from the Shipment Mobility Accountability Collection system (Morris 1998). These shipments range from express mail packages to radioactive waste shipments to spent nuclear fuel shipments. Nonhazardous materials shipments accounted for over 95 percent of INEEL shipments. Radioactive materials and hazardous materials shipments accounted for 1.2 percent and 3.4 percent of the shipments, respectively. Nonhazardous air shipments were the largest

Table 4-21. Highway combination-truck accident, injury, and fatality rates for Idaho.[a]

Accident Rate	Interstate	Primary[b]	Other[c]
Involvement (accidents/kilometer)	3.0×10^{-7}	2.8×10^{-7}	4.6×10^{-7}
Injury (injuries/kilometer)	2.3×10^{-7}	2.2×10^{-7}	3.3×10^{-7}
Fatality (fatalities/kilometer)	9.6×10^{-9}	1.8×10^{-8}	1.7×10^{-8}

a. Source: Saricks and Tompkins (1999).
b. Primary: other principal highways (generally, other components of the national highway system).
c. Other: other roads (i.e., country highways, farm-to-market roads, local streets).

Table 4-22. Annual average shipments to and from the Idaho National Engineering and Environmental Laboratory (1993-1997).[a,b]

	Commodity			
Mode	Hazardous	Nonhazardous	Radioactive	Total
Air	222	24,488	154	24,864
Motor[b]	798	7,007	216	8,021
Other[c]	137	757	41	935
Rail	–	3	128	131
Total	1,157	32,255	539	33,951

a. Source: Shipment Mobility Accountability Collection system (Morris 1998; Beckett 1998).
b. Commercial motor carriers.
c. Freight forwarder, private motor carrier, government vehicles, or parcel carriers.

single category of shipments, 72 percent, largely due to low-cost General Services Administration negotiated rates for letters and parcels. Commercial motor carrier shipments accounted for 24 percent of the INEEL shipments. The remaining category of shipments, denoted "Other" in Table 4-22, is composed of shipments made by freight forwarder, private motor carrier, government vehicles, or parcel carriers. This category accounted for less than 3 percent of the INEEL shipments.

DOE establishes baseline radiological doses from transportation of waste and materials for onsite and offsite transportation. The baseline for onsite, incident-free radioactive materials transportation at INEEL consists of onsite shipments of DOE spent nuclear fuel, naval spent nuclear fuel, and radioactive waste shipments evaluated in the SNF & INEL EIS. The results of the analyses in the SNF & INEL EIS are presented in Table 4-23 in terms of estimated annual collective doses and latent cancer fatalities.

Table 4-23. Estimated annual doses and fatalities from onsite incident-free shipments at the Idaho National Engineering and Environmental Laboratory.[a]

	Estimated collective dose (person-rem)	Estimated latent cancer fatalities	Estimated nonradiological fatalities[b]
Occupational			
DOE spent nuclear fuel	0.09	3.6×10^{-5}	0
Naval spent nuclear fuel	0.01	4.0×10^{-6}	0
Radioactive waste	0.76	3.0×10^{-4}	0
Total	0.86	3.4×10^{-4}	0
General Population			
DOE spent nuclear fuel	2.2×10^{-3}	1.1×10^{-6}	0
Naval spent nuclear fuel	3.8×10^{-4}	1.9×10^{-7}	0
Radioactive waste	0.02	1.0×10^{-5}	0
Total	0.02	1.1×10^{-5}	0

a. Source: DOE (1995).
b. There are no nonradiological accident-free fatalities for onsite shipments. These fatalities are only applicable to urban areas, and the INEEL is a rural area.

To establish a baseline for offsite, incident-free radioactive materials transportation, data from Weiner et al. (1991a,b) were used. 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 1,400 person-rem and an annual collective general population dose of 1,400 person-rem were estimated. These collective doses correspond to 0.56 and 0.70 latent cancer fatalities for workers and the general population, respectively.

Weiner et al. (1991b) also evaluated six categories of radioactive material shipments by airplane: (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 latent cancer fatalities for workers and the general population, respectively.

4.10.6 TRANSPORTATION NOISE

INEEL-related noises that affect the public are dominated primarily by transportation sources such as buses, private vehicles, delivery trucks, construction trucks, aircraft, and freight trains. During a normal workweek, a majority of the 4,000 to 5,000 employees at the INEEL site are transported daily from surrounding communities to various work areas at INEEL by a fleet of buses covering over 300 routes. Approximately 1,600 private vehicles also travel to and from INEEL daily (Berry 1998).

Noise from an occasional commercial aircraft crossing INEEL at high altitudes is indistinguishable from the natural background noise of the site. Therefore, public exposure to aircraft nuisance noise is insignificant. Rail transport noises originate from diesel engines, wheel/track contact, and whistle warnings at rail crossings. Normally no more than one train per day, and usually fewer than one train per week, service INEEL via the Scoville spur.

As shown in Figure 4-23, the noise level at INEEL ranges from 10 dBA (decibels A-weighted; i.e., referenced to the A scale, approximating human hearing response) for the rustling of grass and leaves, to as much as 115 dBA, the upper limit for unprotected hearing exposure established by the Occupational Safety and Health Administration from the combined sources of industrial operations, construction activities, and vehicular traffic. The natural environment of INEEL has relatively low ambient noise levels ranging from 35 to 40 dBA (Leonard 1993). INEEL complies with Occupational Safety and Health Administration regulations (29 CFR 1910.95), which state that personnel exposed to an 8-hour time-weighted average of 85 dBA or greater must be issued hearing protection. Also, exposure to impulse or impact noise should be limited to 140 dBA peak sound pressure level.

Noise measurements taken along U.S. Highway 20 approximately 50 feet from the roadway during a peak commuting period indicate that the sound level from traffic ranges from 69 to 88 dBA (Leonard 1993). Buses are the primary source of this highway noise with a sound level of 82 dBA at 50 feet (Leonard 1993). Industrial activities (i.e., shredding) at the Central Facilities Area produce the highest noise levels measured at 104.0 dBA. Noise generated at INEEL is not propagated at detectable levels offsite, since all primary facilities are at least 3 miles from site boundaries. However, INEEL buses operate offsite, creating normal levels of traffic

Noise Measurement

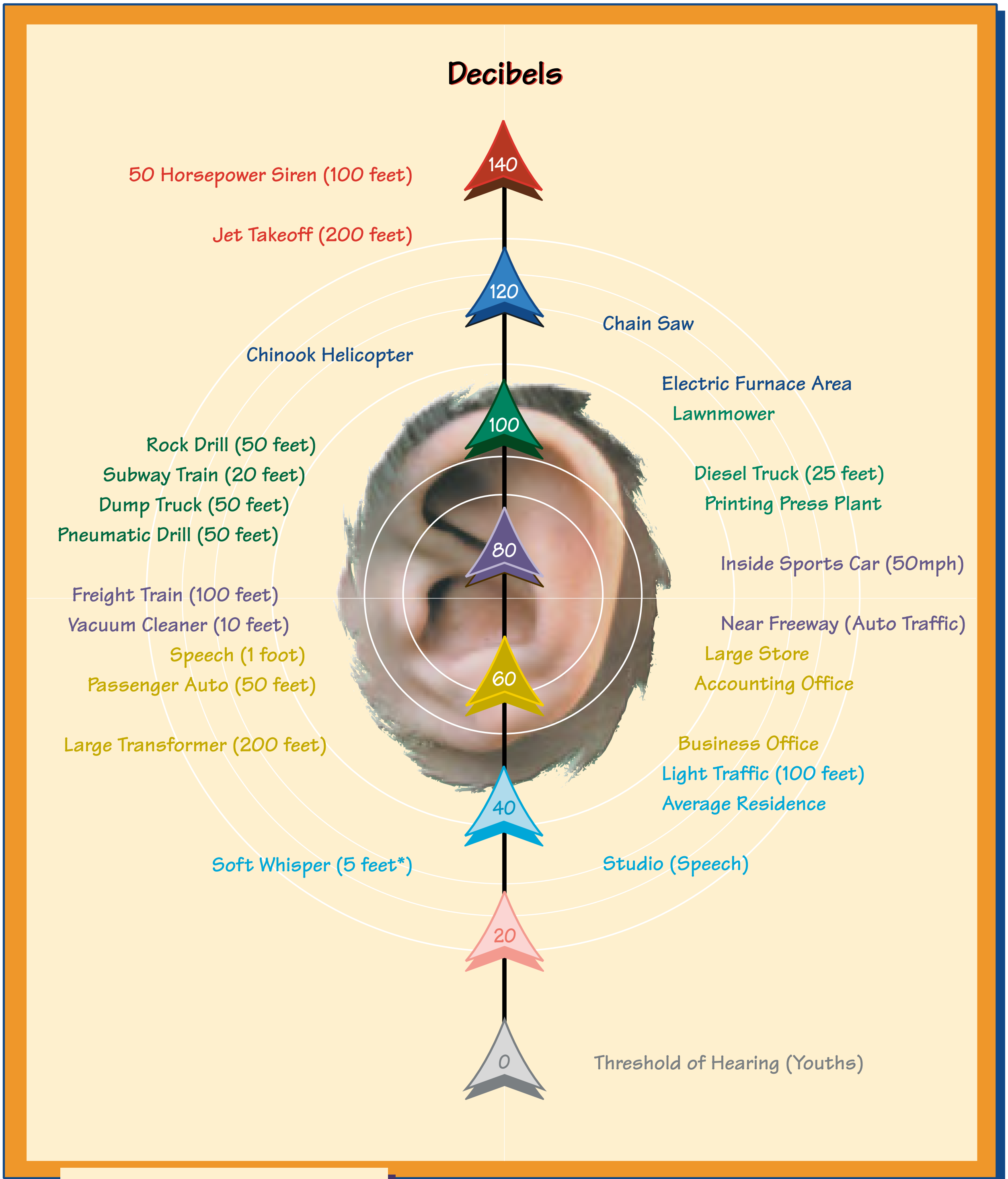
What are sound and noise?

When an object vibrates it possesses energy, some of which transfers to the air, causing the air molecules to vibrate. The disturbance in the air travels to the eardrum, causing it to vibrate at the same frequency. The ear and brain translate the vibration of the eardrum to what we call sound. Noise is simply unwanted sound.

How is sound measured?

The human ear responds to sound pressures over an extremely large range of values. The range of sounds people normally experience extends from low to high pressures by a factor of 1 million. Accordingly, scientists have devised a special scale to measure sound. The term decibel (abbreviated dB), borrowed from electrical engineering, is the unit commonly used.

Another common sound measurement is the A-weighted sound level, denoted as dBA. The A-weighted scale accounts for the fact that the human ear is more sensitive to some pitches than to others. Higher pitches receive less weighting than lower ones. Most of the sound levels provided in this EIS are A-weighted; however, some are in decibels due to a lack of information on the frequency spectrum of the sound. The scale in Figure 4-23 provides common references to sound on the A-weighted sound level scale.



LEGEND

* Operator's Position

SOURCE: Adapted from Glorig (1965) and Golden (1980).

FIGURE 4-23.
Typical A-Weighted Sound Levels.

noise in the community. In addition, previous studies on effects of noise on wildlife indicate that even very high intermittent noise levels at INEEL (over 100 dBA) would not affect wildlife productivity (Leonard 1993).

4.11 Health and Safety

This section presents the potential health effects to the public and workers as a result of current operations at INEEL. The discussion includes estimates of impacts from the release of radioactive and nonradioactive material and also includes occupational injury rates. Emphasis is placed on updating information presented in SNF & INEL EIS (DOE 1995a) from which this document is tiered. Since INTEC employees would be affected most by the waste processing and facility disposition alternatives, this section emphasizes occupational health and safety at INTEC. Background information related to the material presented in this section and details on the health effects methodology are included in Appendix C.3.

4.11.1 PUBLIC HEALTH AND SAFETY

As discussed in Section 4.7, the primary way in which activities under consideration in this EIS could affect public health is through airborne emissions. There is also a possibility of contamination of groundwater under the INEEL, and as noted in Section 4.8, this groundwater is part of the Snake River Plain aquifer, which has been designated a sole source aquifer. Nevertheless, any contamination of soil or groundwater at the INEEL would not be expected to significantly affect the offsite public because of the large size of the site and the large distances between the INTEC area and the offsite public.

The analyses of possible public health effects from projected air or water emissions presented in this EIS tend to be conservative, indicating higher results than would actually be expected to occur.

A number of independent entities monitor and track both radioactive and nonradioactive releases from INEEL, in air and in water. These entities include the National Oceanic and Atmospheric Administration, the U.S. Geologic Survey, the State of Idaho's INEEL Oversight Program, the U.S. Environmental Protection Agency, the State of Idaho's Department of Environmental Quality, the Idaho Department of Water Resources, and numerous university research programs and private contractors. Ongoing studies by the Centers for Disease Control and Prevention, an agency of the U.S. Department of Health and Human Services, also

carefully tracks possible health effects from past activities at INEEL.

4.11.1.1 Radiological Health Risk

Very low doses of radiation are not known to cause health effects in humans; however, extrapolation of the dose-response relationship from high doses indicates that statistical effects might be observed in large populations. The doses reported in this EIS from INEEL operations are in this very low category. This EIS reports two values: collective dose (in person-rem) and the hypothetical number of latent cancer fatalities (LCFs). For effects on individuals, DOE reports dose in millirem and LCF probability.

Table 4-24 provides doses and LCF probabilities from annual exposure due to routine airborne releases for the noninvolved worker and maximally exposed individual near the site boundary for years 1995 and 1996. These doses are well below the current regulatory standard, which limits doses to the maximally exposed member of the public to 10 millirem per year (40 CFR 61).

Table 4-25 provides summaries of the dose and number of LCFs based on annual exposure to the surrounding population for 1995 and 1996. The surrounding population consists of approximately 120,000 people within a 50-mile radius of INEEL (ESRF 1997). The total collective population dose for 1996 of 0.24 person-rem corresponds to much less than one LCF within the entire population over the next 70 years (ESRF 1997). The conversion from collective dose to number of LCFs is performed using risk factors contained in the *1993 Limitations of Exposure to Ionizing Radiation* (NCRP 1993).

Production wells at INTEC and elsewhere on the INEEL are sampled and analyzed for gross alpha, gross beta, tritium, and strontium-90 (ESRF 1997). During 1996, all gross alpha concentrations were within the expected concentration range for naturally occurring alpha activity in the aquifer underlying the Snake River Plain, including INEEL. Two samples from an INTEC production well in June of 1996 had detectable levels of gross beta. Gross beta measurements are used for screening purposes. If a gross beta measurement exceeds the Maximum Contaminant Level, then the radioactive constituents in the sample are identified and doses are assessed. No detectable concentrations of tritium were found in the INTEC distribution samples. Because of the presence of the localized plume of strontium-90 in the groundwater near INTEC, staff at INEEL routinely sample several production wells at INTEC. While samples have historically contained detectable levels of strontium-90, none of the 1996 samples indicated detectable concentrations of strontium-90 (ESRF 1997).

Potential health effects to the offsite population from the lifetime groundwater pathway are reported in the SNF & INEL EIS and were calculated as an estimated LCF risk of 1 occurrence in 170 million.

Table 4-24. Annual dose to individuals from exposure to routine airborne releases at the Idaho National Engineering and Environmental Laboratory.

Maximally exposed individual	Annual dose (millirem)[a,b,c]	LCF Probability [d]
Onsite worker (1995)	0.32	1.3×10^{-4}
Offsite individual (public) (1995)	0.008	4.0×10^{-6}
Offsite individual (public) (1996)	0.03	1.5×10^{-5}

a. DOE (1995a), maximum dose at any onsite area from permanent facility emissions for onsite worker.
b. ESRF (1996) for offsite individual, 1995.
c. ESRF (1997) for offsite individual, 1996.
d. LCF = Latent cancer fatality

Table 4-25. Estimated increased health effects due to routine airborne releases at the Idaho National Engineering and Environmental Laboratory.

Year	Population dose (person-rem)[a,b]	Number of latent cancer fatalities
1995	0.08	4.0×10^{-5}
1996	0.24	1.2×10^{-4}

a. ESRF (1996) for year 1995.
b. ESRF (1997) for year 1996.

4.11.1.2 Nonradiological Health Risk

The potential health risk to workers and the public from exposure to carcinogenic and noncarcinogenic chemicals was assessed in Volume 2, Section 4.12.1 of SNF & INEL EIS. The assessment included the evaluation of health effects from routine airborne releases from facilities at INEEL. The three categories of exposed individuals were (1) a maximally exposed offsite individual, (2) population within 50 miles of INTEC, and (3) noninvolved worker. The potential nonradiological health effects to workers and the public from routine air emissions calculated in DOE (1995a) are summarized in the following paragraphs.

For non-occupational exposures to members of the public, data concerning the toxicity of carcinogenic and noncarcinogenic constituents were obtained from dose response values approved by the U.S. Environmental Protection Agency (EPA 1993, 1994). The values included slope factors and unit risks for evaluating cancer risks, reference doses and reference concentrations for evaluating exposures to noncarcinogens, and primary National Ambient Air Quality Standards for evaluating criteria pollutants. For the individual noncarcinogenic toxic air pollutants (such as fluorides, ammonia, and hydrochloric and sulfuric acids), all hazard quotients were less than one. (The hazard quotient is a ratio of the calculated concentration in the air to the reference concentration.) This indicates that no adverse health effects would be projected as a result of noncarcinogenic emissions. The offsite excess cancer risk from carcinogenic emissions (such as arsenic, benzene, carbon tetrachloride, and formaldehyde) ranged from 1 in 1.4 million to 1 in 625 million. Current emission rates for some toxic pollutants (carcinogenic and noncarcinogenic) are higher than the baseline levels assessed in the SNF & INEL EIS, but resultant ambient concentrations are expected to remain below reference levels for public and occupational exposure. The hazard quotients for maximum baseline offsite criteria air pollutants were all less than one. These results indicate that no adverse health effects were projected from criteria pollutant emissions (DOE 1995a). The recent actual site-wide emissions for criteria pollutants presented in Table 4-10 of this EIS would result in similar impacts. For each criteria pollutant except lead, the current (1995 and 1996) emission rates are less than

the levels assessed in the SNF & INEL EIS. Lead emission levels were about three times higher in 1996 (average hourly emissions) but still within applicable regulatory standards. Table 4-11 shows that ambient air concentrations offsite are all well below the ambient air quality standards.

For occupational exposures to workers at INEEL, DOE compared modeled chemical concentrations with the applicable occupational standard. The comparison was made by calculating hazard quotients, which for noncarcinogenic and carcinogenic air pollutants at INTEC were less than one. With one exception, the estimated INEEL concentrations of toxic air pollutants were estimated at levels well below those established for protection of workers. The exception was for maximum short-term benzene concentration, which slightly exceeded the standard at the maximum predicted location within the Central Facilities Area. These levels result primarily from emissions associated with petroleum fuel storage, handling, and combustion.

Drinking water from INTEC wells and distribution systems is routinely sampled for volatile organic compounds and for inorganic constituents (ESRF 1997). For 1996, the EPA maximum contaminant levels and the State of Idaho drinking water limits were not exceeded. For chemical carcinogens, these levels indicate an excess incidence of cancer risk of less than 1 occurrence in 1 million. For noncarcinogenic chemical contaminants these levels indicate that no adverse health effects are expected as a result of these contaminants. Potable water at INEEL was monitored for coliform bacteria. No samples showed positive results for coliform at INTEC (ESRF 1997).

4.11.2 OCCUPATIONAL HEALTH AND SAFETY

The radiation doses and nonradiological hazards presented here are based on personnel monitoring data and reported occupational incidences at INEEL. For occupational exposure to ionizing radiation, health effects assessments are based on actual exposure measurements. For routine workplace hazards, the health risk is presented as reported injuries, illness, and fatalities in the workforce.

Risks to the worker are reduced by instituting health and safety programs. DOE relies on a program to keep worker exposures to radiation and radioactive material as low as reasonably achievable (ALARA). An effective ALARA program must balance minimizing individual worker doses from external and internal sources with the goal to minimize the collective dose of all workers in a given group. ALARA evaluations must consider individual and collective doses to ensure the minimization of both within the practical limits associated with minimization balancing. INEEL worker doses have typically been well below DOE worker exposure limits, and DOE will continue to use the ALARA program to maintain this level of safety.

DOE's Voluntary Protection Program was established to promote and recognize highly effective safety and health programs. Through the DOE-Voluntary Protection Program, INEEL's operating contractor has established a cooperative relationship in which management administers a comprehensive program that exceeds mere compliance and employees actively participate in the program and work with management to ensure a safe and healthful work site (LMITCO 1998).

Worker safety is also improved by the new Integrated Safety Management System. The INEEL Integrated Safety Management System Program Description (LMITCO 1999) is a document that defines the safety culture for INEEL. Safety at INEEL has been governed by many different procedures. This new plan outlines how all of the various safety programs, procedures, and documents relate to and integrate with each other. The term "safety" includes all aspects of environmental, safety, and health management including pollution prevention and waste minimization. The Plan covers the issues, responsibilities, methodologies, documents, and training (safety culture) that protects the worker, noninvolved worker, public, environment, and programmatic facilities (environmental targets).

4.11.2.1 Radiological Exposure and Health Effects

Radiological workers are trained to work safely in areas controlled for radiological purposes. Radiological workers at INEEL and INTEC may be exposed either internally (from inhalation and ingestion) or externally (from direct exposure) to radiation. The largest fraction of occupational dose received by INEEL and INTEC workers is from external radiation from direct exposure. The average occupational dose from 1992 to 1996 to individuals with measurable doses was 150 millirem, which results in an average annual collective dose of about 202 person-rem (DOE 1995b; DOE 1997a). This collective dose corresponds to 0.08 LCFs resulting from each year of exposure to INEEL personnel, including INTEC personnel. The average occupational dose DOE-wide from 1992 to 1996 to individuals with measurable doses was 72 millirem, which results in an average annual collective dose of about 1,812 person-rem (DOE 1995b; DOE 1997a); this corresponds to 0.72 LCFs resulting from each year of exposure to all DOE workers. For airborne emissions (as shown in Table 4-24), the maximum dose to an onsite worker from permanent facility emissions is 0.32 millirem.

4.11.2.2 Nonradiological Exposure and Health Effects to the Onsite Population

At INEEL, occupational nonradiological health and safety programs include industrial hygiene programs and occupational safety programs. Total recordable case rate for injury and illness incidence at INEEL varied from an annual average of 3.1 to 3.7 per 200,000 work hours from 1992 to 1996. During this time, total lost workday cases ranged from 1.3 to 1.8 per 200,000 work hours (DOE 1997b). The total recordable case rate for injury and illnesses for INEEL workers is less than that for DOE and its contractors at other facilities, which varied from 3.5 to 3.8 per 200,000 work hours. During this time, total lost workday case rate varied from 1.6 to 1.8 per 200,000 work hours (DOE 1997b). Two fatalities have occurred at INEEL between 1992 and July 1998. One incident occurred when a construction worker fell from an elevated area. The second incident occurred when a carbon dioxide fire suppression system activated during routine maintenance in an electrical switchgear building, causing asphyxiation of one employee.

4.12 Environmental Justice

Executive Order 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*, directs Federal agencies to make the achievement of environmental justice part of their mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of their programs, policies, and activities on minority populations and low-income populations. Where appropriate, Federal agencies will indicate the potential for disproportionately high and adverse human health or environmental effects on low-income populations, minority populations, and Indian tribes. When conducting NEPA evaluations, DOE incorporates environmental justice considerations into both its technical analyses and its public involvement program in accordance with EPA and Council on Environmental Quality guidance (CEQ 1997).

This section identifies minority and low-income populations in the geographic area near the proposed action. Demographic information from the U.S. Bureau of Census (USBC 1992) was used to identify the minority populations and low-income populations within a 50-mile radius of INTEC, defining the region of influence. This 50-mile region of influence was selected because it was consistent with the region of influence for air emissions and because it includes portions of the seven counties that constitute the region of influence for socioeconomics. The circle has INTEC at its center since the actions proposed in this EIS would be carried out at INTEC. Therefore, INTEC would be the source of most emissions with the potential for producing disproportionate human health or environmental impacts to minority populations, low-income populations, and children. In addition, all of the facility accidents analyzed in Section 5.2.14 of this EIS were postulated to occur at INTEC. Potential impacts to minority populations and low-income populations in the region of influence from implementation of the proposed alternatives are analyzed in Chapter 5.

4.12.1 COMMUNITY CHARACTERISTICS

Demographic maps were prepared using 1990 census data from the U.S. Bureau of Census. These maps were generated with census tracts and Block Numbering Areas (BNAs) defined by the Bureau of the Census, as geographical information system files supplied by Environmental Systems Research Institute, Inc. and provided by Geographic Data Technology, Inc. Census tracts are designated areas that encompass from 2,500 to 8,000 people. Block numbering areas follow the same basic criteria as census tracts in counties without formally-defined tracts. Both are derived from the Bureau of Census TIGER/Line files. Figures 4-24 and 4-25 illustrate census tract distributions for both minority populations and low-income populations, respectively. Environmental justice guidance developed by the Council on Environmental Quality defines "minority" as individual(s) who are members of the following population groups: American Indian or Alaskan Native; Asian or Pacific Islander; Black, not of Hispanic origin; or Hispanic (CEQ 1997). The Council defines these groups as minority populations when either the minority population of the affected area exceeds 50 percent or the percentage of minority population in the affected area is meaningfully greater than the minority population percentage in the general population or other appropriate unit of geographical analysis.

Low-income populations are identified using statistical poverty thresholds from the Bureau of Census Current Population Reports, Series P-60 on Income and Poverty. In identifying low-income populations, a community may be considered either as a group of individuals living in geographic proximity to one another, or a set of individuals (such as migrant workers or Native Americans), where either type of group experiences common conditions of environmental exposure or effect. The threshold for the 1990 census was a 1989 income of $12,674 for a family of four. This threshold is a weighted average based on family size and ages of the family members. Table 4-26 presents the U.S. Census poverty thresholds (USBC 1992).

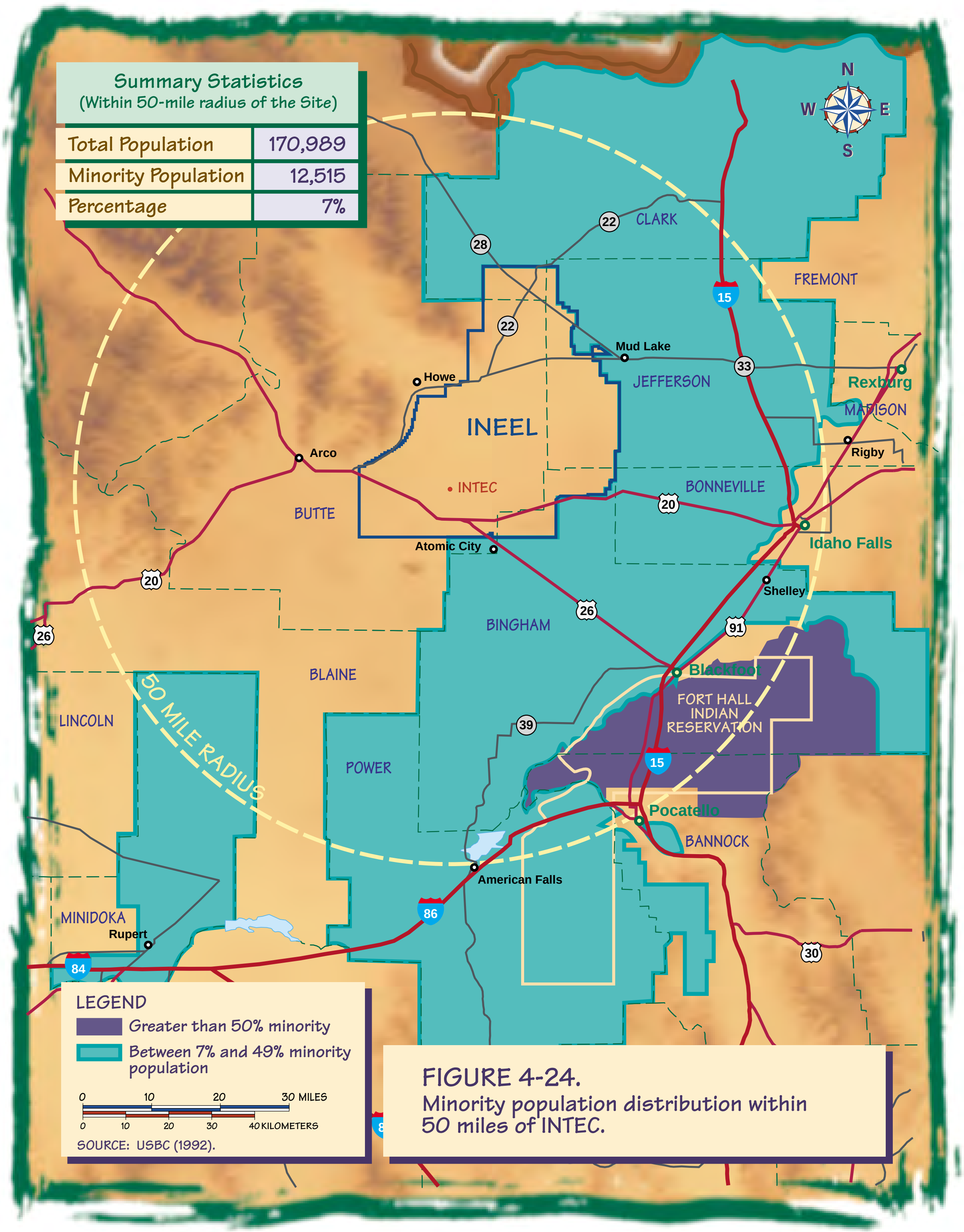


FIGURE 4-24.
Minority population distribution within 50 miles of INTEC.

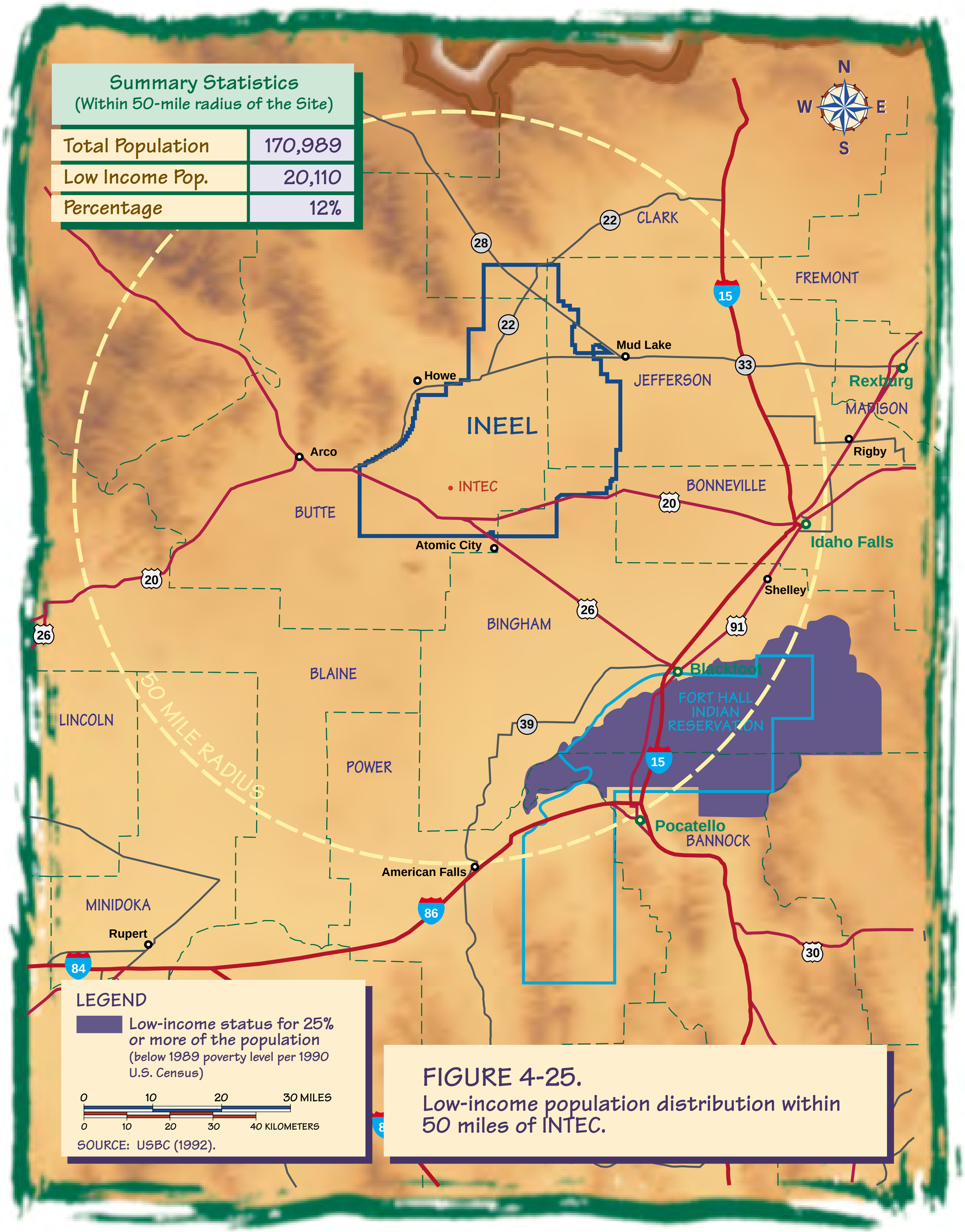


FIGURE 4-25.
Low-income population distribution within 50 miles of INTEC.

4.12.2 DISTRIBUTION OF MINORITY AND LOW-INCOME POPULATIONS

Accordingly to the 1990 census data, 170,989 people resided within the 50-mile INTEC region of influence. Of that population, approximately 12,515 individuals (7 percent) are classified as minority individuals. The minority composition is primarily Hispanic, Native American, and Asian. The Fort Hall Indian Reservation of the Shoshone-Bannock Tribes lies largely within the 50-mile region of influence. The spatial distribution of minority populations residing in 42 census tracts within 50 miles of INTEC is shown in Figure 4-24. In some cases, census tracts lie partly within the 50-mile radius circumference. Because the exact distribution of the populations within such tracts is not available, the data are insufficient to allow a precise count. To address this situation, the entire population of census tracts that were bisected by the 50-mile radius circumference line is included in the analysis.

Of the total population, approximately 20,110 individuals (12 percent) fall within the definition of low-income for the purpose of this analysis. Figure 4-25 shows the spatial distribution of low-income individuals within the 50-mile region of influence.

4.13 Utilities and Energy

This section provides baseline usage rates on current INEEL utilities and energy, focusing on INTEC. It includes water consumption, electricity consumption, fuel consumption, and wastewater disposal. The contents of this section are tiered from Volume 2 of the SNF & INEL EIS (DOE 1995).

Table 4-26. U.S. Census poverty thresholds in 1989 by size of family and number of related children under 18 years.[a]

Size of Family Unit	Weighted average threshold ($)	Children under 18 years: None ($)	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 & 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

a. Source: USBC (1992)

4.13.1 WATER CONSUMPTION

The water supply system for each INEEL facility area is provided independent of other facilities by a system of wells. DOE holds a Federal Reserve Water Right permitting INEEL to claim 36,000 gallons per minute of groundwater, not to exceed 11.4 billion gallons per year. Water consumption rates at each facility area are calculated based on the cumulative volume of water withdrawn from production wells for each facility. A total of 1.6 billion gallons of water was pumped from the aquifer by the INEEL during 1996; of that, 0.6 billion gallons was pumped by INTEC (DOE 1997). Comparably, water pumped by INEEL in past years was 1.3 billion gallons and 1.5 billion gallons in 1995 and 1994, respectively (DOE 1997). A majority of this water returns to the aquifer through seepage ponds, with the remaining water lost to the atmosphere through cooling towers and other evaporation processes.

4.13.2 ELECTRICITY CONSUMPTION

DOE presently contracts with Idaho Power Company to supply power to INEEL. The contract allows for power demand of up to 45,000 kilowatts, which can be increased to 55,000 kilowatts by notifying Idaho Power in advance. Power demand above 55,000 kilowatts is possible but would have to be negotiated with Idaho Power. INEEL customers (INTEC, Test Reactor Area, etc.) pay about $0.041 per kilowatt hour, which is a combination of the rate Idaho Power charges and costs the INEEL operating contractor adds for maintaining the INEEL power system and general and accounting costs. Idaho Power transmits power to INEEL via a 230-kilovolt line to the Antelope substation, which is owned by PacifiCorp (Utah Power Company). PacifiCorp also has transmission lines to this substation, which provides backup in case of problems with the Idaho Power system. At the Antelope substation the voltage is dropped to 138 kilovolts, then transmitted to the DOE-owned Scoville substation via two redundant feeders. The INEEL transmission system is a 138-kilovolt 65-mile loop configuration that encompasses seven substations, where the power is reduced to distribution voltages (13.8 or 12.5 kilovolts) for use at the various INEEL facilities. The loop allows for a redundant power feed to all substations and facilities.

Peak demand on this electrical power system for fiscal year (FY) 97 was 39 megawatts, compared to 40 megawatts for FY 1996. The monthly average consumption on this system for FY 97 was 18,481 megawatt-hours. Past years were at 18,158 megawatt-hours for FY 96, 18,541 megawatt-hours for FY 95, 13,181 megawatt-hours FY 94, and 12,666 megawatt-hours for FY 93. Yearly average consumption was 194,000 megawatt-hours for FYs 1993 to 1997. Monthly average consumption of purchased power increased substantially after 1994 because

Emergency Diesel Generator.

the Experimental Breeder Reactor-II was shut down. Power supplied by this reactor prior to 1995 now must be purchased from Idaho Power Company.

4.13.3 FUEL CONSUMPTION

Fossil fuels consumed at INEEL include fuel oil, coal, diesel fuel, gasoline, propane (liquid petroleum gas), and kerosene. All fuels are provided and transported by various distributors to each facility.

Fossil fuels consumed at INTEC include fuel oil and coal. In 1996, INTEC facilities used 97,000 gallons of fuel oil, compared to 280,000 gallons in 1995 (DOE 1997). A total of 14,600 tons of coal was burned at INTEC during the 1996 calendar year, while in 1995 11,800 tons were burned, and in 1994 8,700 tons were burned (DOE 1997).

4.13.4 WASTEWATER DISPOSAL

Wastewater systems at smaller facility areas consist primarily of septic tanks, drain fields, and lagoons. Wastewater treatment facilities are also provided for larger facility areas including INTEC, Central Facilities Area, and Test Reactor Area.

Annual wastewater discharge volume at INEEL for 1996 was 1.2 billion gallons, compared to 1.1 billion gallons in 1995 and 1.4 billion gallons in 1994. The difference between water pumped and wastewater discharge is caused mainly by evaporation from ponds and cooling towers.

4.14 Waste and Materials

This section summarizes the management of materials and wastes (hazardous, mixed low-level, low-level, transuranic, industrial solid, and high-level) and presents an overview of the current status of the various waste types generated, stored, and disposed of at INEEL. This section also summarizes Waste Minimization/Pollution Prevention programs in place to reduce the hazard and quantity of waste generation at INEEL.

The total amount of waste generated and disposed of at INEEL has been reduced through waste minimization and pollution prevention. More detailed descriptions can be found in the *Annual Report of Waste Generation and Pollution Prevention Progress* (DOE 1997a) and the DOE *Pollution Prevention Plan* (DOE 1997b).

INEEL has programs and physical or engineered processes in place to reduce or eliminate waste generation and to reduce the hazard, toxicity, and quantity of waste generated. Waste is also recycled to the extent possible before, or in lieu of, its storage or disposal. In addition, the site has achieved volume reduction of radioactive wastes through more intensive surveying, waste segregation, and use of administrative and engineering controls. These programs and their accomplishments have been described in various documents including site treatment plans (DOE 1998a) and annual progress reports (DOE 1997a).

DOE and the INEEL operating contractor have signed an incentive plan that sets a 5-year goal to reduce the amount of liquid waste going into the Tank Farm by about 43 percent. Waste minimization technologies expected to be used to meet the goal include using non-chemical decontamination systems, improving practices in the Process Equipment Waste Facility, and recycling acids for use in the New Waste Calcining Facility calciner. A key milestone under the settlement agreement between DOE, the State of Idaho, and the U.S. Navy calls for the Tank Farm to be empty of all liquid radioactive waste by 2012. Efforts initiated as a result of the Liquid Waste Minimization Incentive Plan are expected to play a major role in the INEEL's ability to meet this milestone.

Table 4-27 provides a summary of waste volumes for individual waste types at INEEL. Each waste type is then discussed further in the sections that follow.

4.14.1 INDUSTRIAL SOLID WASTE

Industrial and commercial solid waste is disposed at the INEEL Landfill Complex in the Central Facilities Area. About 225 acres are available for solid waste disposal at the Landfill Complex. The capacity is sufficient to dispose of INEEL waste for 30 to 50 years. Recyclable materials are segregated from the solid waste stream at each INEEL facility. The average annual volume of waste disposed of at the Landfill Complex from 1988 through 1992 was 52,000 cubic meters (EG&G 1993). For 1996 and 1997, the volume of waste was approximately 45,000 and 54,000 cubic meters, respectively.

4.14.2 HAZARDOUS WASTE

The INEEL's hazardous waste management strategy is to minimize generation and storage and use private sector treatment and disposal. Approximately 120 cubic meters of hazardous waste are generated at the site each year. Hazardous waste is treated and disposed of at offsite facilities and is transported by the contracted commercial treatment facility. The waste is packaged for shipment according to the receiving facility's waste acceptance criteria. The waste generator normally holds waste in a temporary accumulation area until it is shipped directly to the offsite commercial treatment facility.

4.14.3 MIXED LOW-LEVEL WASTE

Presently, there are about 1,700 cubic meters of mixed low-level waste in inventory at INEEL (DOE 1998a). In addition to the current volume of mixed low-level waste in inventory at the site, approximately 230 cubic meters of mixed low-level waste is generated annually (DOE 1998a). Several mixed waste treatment facilities exist at the INEEL. These facilities currently accept mixed waste from INEEL waste generators only (DOE 1998a).

4.14.4 LOW-LEVEL WASTE

Approximately 170,000 cubic meters of low-level waste have been disposed of at the Radioactive Waste Management Complex (DOE 1995, 1997c). Currently, about 6,000 cubic meters of low-level waste are in inventory at INEEL (Bright 1999). All on-site-generated low-level waste is stored temporarily at generator facilities until it can be shipped directly to the Waste Experimental Reduction Facility for volume reduction or to the Radioactive Waste Management Complex for disposal. DOE expects that the Radioactive Waste Management Complex will stop taking contact-handled low-level waste in 2006 and remote-handled low-level waste in 2008 (DOE 1998b).

4.14.5 TRANSURANIC WASTE

Approximately 65,000 cubic meters of transuranic and alpha-contaminated mixed low-level waste are retrievably stored, and 60,000 cubic meters of transuranic waste have been buried at the Radioactive Waste Management

Table 4-27. Summary of waste volumes awaiting treatment and disposal at INEEL[a]

Waste type[b]	Current inventory (cubic meters)	Annual generation (cubic meters)
Industrial solid[c]	–[d]	52,000
Hazardous waste[e]	None[f]	120
MLLW	1,700[g]	230[g]
LLW	6,000[h]	6,400[i]
Transuranic waste[j,k]	65,000	–
HLW (calcine)	4,200	–
Mixed transuranic waste/ SBW[l]	1,400,000 gallons	–

a. Does not include waste already disposed of at the Radioactive Waste Management Complex or other locations.
b. Waste types: MLLW = mixed low-level waste; LLW = low-level.
c. Source: EG&G (1993); this does not take into account the estimated volume reduction due to the paper pelletizer.
d. Dash indicates no information is available.
e. Source: DOE (1996).
f. Waste is shipped off-site before any significant inventory buildup.
g. Source: DOE (1998a).
h. Source: Bright (1999).
i. Source: Willson (1998).
j. Source: DOE (1995).
k. A portion of the 65,000 cubic meters of transuranic waste retrievably stored at the Radioactive Waste Management Complex may be reclassified as alpha MLLW. It has been estimated that approximately 40 percent of the 65,000 cubic meters is alpha MLLW and 60 percent is actually transuranic waste.
l. Source: Palmer (1999).

Complex (DOE 1995). The Radioactive Waste Management Complex is made up of seven Type II storage modules, each of which can hold up to 4,465 cubic meters of waste in drums or boxes. The total storage capacity is 31,255 cubic meters. The processing capacity of the Advanced Mixed Waste Treatment Facility is 6,500 cubic meters per year and the expected duration of facility operation is 30 years (DOE 1999). All 65,000 cubic meters of the retrievably stored waste were considered to be transuranic waste when first stored at INEEL. In 1982, DOE Order 5820.2 changed the definition of transuranic waste. The new definition excluded alpha-emitting waste less than 100 nanocuries per gram at the time of assay. Since all of the waste was initially considered to be transuranic waste, the alpha wastes were co-mingled in the same containers as the transuranic waste.

DOE has not determined the disposition of the buried transuranic waste (DOE 1995). However, DOE currently plans to treat and repackage the retrievably-stored transuranic and alpha-contaminated low-level waste so that all the resulting waste qualifies as transuranic waste. This waste would then be certified and shipped to the Waste Isolation Pilot Plant in New Mexico for final disposition. The Record of Decision from the *Waste Isolation Pilot Plant Disposal Phase Final Supplemental Environmental Impact Statement* was issued in January 1998 (DOE 1998c) and the first shipments of transuranic waste from the INEEL to the Waste Isolation Pilot Plant occurred in April and August 1999. Since the October 1988 ban by the State of Idaho on shipments of transuranic waste to INEEL, DOE has shipped only small amounts of transuranic waste generated on the site to the Radioactive Waste Management Complex for interim storage.

4.14.6 HIGH-LEVEL WASTE

From 1952 to 1991, DOE processed spent nuclear fuel and irradiated targets at the INTEC. The resulting liquid mixed HLW was stored in the Tank Farm. Mixed transuranic waste/SBW generated from the cleanup of solvent used to recover uranium and from decontamination processes at the INTEC is also stored in the Tank Farm. Although not directly produced from spent nuclear fuel processing, mixed transuranic waste/SBW at INEEL has been historically managed as HLW because of some of its physical properties. For purposes of analysis, the EIS assumes that SBW is mixed transuranic waste.

At present, approximately 4,200 cubic meters of HLW calcine are stored at INTEC. INEEL no longer generates liquid mixed HLW because spent nuclear fuel processing has been terminated (DOE 1995). All liquid mixed HLW produced from past processing has been blended and reprocessed, through calcination, to produce granular calcine. Liquid mixed transuranic waste/SBW is generated from incidental activities associated with operations at INTEC (DOE 1996). Currently, there are approximately 1.4 million gallons of mixed transuranic waste/SBW in storage at INTEC and this is expected to be reduced to about 800,000 gallons by the time processing begins under the proposed action (Barnes 1999).

Idaho High-Level Waste & Facilities Disposition

DRAFT ENVIRONMENTAL IMPACT STATEMENT

DECEMBER 1999 DOE/EIS-0287D

Volume 2

CHAPTERS 5 THROUGH 10

Cover Sheet

Responsible Agency: Lead Federal Agency: U.S. Department of Energy (DOE)
Cooperating Agency: The State of Idaho

Title: Idaho High-Level Waste and Facilities Disposition Draft Environmental Impact Statement (DOE/EIS-0287D)

Contact: For additional information on this Draft Environmental Impact Statement (EIS) and its related public hearings and meetings, write or call:

T.L. Wichmann, Document Manager
U.S. Department of Energy,
Idaho Operations Office
850 Energy Drive, MS 1108
Idaho Falls, ID 83401-1563
Attention: Idaho HLW & FD EIS
Telephone: (208) 526-0535

Ann Dold, Project Lead
State of Idaho INEEL Oversight Program
900 N. Skyline, Suite C
Idaho Falls, ID 83706
Telephone: (208) 526-2600

This Draft EIS is also available on the Internet at:
http://tis.eh.doe.gov/nepa/docs/docs.htm

For general information on the process that DOE follows in complying with the National Environmental Policy Act process, write or call:

Ms. Carol M. Borgstrom, Director, Office of NEPA Policy and Assistance, EH-42
U.S. Department of Energy
1000 Independence Avenue, S.W.
Washington, D.C. 20585
Telephone: (202) 586-4600, or leave message at (800) 472-2756

Abstract:

This Idaho High-Level Waste and Facilities Disposition Draft EIS analyzes the potential environmental consequences of managing two waste types at the Idaho National Engineering and Environmental Laboratory, namely, high-level waste in a calcine form and liquid mixed transuranic waste (historically known as sodium bearing waste and newly generated liquid waste). It also analyzes the disposition of existing and proposed high-level waste facilities after their missions have been completed. The waste processing alternatives are No Action, Continued Current Operations, Separations, Non-Separations, and Minimum INEEL Processing. The facilities disposition alternatives are No Action, Clean Closure, Performance-Based Closure, Closure to Landfill Standards, Performance-Based Closure with Class A Grout Disposal, and Performance-Based Closure with Class C Grout Disposal. The period of analysis for actions considered in this EIS is from 2000 through 2095. For residual contamination and waste disposal, DOE analyzed potential impacts over 10,000 years.

Public Comments:

In preparing this Draft EIS, DOE considered comments received by letter and voice mail, and formal statements made at public scoping meetings in Idaho Falls, Idaho, on October 16, 1997, and Boise, Idaho, on October 23, 1997.

A 60-day comment period on the Idaho High-Level Waste and Facilities Disposition Draft EIS begins with the publication of the U.S. Environmental Protection Agency Notice of Availability in the Federal Register. Public hearings to discuss and receive comments on the Draft EIS will be held at times and locations to be announced in the DOE Notice of Availability. Comments may also be submitted by mail to T.L. Wichmann at the address above or electronically at http://www.jason.com/hlwfdeis. The comments received during the comment period will be considered in the preparation of the Final EIS. Late comments will be considered to the extent practicable.

5.0 Environmental Consequences

5.1 Introduction

Chapter 5 describes the potential environmental consequences of implementing each of the alternatives described in Chapter 3. Environmental consequences of actions could include direct physical disturbance of resources, consumption of affected resources, and degradation of resources caused by effluents and emissions. Potentially affected resources include air, water, soils, plants, animals, cultural artifacts, and people, including workers and people in nearby communities. Consequences may be detrimental (e.g., wildlife habitat lost as a result of new construction) or beneficial (e.g., jobs created by new construction).

DOE prepared engineering studies that identify activities required under the various alternatives and supply data necessary for the impact analysis. Operating parameters for existing facilities and on-going operations were determined by examining historical data and impacts associated with these operations. If new processes or facilities would be required under a particular alternative, the operating parameters for it were extrapolated from similar processes or facilities or from the scientific literature, or developed by engineering scoping studies.

The impact assessments in this EIS have generally been performed in such a way that the magnitude and intensity of estimated impacts are unlikely to be exceeded during either normal operations or in the event of an accident. For routine operations, estimates from actual operations provide a reasonable basis for predictions of impacts. For accidents there is more uncertainty because the estimates are based on events that have not occurred. In this EIS, DOE selected hypothetical accidents that would produce impacts as severe or more severe than any reasonably foreseeable accidents.

To ensure that small potential impacts are not over-analyzed and large potential impacts are not under-analyzed, analysts have assessed potential impacts in a level of detail that is commensurate with their significance. This methodology follows the recommendation for the use of a "sliding scale" approach to analysis described in *Recommendations for the Preparation of Environmental Assessments and Environmental Impact Statements* (DOE 1993).

This EIS is concerned with two kinds of potential impacts, impacts from ***processing*** (i.e., retrieving, treating, and packaging) mixed HLW and mixed transuranic waste (SBW and newly generated liquid waste) and impacts from the ***disposition*** of facilities used to manage these wastes. Potential impacts from the five waste processing alternatives are discussed in Section 5.2. Potential impacts from the six facility disposition alternatives are discussed in Section 5.3.

Impacts that are cumulative with other past, present, or reasonably foreseeable actions are discussed in Section 5.4, Cumulative Impacts. Section 5.5, Mitigation Measures, describes measures that could reduce or offset the potential environmental consequences of the alternatives presented in this EIS. Unavoidable adverse environmental impacts are summarized in Section 5.6. Section 5.7 compares the potential short-term influences of each alternative with the resultant long-term productivity of the environment. Irreversible and irretrievable resource commitments are discussed in Section 5.8.

5.2 Waste Processing Impacts

Section 5.2 presents a discussion of potential environmental impacts from retrieving, analyzing, treating, and preparing mixed transuranic waste/SBW and mixed HLW for disposal. These are relatively short-term actions because DOE has committed to preparing all of the calcined waste by a target date of December 31, 2035 for shipment to a disposal facility. After 2035, storage of road-ready waste forms (and long-term storage of calcine under the No Action and Continued Current Operations Alternatives) would produce constant impacts on an annual basis. Five waste processing alternatives, described in detail in Section 3.1, are evaluated: the No Action Alternative, the Continued Current Operations Alternative, the Separations Alternative, the Non-Separations Alternative, and the Minimum INEEL Processing Alternative.

Potential impacts are presented by work phase, with the discussion of construction impacts preceding the discussion of operational impacts. Construction impacts would be those associated with (1) development of new waste processing facilities and (2) modification, refurbishment, or expansion of existing waste processing facilities. A representative construction impact would be noise-related disturbance to wildlife. Operational impacts would be those associated with the actual processing of mixed HLW and mixed transuranic waste/SBW within the various facilities. A representative operational impact would be air concentrations of hazardous substances from facility emissions.

Because two of the alternatives, the Separations Alternative and the Minimum INEEL Processing Alternative, could require construction of an onsite disposal facility for the low-level waste fraction, the potential impacts of building and operating this facility and transporting wastes to it for disposal are discussed in Section 5.2. Section 5.3 presents potential post-closure impacts from disposal of the low-level waste fraction in this new facility.

Section 5.2 summarizes the potential environmental impacts of treating INEEL's mixed HLW at the Hanford Site under the Minimum INEEL Processing Alternative. The incremental Hanford Site impacts for treatment of the INEEL mixed HLW were obtained by scaling impacts for similar activities presented in the Tank Waste Remediation System EIS. The "at Hanford" impacts are not directly comparable to those reported for the waste processing activities at INEEL because the impacts would affect different environments and populations and because of differences in the scope of the analyses in the Tank Waste Remediation System EIS and this EIS.

A more detailed analysis of impacts, along with a description of the Hanford Site Affected Environment, may be found in Appendix C.8. Decontamination and decommissioning activities at the Hanford Site would be carried out in accordance with site-specific plans and waste accords (e.g., Tri-Party Agreement) and are not discussed in this EIS.

Tables in Appendix C.6 list projects to be implemented under each waste processing alternative. Appendix C.6 also contains project summaries and project data sheets, which are the primary sources of information for the impact analysis. Appendix C.10 presents a compilation of environmental consequence data for each discipline by alternative, identifying acres disturbed, resources used (energy, services, and so forth), personnel required, and other important attributes. These attributes were used to determine the potential impacts of each alternative as discussed in this chapter.

Some waste processing alternatives would generate significant quantities of service waste water. However, DOE has not made the selection of the service waste water system. Therefore, the system's impacts are not included as part of the waste processing alternative impact analysis. Once an alternative is identified, the service waste water requirements will be estimated and the waste water system options will be considered under the National Environmental Policy Act as appropriate.

The structure of Section 5.2 closely parallels that of Chapter 4, Affected Environment. Thirteen sections of Chapter 4 have corresponding sections in Section 5.2. The sections discuss methodology and present the potential impacts of each waste processing alternative evaluated. In addition, for five key disciplines more details on methodology are provided in Appendix C. These disciplines are Socioeconomics (Appendix C.1), Air Resources (Appendix C.2), Health and Safety (Appendix C.3), Facility Accidents (Appendix C.4), and Transportation (Appendix C.5).

5.2.1 LAND USE

This section presents potential land use impacts from implementing the waste processing alternatives described in Chapter 3. Potential impacts were assessed by reviewing project plans for the five alternatives to determine if (1) project activities are likely to produce land use changes on the INEEL or surrounding region and (2) project plans conform to existing DOE land use plans and policies. Because one of the alternatives (Minimum INEEL Processing) would involve shipment of INEEL's mixed HLW to the Hanford Site for treatment, possible land use changes at the Hanford Site were also evaluated (see Appendix C.8). Unless otherwise noted, the discussion of impacts presented in this section applies specifically to the INEEL.

Most of the activities associated with waste management would take place inside the secure perimeter fence at INTEC, an area that has been dedicated to industrial use for more than 40 years. Because proposed activities would be conducted within or immediately adjacent to INTEC, land use on government-owned and privately-owned lands surrounding INEEL (see Section 4.2.2) would not be affected. Construction activities (e.g., development or expansion of facilities) have the greatest potential for affecting land use. Because none of the anticipated operational impacts (e.g., emissions from waste processing facilities) are expected to affect land use, no operational impacts are discussed in this section. Table 5.2-1 compares new facility and land requirements for the nine options under the five proposed waste processing alternatives. All activities would be consistent with DOE policy on land use and facility planning (DOE 1996a) and existing INEEL land use plans (DOE 1997).

5.2.1.1 No Action

Under this alternative, the New Waste Calcining Facility calciner would be placed in standby in June 2000. Remaining mixed transuranic waste/SBW would be left in the Tank Farm. Maintenance essential for the protection of workers and the environment would continue, but there would be no major facility upgrades. A new Calcine Retrieval and Transport System would be required to retrieve calcine from bin set 1 and transport it to bin set 6 or 7; otherwise, there would be no change in land use within INTEC and no overall change in land use on INEEL.

5.2.1.2 Continued Current Operations Alternative

As described in Section 3.1.2, this alternative would involve placing the New Waste Calcining Facility calciner in standby in June 2000 until upgrades are completed to put the facility in compliance with Maximum Achievable Control Technology requirements. Any remaining mixed transuranic waste/SBW would be left in the Tank Farm until 2011, when the New Waste Calcining Facility would resume operation. Other than a Newly Generated Liquid Waste Treatment Facility and a Calcine Retrieval and Transport System, no new facilities would be required. There would be no other change in land use within the INTEC and no overall change in land use on the INEEL.

5.2.1.3 Separations Alternative

Full Separations Option - Under this option, a number of new waste management and support facilities would be built within the developed portion of INTEC, including a Waste Separations Facility, Vitrification Plant, Class A Grout Plant, Vitrified Product Interim Storage Facility, and New Analytical Laboratory. DOE is evaluating three methods for disposing of the low-level waste fraction (Class A type grout) produced by processing mixed HLW and mixed transuranic waste/SBW: (1) offsite disposal, (2) onsite disposal in the Tank Farm and bin sets,

Table 5.2-1. New facilities and land requirements by waste processing alternative.[a]

Waste Processing Alternative	New INTEC facilities	New INEEL facilities outside of INTEC	Open land converted to industrial use (acres)
No Action Alternative	Calcine Retrieval and Transport System (bin set 1 only)	None	None
Continued Current Operations Alternative	Calcine Retrieval and Transport System (bin set 1 only), Newly Generated Liquid Waste Treatment Facility	None	None
Separations Alternative			
Full Separations Option	Calcine Retrieval and Transport System, Waste Separations Facility, Vitrification Plant, Class A Grout Plant, Vitrified Product Interim Storage Facility, New Analytical Laboratory, Waste Treatment Pilot Plant	Low-Activity Waste Disposal Facility[b]	22
Planning Basis Option	Calcine Retrieval and Transport System, Waste Separations Facility, Vitrification Plant, Class A Grout Plant, Vitrified Product Interim Storage Facility, Newly Generated Liquid Waste Treatment Facility, New Analytical Laboratory, Waste Treatment Pilot Plant	None	None
Transuranic Separations Option	Calcine Retrieval and Transport System, Transuranic Separations Facility, Class C Grout Plant, New Analytical Laboratory, Waste Treatment Pilot Plant	Low-Activity Waste Disposal Facility[b]	22
Non-Separations Alternative			
Hot Isostatic Pressed Waste Option	Calcine Retrieval and Transport System, Hot Isostatic Press Facility, HLW Interim Storage Facility, Newly Generated Liquid Waste Treatment Facility, New Analytical Laboratory, Waste Treatment Pilot Plant	None	None
Direct Cement Waste Option	Calcine Retrieval and Transport System, Direct Cement Facility, HLW Interim Storage Facility, Newly Generated Liquid Waste Treatment Facility, New Analytical Laboratory, Waste Treatment Pilot Plant	None	None
Early Vitrification Option	Calcine Retrieval and Transport System, Early Vitrification Facility, HLW Interim Storage Facility, New Analytical Laboratory, Waste Treatment Pilot Plant	None	None
Minimum INEEL Processing Alternative			
At INEEL	Calcine Retrieval and Transport System, Calcine Packaging Facility, SBW and Newly Generated Liquid Waste Treatment Facility, Vitrified Product Interim Storage Facility, New Analytical Laboratory, Waste Treatment Pilot Plant	Low-Activity Waste Disposal Facility[b]	22
At Hanford[c]	Canister Storage Buildings[d], Calcine Dissolution Facility	NA[e]	52

a. Source: Project Data Sheets in Appendix C.6.
b. Applicable to disposal of low-activity waste in a new INEEL disposal facility.
c. Source: Appendix C.8 of this EIS.
d. Applicable to the Interim Storage Shipping Scenario only.
e. NA = not applicable. For the onsite disposal facility only.

and (3) disposal in a new near-surface land disposal facility (see Section 3.1.3). If DOE chooses to dispose of the low-level waste fraction onsite in a land disposal facility, a new Low-Activity Waste Disposal Facility would be built approximately 2,000 feet east of the INTEC Coal-Fired Steam Generating Facility, which is outside the existing security perimeter fence (Figure 3-5). Appendix A discusses the process DOE used to select this site.

The total area of the Low-Activity Waste Disposal Facility, support facilities (e.g., guardhouse), and open buffer zone would be 22 acres; the disposal facility itself would be a 367-foot by 379-foot reinforced concrete structure with a maximum capacity of 34,800 cubic meters (Kiser et al. 1998). Once filled to capacity, the Low-Activity Waste Disposal Facility would be equipped with an engineered cap sloping from centerline to ground level with a four percent grade (Kiser et al. 1998). If a soil cap is used it would be revegetated with selected native plants to prevent erosion, improve the appearance of the closed facility, and blend in with surrounding vegetation.

This option would be consistent with current and planned uses of INTEC outlined in the *INEEL Comprehensive Facility and Land Use Plan* (DOE 1997). Implementing this option would not affect overall INEEL land use or land use on surrounding areas.

Planning Basis Option - This option is similar to the Full Separations Option, but differs in the way that mixed transuranic waste/SBW would be managed (see Chapter 3) and in the way that the low-level waste fraction (produced by processing mixed HLW and mixed transuranic waste/SBW) would be disposed of. Under the Planning Basis Option, mixed transuranic waste/SBW would be calcined in the New Waste Calcining Facility prior to dissolution and chemical separation rather than being separated directly into mixed high- and low-level waste fractions. Although the timing of processing would be different, the same new waste processing facilities would be required under this option as under the Full Separations Option. Under this option, the low-level waste Class A type grout fraction would be disposed of offsite at a commercial radioactive waste disposal facility. This option would be consistent with current and planned uses of INTEC outlined in the *Comprehensive Facility and Land Use Plan* (DOE 1997). Implementing this option would not affect overall INEEL land use or land use on surrounding areas.

Transuranic Separations Option - Under this option, a number of new facilities would be built within the developed portion of INTEC, including a Transuranic Separations Facility, Class C Grout Plant, and New Analytical Laboratory. As with the Full Separations Option, a new Low-Activity Waste Disposal Facility would be built if DOE chooses to dispose of the low-level waste fraction onsite in a near-surface land disposal facility. The location, dimensions, and basic design of this facility are discussed in the previous sections. Once filled, the Low-Activity Waste Disposal Facility would be capped and revegetated as described in the discussion of the Full Separations Option. Implementing this option would not affect overall INEEL land use or land use in surrounding areas.

5.2.1.4 Non-Separations Alternative

If DOE selects one of the three options under the Non-Separations Alternative, a number of new facilities would be built within the developed portion of INTEC including an immobilization (Hot Isostatic Press, Cement, or Early Vitrification) facility, a HLW Interim Storage Facility, a Newly Generated Liquid Waste Facility, and a New Analytical Laboratory. Development of these new facilities would be consistent with current and planned uses of INTEC outlined in the *INEEL Comprehensive Facility and Land Use Plan* (DOE 1997). No new construction would occur outside of the INTEC security perimeter fence, so there would be no overall change in land use on the INEEL.

5.2.1.5 Minimum INEEL Processing Alternative

This alternative would involve the shipment of calcined HLW to the Hanford Site, where it would be separated into high- and low-level fractions and vitrified (see Chapter 3). The vitrified wastes would then be returned to INEEL where the vitrified high-level waste fraction would be placed in storage and the vitrified low-level waste fraction would either be shipped to an offsite disposal facility or placed in a new Low-Activity Waste Disposal Facility east of INTEC. A number of new facilities would be built at INEEL in support of this alternative (see Table 5.2-1) including the Low-Activity Waste Disposal Facility, which is discussed in detail in Section 5.2.1.3. Development of these new facilities would be consistent with current and planned uses of INTEC outlined in the *INEEL Comprehensive Facility and Land Use Plan* (DOE 1997). The Low-Activity Waste Disposal Facility would require 22 acres of previously undisturbed land. Two new waste management facilities (Canister Storage Buildings and Calcine Dissolution Facility) would be built at Hanford under the Interim Storage Scenario. These new facilities would be built in an undisturbed 52-acre area within the 200-East Area at the Hanford Site. The development of these two new Hanford facilities would be consistent with Hanford Site land use plans (DOE 1996b). See Appendix C.8 for a more detailed analysis of at-Hanford impacts.

5.2.2 SOCIOECONOMICS

This section presents the potential effects of implementing the waste processing alternatives described in Chapter 3 on the socioeconomic factors of the INEEL region of influence as defined in Section 4.3, Socioeconomics. Changes to INEEL-related expenditures and workforce levels have the potential to generate economic impacts that may affect local employment, population, and community services. These potential impacts should be positive in that they would contribute to stabilization of the INEEL workforce and thus the regional economy. Since 1991, INEEL employment levels have declined about 35 percent to approximately 8,100 jobs. Long-range employment forecasts are not available for INEEL missions but indications based on budget forecasts suggest workforce levels have stabilized at current levels and will not fluctuate more than $\pm$ 5 percent (McCammon 1999). Currently about 1,100 of these workers are associated with INTEC (Beck 1998). DOE assumes that these workers are the basis for the HLW workforce. Since comprehensive staffing plans determining the number of employees that would be retrained and reassigned, if necessary, to support the HLW mission have not yet been prepared, it is assumed all 1,100 would be potentially available for HLW work.

Figure 5.2-1 shows projected total direct waste processing job requirements by alternative and option. The projected employment levels

Canister Storage Building at Hanford.

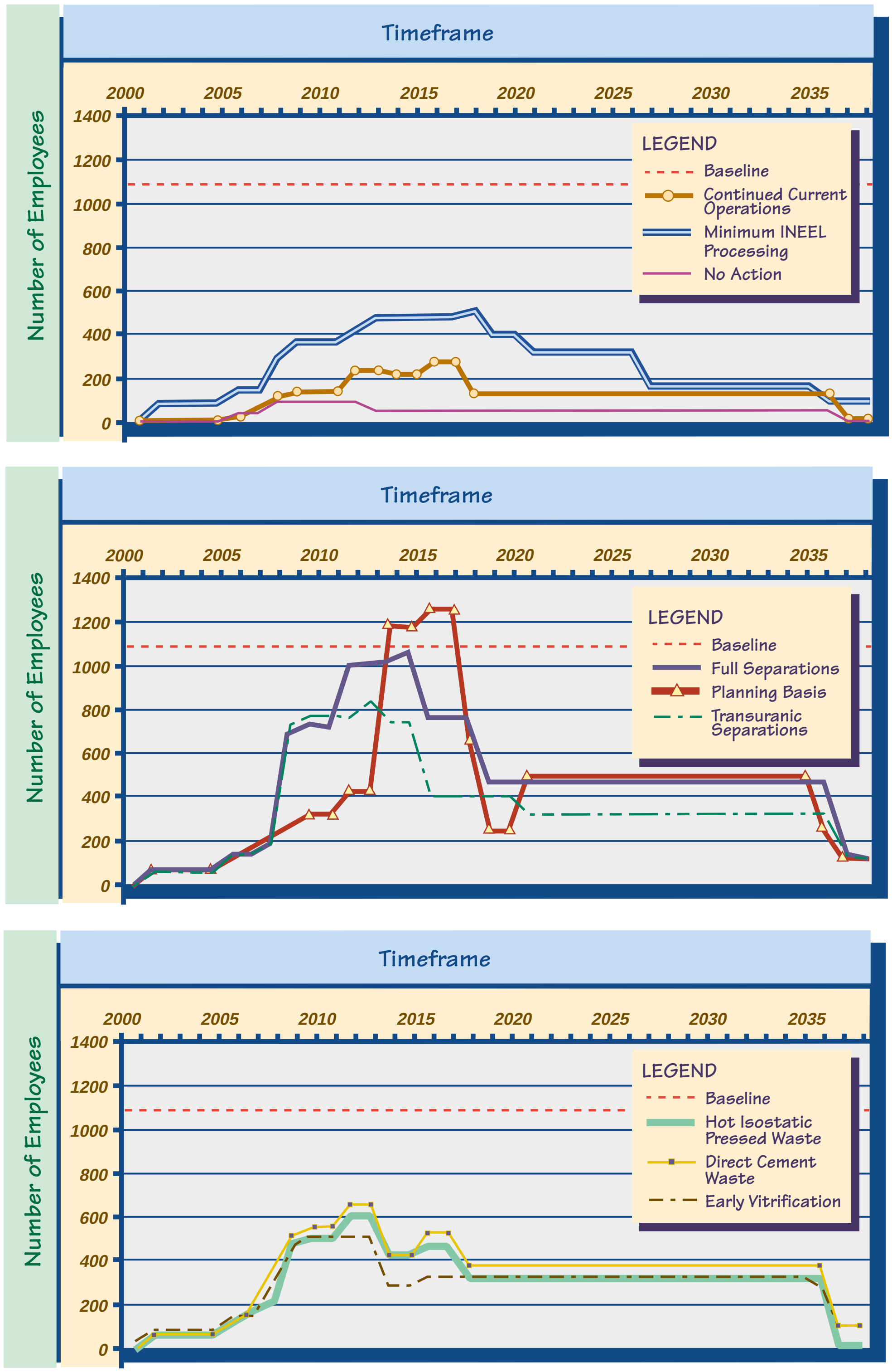
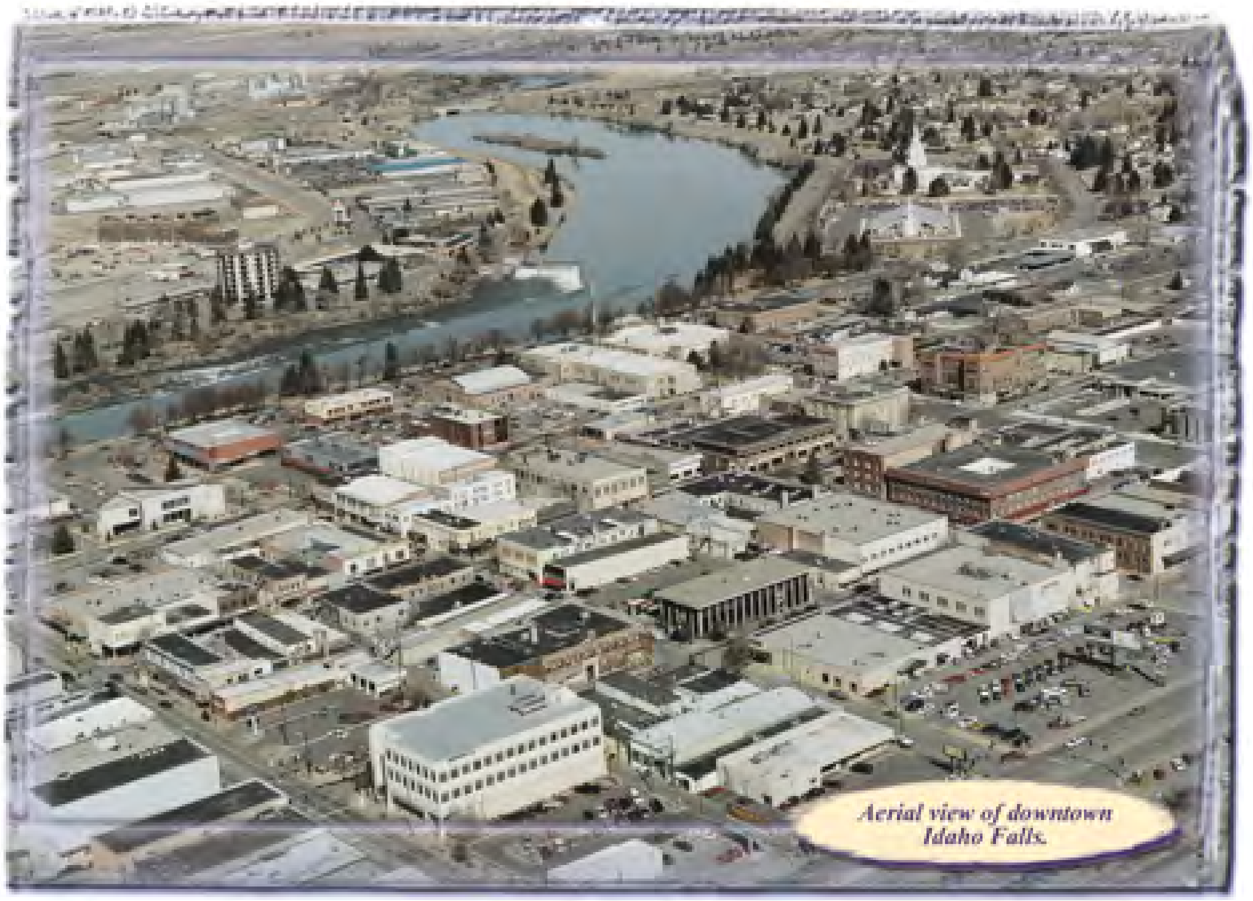


FIGURE 5.2-1.
Total projected direct employment by alternative compared to projected baseline employment at INTEC.



Aerial view of downtown Idaho Falls.

include a total of both construction and operations employment in a given year. Workforce levels marginally exceed the baseline for the Planning Basis Option during the operational phase.

Following a short discussion on methodology, potential impacts for both the construction and operational phases are discussed in terms of employment and earnings, population and housing, community services, and public finance. Facility disposition is discussed in Section 5.3.2.

5.2.2.1 Methodology

Socioeconomic impacts are addressed in terms of both direct and indirect jobs. Direct jobs are the employment levels directly expected to take place under each alternative and include both construction and operations phases. This may also include existing INEEL employees doing work that will transition to a waste processing alternative, especially in operations where existing employees would be expected to be retrained and reassigned, whenever possible. In some cases, the skill mix and the number of personnel available may dictate a reduction in force. The number of workers affected will depend on the alternatives selected and the timing. History has shown that such reductions are generally small. Indirect jobs can result from spending by INEEL employees which in turn generates non-INEEL jobs. The total economic impact to the region of influence is the sum of direct and indirect impacts.

The direct jobs for each option estimated in the socioeconomic analysis are based on the project data provided in Appendix C.6, Project Summaries, for all projects that make up the option. Total employment and earnings impacts were estimated using Regional Input-Output Modeling System (RIMS) multipliers developed specifically for the INEEL region of influence by the U.S. Bureau of Economic Analysis. A discussion of the methodology can be found in Appendix C.1, Socioeconomics.

The conditions described for the affected environment region of influence provide the basis for determining the potential impacts of each alternative. Projected baseline employment and population represent socioeconomic conditions that are likely to exist in the region of influence through 2035, which is the latest information available. Long term baseline projections that would serve as a comparison to long term HLW operations would be too speculative to be meaningful. Every alternative is expected to result in short-term employment for the construction of new facilities and longer-term employment for the implementation of the waste processing alternatives.

5.2.2.2 Construction Impacts

Employment and Earnings - Table 5.2-2 presents construction phase employment and earnings by alternative. Under the No Action Alternative, minimal construction would occur (a calcine retrieval and transport system) and would have the smallest incremental impact, about 40 jobs contributing less than $1 million to the economy. For the construction phase, the Planning Basis Option under the Separations Alternative represents the largest potential impact. A total of 1,770 jobs (870 direct and 900 indirect) are expected to be retained in the peak year (2013) as a result of implementing this option (Table 5.2-2). For the same peak year, employment in the region of influence is projected to be 152,000 (RIMS II). As can be seen, the INEEL employment levels retained by the Separations Alternative would be small compared to the region as a whole. The Continued Current Operations Alternative would result in the smallest number of jobs, except for No Action [180 jobs (90 direct and 90 indirect)]. During their respective peak years, the Planning Basis Option would contribute approximately $43 million (1996 dollars) in earnings to the local economy, while the Continued Current Operations Alternative would add $4.4 million (1996 dollars) (BEA 1998). The Minimum INEEL Processing Alternative at Hanford would result in approximately 290 direct jobs during the peak year. These contributions to the local economy would be temporary, lasting only as long as construction.

Although a few technical positions (such as iron and steel workers) may be required that would necessitate the in-migration of some workers and their dependents, the vast majority of workers would come from workers at INEEL or the region of influence unemployment pool. Table 5.2-3 projects regional employment to the year 2025. Sufficient labor resources appear available at INEEL and in the regional employment pool to accommodate INEEL employment requirements. Should unforeseen major construction activities begin in the future, availability of workers could become more constrained, but given the forecasted needs and projected labor pool, additional in-migration should be minimal. In the construction sector, forecasts indicate that about 6,500 to 7,000 construction workers would be in the area (RIMS II). The Planning Basis Option, the bounding case, requires 870 direct jobs which would be 12 to 13 percent of the projected construction workforce. The potential socioeconomic impacts at the Hanford Site would be similar to those described for INEEL but would be smaller in magnitude (see Appendix C.8).

Population and Housing - As the demand for workers in a region varies, the population 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 into (or out of) the region in search of new jobs. As can be seen from Table 4.3-1 and Table 5.2-3, both the population and the employment pool are projected to continue growing.

As mentioned in the introduction to this section, indications are that the INEEL workforce has stabilized but could vary by about 5 percent. If the variation resulted in downsizing, about 400 jobs could be lost. As noted in the previous section, any in-migration is expected to be minimal and would do little to offset the job losses.

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. Consequently, the reduction of employment could result in a

Table 5.2-2. Construction phase employment and income by alternative during respective peak year.

Alternatives	Peak[a]	Employment			Total earnings
		Direct[b]	Indirect	Total	(Dollars)[c]
No Action Alternative	2005	20	20	40	1,000,000
Continued Current Operations Alternative	2008	90	90	180	4,400,000
Separations Alternative					
Full Separations Option	2013	850	880	1,730	42,400,000
Planning Basis Option	2013	870	900	1,770	43,100,000
Transuranic Separations Option	2012	680	700	1,380	33,700,000
Non-Separations Alternative					
Hot Isostatic Pressed Waste Option	2008	360	370	730	17,900,000
Direct Cement Waste Option	2008	400	420	820	20,000,000
Early Vitrification Option	2008	330	340	670	16,400,000
Minimum INEEL Processing Alternative					
At INEEL	2008	200	210	410	9,900,000
At Hanford[d, e]	2024	290	300	590	14,400,000

a. Peak represents the first year of construction phase that employs the maximum direct workers.
b. Source: Data from project data sheets in Appendix C.6.
c. Source: IDOL (1998a) presented in 1996 dollars.
d. Source: Data from project data sheets in Appendix C.8.
e. Based on same wage structure and employment multiplier as INEEL.

Table 5.2-3. Population and labor projections.

Year	Region of influence population	Labor force	Unemployment	Employment
2000	258,774	134,975	6,159	128,816
2001	260,792	136,028	6,207	129,821
2002	262,810	137,080	6,255	130,826
2003	264,829	138,133	6,303	131,830
2004	266,847	139,186	6,351	132,835
2005	268,865	140,238	6,399	133,840
2006	270,962	141,332	6,449	134,884
2007	273,059	142,426	6,499	135,927
2008	275,156	143,520	6,548	136,971
2009	277,253	144,613	6,598	138,015
2010	279,350	145,707	6,648	139,059
2011	283,596	147,922	6,749	141,173
2012	287,843	150,137	6,850	143,287
2013	292,089	152,352	6,951	145,401
2014	296,336	154,567	7,052	147,514
2015	300,582	156,782	7,154	149,628
2016	304,489	158,820	7,247	151,573
2017	308,397	160,858	7,340	153,518
2018	312,304	162,896	7,433	155,463
2019	316,212	164,934	7,525	157,409
2020	320,119	166,972	7,618	159,354
2021	324,027	169,010	7,711	161,299
2022	327,934	171,048	7,804	163,244
2023	331,842	173,087	7,897	165,189
2024	335,749	175,125	7,990	167,134
2025	339,657	177,163	8,083	169,080

a. Source: BEA (1997).

reduced demand for housing and rental units. Assuming all 400 individuals own or rent housing and all are relocated, based on 1992 housing units, the amount of available housing would increase by about one-half of 1 percent (or 0.005).

Community Services and Public Finance - The situation involving potential impacts to community services and public finance is similar to that described for population and housing. As the demand for workers in a region varies, the pressure on community services and the tax base also varies. Assuming a stabilized INEEL workforce that would not vary by more than 5 percent, a downsizing of 400 jobs as discussed in the previous section would not likely generate discernible impacts on community services and public finance within the region of influence. While the magnitude of the impacts may be small, they could result in reduced school enrollments and 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 declines in regional economic activity.

5.2.2.3 Operational Impacts

Employment and Earnings - For the operations phase, the Direct Cement Waste Option represents the largest potential impact. As shown in Table 5.2-4, a total of 1,460 jobs (530 direct and 930 indirect) are expected to be retained during the peak year (2015) and would contribute about $31 million to the economy. Projected Idaho employment levels for the region are expected to be about 157,000 (RIMS II). Again, the INEEL workforce maintained by the waste processing alternatives would be small when compared to the regional workforce. The No Action Alternative would have the smallest number of jobs and would contribute about $5 million to the economy. The Continued Current Operations Alternative would have the next smallest workforce representing 780 jobs (280 direct and 500 indirect) with an economic contribution of about $16 million. As in the case of the construction phase, wages generated during operations could result in additional non-INEEL jobs. In general, operations would contribute less income to the regional economy than would construction, on a peak-year basis.

Although a few technical positions may be required that would necessitate the in-migration of some workers and their dependents, the vast majority of workers would come from the local unemployment pool in the region of influence. Unemployment in the region of influence ranged between 5 and 6 percent in the 1990s (BLS 1997). As was the case for construction, sufficient labor resources appear available at INEEL and in the regional employment pool to accommodate INEEL employment requirements. However, as can be seen on Figure 5.2-1, the operational peak marginally exceeds the baseline employment level. These additional employees would have to be reassigned from other INEEL missions or obtained from the regional employment pool. Again, as with the construction phase, in-migration should be minimal. The Direct Cement Waste Option is projected to require 530 direct employees. During the peak year of operations, forecast indicates about 7,000 to 7,500 operational sector employees would be in the area.

Population and Housing - Potential impacts would be the same as for the construction phase.

Community Services and Public Finance - Potential impacts would be the same as for the construction phase.

5.2.3 CULTURAL RESOURCES

This section presents potential impacts to cultural resources from implementing the proposed waste processing alternatives described in Chapter 3. The analysis of potential impacts to cultural resources, which is based on the five waste processing alternatives described in Chapter 3, focuses on archaeological and historic sites, areas of cultural or religious importance to local Native Americans, and paleontological localities on the INEEL. Because one of the alternatives (Minimum INEEL Processing) involves shipment of mixed HLW to the Hanford Site for treatment, possible impacts to Hanford cultural resources were also evaluated (see Appendix C.8). Unless otherwise

Table 5.2-4. Operations phase employment and income by alternative during respective peak year.

Alternatives	Peak[a]	Employment			Income
		Direct[b]	Indirect	Total	(dollars)[c]
No Action Alternative	2007	70	170	240	5,000,000
Continued Current Operations Alternative	2015	280	500	780	16,100,000
Separations Alternative					
Full Separations Option	2018	440	790	1,230	25,600,000
Planning Basis Option	2020	480	860	1,340	27,900,000
Transuranic Separations Option	2015	320	570	890	18,400,000
Non-Separations Alternative					
Hot Isostatic Pressed Waste Option	2015	460	820	1,280	26,800,000
Direct Cement Waste Option	2015	530	930	1,460	30,500,000
Early Vitrification Option	2015	330	590	920	19,000,000
Minimum INEEL Processing Alternative					
At INEEL	2018	330	590	920	19,000,000
At Hanford[d,e]	2029	740	1,320	2,060	42,800,000[e]

a. Peak represents the first year of operations phase that employs the maximum direct workers.
b. Source: Data from project data sheets contained in Appendix C.6.
c. Source: IDOL (1998b) presented in 1996 dollars.
d. Source: Data from project data sheets in Appendix C.8.
e. Based on same wage and employment multipliers as INEEL.

noted, however, the discussion of impacts presented in this section specifically applies to the INEEL. DOE assessed potential impacts by (a) identifying project activities that could directly or indirectly affect cultural resources, (b) identifying the known or expected cultural resources in areas of potential impact, and (c) determining whether a project activity would have an adverse effect on these resources.

DOE evaluated both direct and indirect potential impacts. Direct impacts to archaeological resources are usually those associated with ground disturbance from construction activities. Direct impacts to archaeological sites may result from vandalism due to increased access to sites. Direct impacts to existing historic structures could 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 with, or alter, the property's setting. Direct impacts to traditional Native American cultural resources could occur through land disturbance, vandalism, or alteration of the environmental setting of traditional use and sacred areas.

Indirect impacts to traditional Native American cultural resources could occur from an overall increase in activity brought about by the construction and operational workforces employed under the waste processing alternatives. The Shoshone-Bannock Tribes embrace a holistic approach to protection of Native American cultural resources and land. This approach encompasses all the components of the environment, such as the air, soils, plants, and animals, and ascribes greater value to the whole than would be found by adding the individual components. Section 4.4 discusses the holistic approach in greater detail. Non-traditional activities in the region (e.g., construction and operation of waste processing activities) are considered by the Shoshone-Bannock Tribes to diminish the quality of the cultural setting when they can be seen or heard from sacred or traditional-use areas. The broad, open expanse of the Eastern Snake River Plain allows a high degree of visibility for long distances, thus increasing the potential for impacts of this nature. From the tribal perspective, the ideal level of non-traditional activity in the region would be zero; however, because activity is on-going in the region, DOE has established the current level of activity as the baseline for the analysis.

5.2.3.1 Construction Impacts

Most of the activities associated with HLW management at INEEL would take place inside the perimeter security fence at INTEC, an area that has been highly altered by development and dedicated to industrial use for more than 40 years. Because extensive ground disturbance has already occurred within the fenced perimeter of the INTEC, it is unlikely that new construction or remediation activities would disturb archaeological resources. There are no existing known archaeological sites within the fenced perimeter at INTEC. Therefore, none of the alternatives is likely to result in direct or indirect impacts to archaeological sites within the fenced perimeter at INTEC. Activities outside the fence are more likely to result in impacts to archaeological sites.

Under the Separations and Minimum INEEL Processing Alternatives, DOE may choose to dispose of the low-level waste fraction onsite. If so, a new Low-Activity Waste Disposal Facility could be built in a previously undisturbed area approximately 2,000 feet east of the INTEC Coal-Fired Steam Generating Facility, outside the existing security perimeter fence (Figure 3-5). Prior to construction, this area would be surveyed for archaeological resources. If any archaeological resources are located during the survey, DOE would work in consultation with the State Historic Preservation Office, the Advisory Council on Historic Preservation, and the Shoshone-Bannock Tribes. Upon completion of disposal activities, an engineered cap would be placed over the disposal facility and if a soil cap is used it would be revegetated with native species. The waste disposal facility would blend naturally into the landscape over time.

The INEEL has implemented strong "Stop Work" stipulations in the event that archaeological resources or human remains are discovered during any project implementation. These stipulations include provisions for notification of, and consultation with, the State Historic Preservation Officer, the Advisory Council on Historic Preservation, and the Shoshone-Bannock Tribes in accordance with National Historic Preservation Act and Native American Graves Protection and Repatriation Act (Ringe-Pace 1998, Yohe 1995). Additionally 36 CFR 800.13(b) (regarding inadvertent discoveries) mandates that a reasonable effort be made to avoid, minimize, or mitigate adverse effects to any discovered items.

There are 38 known historic properties within the INTEC fence, but none are expected to be directly or indirectly affected. Reuse of historic structures must be considered prior to acquiring, constructing, or leasing new structures (National Historic Preservation Act Section 110). Under the Continued Current Operations Alternative, DOE would modify the New Waste Calcining Facility. The New Waste Calcining Facility would also be modified under the Planning Basis, Hot Isostatic Pressed Waste, and Direct Cement Waste Options. DOE would disposition these facilities at the conclusion of waste processing activities. These buildings were determined in 1997 to be too recently built to be evaluated for their historic significance. They will be reassessed for their eligibility for nomination to the National Register of Historic Places at a later date, or prior to modification or demolition. Also, these buildings could be eligible for nomination to the National Register of Historic Places under Criterion G, "exceptional significance"; however, this eligibility must be conducted in consultation with the Idaho State Historic Preservation Office and the Advisory Council on Historic Preservation. If the buildings are determined to be eligible for nomination to the National Register of Historic Places, a Memorandum of Agreement would be required to ensure the mitigation of impacts. Stipulations to mitigate adverse impacts contained within this Agreement would be negotiated by DOE with the State Historic Preservation Office. Therefore, the only sources of potential impacts to cultural resources during construction on the INEEL are from emissions and overall increases in worker numbers and traffic under the alternatives.

5.2.3.2 Operational Impacts

No Action Alternative – This alternative assumes the New Waste Calcining Facility calciner would be placed on standby in June 2000. A new Calcine Retrieval and Transport System would be required to move calcine from bin set 1 to bin set 6 or 7; no other HLW facilities would be built. The calciner would be shut down; therefore, minimal process emissions would be generated. There would be fewer workers employed at INTEC (see Section 5.2.2) and a corresponding decrease in traffic (see Section 5.2.9) under this alternative. DOE expects that no potential impacts to cultural resources would occur from this alternative. No adverse visual or auditory impacts would occur to the archaeological, historic, or cultural resources setting on the INEEL or along the transportation routes as a result of the implementation of the No Action Alternative at INTEC.

Continued Current Operations Alternative – Under this alternative, current HLW management activities would continue after the New Waste Calcining Facility has been upgraded. Several INTEC facilities, including the New Waste Calcining Facility, would be upgraded or expanded, and the remaining mixed transuranic waste/SBW would be calcined beginning in 2011. Air emissions from the existing calciner stack would continue at a reduced level after Maximum Achievable Control Technology upgrades, resulting in decreased visual degradation of the cultural setting of the INEEL and adjacent lands. Stack emissions from the calciner would be substantially reduced upon completion of mixed transuranic waste/SBW calcining operations in 2014. Calcining operations and associated stack emissions would cease after 2016. After 2016, no potential impacts to cultural resources would occur from emissions. Section 5.2.6, Air Resources, discusses emission levels in greater detail. There would be approximately the same number of workers employed at INTEC (see Section 5.2.2) and no change in the level of traffic (see Section 5.2.9) under this alternative; therefore, DOE expects that impacts to cultural resources other than the facility modifications would not occur from this alternative. The modifications would be mitigated through an agreement with the State Historic Preservation Office.

Separations Alternative – This alternative would require a number of new waste management and support facilities within the developed portion of INTEC under the Full Separations, Planning Basis, or Transuranic Separations Options (see Table 5.2-1). Some temporary visual degradation of the cultural setting of the INEEL and adjacent lands would occur from process air emissions under this alternative. Stack emissions from all waste processing operations would cease upon completion in 2035. Section 5.2.6, Air Resources, discusses emission levels in greater detail. In general, this alternative would employ the greatest number of workers at INTEC (see Section 5.2.2). This would result in the highest increase in traffic (see Section 5.2.9) among the alternatives on the INEEL property. This increase, however, would be small relative to existing levels; therefore, DOE does not expect impacts to cultural resources from this alternative.

Non-Separations Alternative – This alternative would require a number of new waste management and support facilities within the developed portion of INTEC under the Hot Isostatic Pressed Waste and Direct Cement Waste Options (see Table 5.2-1). Five new facilities would be required under the Early Vitrification Option. Some temporary visual degradation of the cultural setting of the INEEL and adjacent lands would occur from process air emissions under this option. Stack emissions from all waste processing operations would cease upon completion in 2035. After 2035, no potential impacts to cultural resources would occur from emissions. Section 5.2.6, Air Resources, discusses emission levels in greater detail. In general, increased employment would result in approximately the same number of workers employed at INTEC under this alternative as under the Separations Alternative (see Section 5.2.2). Similarly, the increased traffic on INEEL would be approximately the same as the traffic under the Separations Alternative (see Section 5.2.9) and would be small relative to existing levels; therefore, DOE does not expect impacts to cultural resources from this alternative.

Minimum INEEL Processing Alternative – Under this alternative, a small number of new waste management and support facilities would be built within the developed portion of INTEC. Some minor temporary visual degradation of the cultural setting of the INEEL and adjacent lands would occur from air emissions under this option. Emissions from all waste processing operations would cease upon completion in 2035. After 2035, no potential impacts to cultural resources would occur from emissions. Section 5.2.6, Air Resources, discusses emission levels in greater detail. In general, this alternative would result in fewer workers employed at INTEC (see Section 5.2.2) than under the Separations or Non-Separations Alternatives. Similarly, the increased traffic on the INEEL would be substantially less than the traffic under the Non-Separations Alternative and would be small relative to existing levels; therefore, DOE does not expect impacts to cultural resources at INEEL from this alternative.

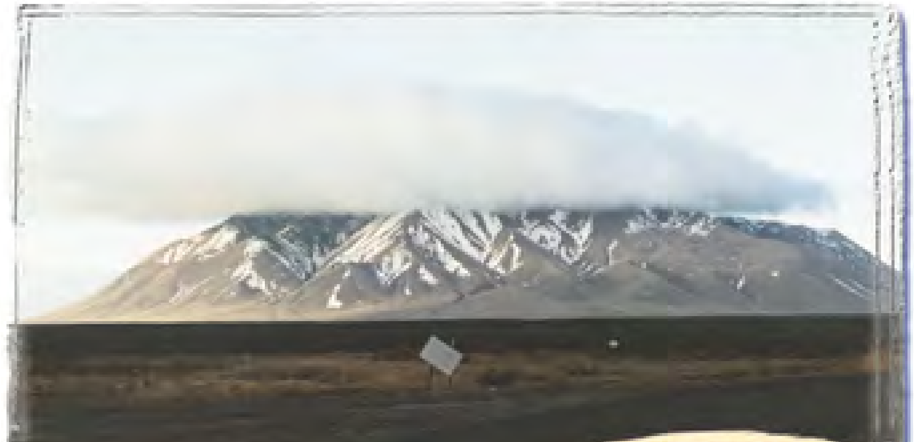
In addition, two new facilities could be built within the 200-East Area of the Hanford Site under the Interim Storage Scenario. These activities would be carried out in accordance with the *Hanford Cultural Resources Management Plan* (Chatters 1989) to identify and evaluate cultural resources associated with the project locations and mitigate possible damage to those cultural resources. Employment and the corresponding increase in traffic at Hanford would be substantially higher under this alternative (see Appendix C.8) than they would be at INEEL under all the other alternatives. The increase in traffic, however, would still be small in comparison with existing levels; therefore, DOE expects no impacts to cultural resources at Hanford under this alternative.

5.2.4 AESTHETIC AND SCENIC RESOURCES

5.2.4.1 Methodology

This section presents potential aesthetic and scenic resource impacts from implementing the proposed waste processing alternatives described in Chapter 3. DOE assessed potential impacts by reviewing project plans for the nine proposed options that define the five alternatives to determine if (1) project activities would be likely to produce aesthetic and scenic resource changes and (2) those changes would be likely to result in significant impacts to the aesthetic and scenic resources of the INEEL and its adjacent lands. Because one of the alternatives (Minimum INEEL Processing) would involve shipment of calcined HLW to the Hanford Site for treatment, possible impacts to Hanford's aesthetic and scenic resources were also evaluated (see Appendix C.8). Unless otherwise noted, however, the discussion of impacts presented in this section applies specifically to the INEEL. DOE did not analyze separately the nine individual options within the five alternatives because there are no significant distinctions between them for the purposes of the aesthetics analysis. In order to keep the discussions clear, concise, and easy to compare, this analysis presents only the differences between the alternatives.

Most of the waste processing activities would take place inside the perimeter security fence at INTEC, an area that has been highly altered by development and dedicated to industrial use for more than 40 years. Potential impacts to aesthetic and scenic resources include (a) the addition or modification of structures and (b) the addition of construction and process emissions that could alter the view. Determination of significant visual resource degradation from new or modified 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 incompati-



Big Southern Butte in southeast Idaho.

ble with the general setting and the Bureau of Land Management Visual Resource Management Class designation for the area, DOE would consider the impacts to be significant.

DOE used conservative screening-level methods to quantitatively assess impacts to visibility at Craters of the Moon National Wilderness Area, which at 28 miles southwest of INTEC is the nearest Class I area. The results (see Appendix C.2 for numerical results) indicate that predicted levels of particulate matter and oxides of nitrogen from any of the HLW processing alternatives would be well below the numerical criteria that represent a threshold for perceptible impacts.

Visual resources include the natural and man-made physical features that give a particular landscape its character and value. There are four visual resource classes in the Bureau of Land Management inventory (BLM 1986). Classes I and II are the most valued; Class III is moderately valued; and Class IV is of least value (see Table 5.2-5). The industrialized area of the INTEC has a Bureau of Land Management Visual Resource Management rating of Class IV.

Within the region of influence, potential impacts to aesthetic and visual resources include factors resulting from waste processing activities that would be detrimental to the available views, such as visibility degradation caused by air emissions from INTEC operating plants. Emissions released into the atmosphere during both the construction and operation of waste processing 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 horizon, 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.

The visual setting, particularly in the Middle Butte area located in the southern portion of the INEEL, is regarded by the Shoshone-Bannock Tribes as an important Native American visual resource. The Shoshone-Bannock Tribes would be consulted before projects were developed that could have impacts to resources of importance to the tribes.

5.2.4.2 Construction Impacts

Under the Separations and Minimum INEEL Processing Alternatives, DOE may choose to dispose of the low-level waste fraction onsite in a new Low-Activity Waste Disposal Facility. The facility would be built approximately 2,000 feet east of the INTEC Coal-Fired Steam Generating Facility, outside the existing security perimeter fence (see Figure 3-5). This site has previously been disturbed by activities at INTEC (Kiser et al. 1998). The total area of the Low-Activity Waste Disposal Facility, support facilities (e.g., guardhouse), and open buffer zone would be 22 acres. The disposal facility itself would be a 367-foot by 379-foot reinforced con-

Table 5.2-5. Bureau of Land Management Visual Resource Management objectives.[a]

Rating	Management objectives
Class I	The objective of this class is to preserve the existing character of the landscape. This class provides for natural ecological changes; however, it does not preclude very limited management activity. The level of change to the characteristic landscape should be very low and must not attract attention.
Class II	The objective of this class is to retain the existing character of the landscape. The level of change to the characteristic landscape should be low. Management activities may be seen but should not attract the attention of the casual observer. Any changes must repeat the basic elements of form, line, color, and texture found in the predominant natural features of the characteristic landscape.
Class III	The objective of this class is to partially retain the existing character of the landscape. The level of change to the characteristic landscape should be moderate. Management activities may attract attention but should not dominate the view of the casual observer. Changes should repeat the basic elements found in the predominant natural features of the characteristic landscape.
Class IV	The objective of this class is to provide for management activities that require major modification of the existing character of the landscape. The level of change to the characteristic landscape can be high. These management activities may dominate the view and be the major focus of viewer attention. However, every attempt should be made to minimize the impact of these activities through careful location, minimal disturbance, and repeating the basic elements.

a. Source: BLM (1986).

crete structure with a maximum storage capacity of 34,800 cubic meters. The facility would be equipped with an engineered cap sloping from the center to ground level with a 4-percent grade (Kiser et al. 1998). The cap would be revegetated with selected indigenous species to minimize erosion and restore appearance. From U.S. 20, the nearest public access, the revegetated cap would blend in with the rolling topography of the area and would not be visible.

Construction activities under all the alternatives would produce fugitive dust that could affect visibility temporarily in localized areas; however, it would not be visible from lands adjacent to the INEEL or beyond and would not exceed the Class III objectives. Heavy equipment would produce some exhaust emissions; however, these emissions would not be expected to produce any significant visual impacts. Section 5.2.6, Air Resources, discusses emission levels in greater detail. Construction activities would be limited in duration, and DOE would follow standard best management practices (e.g., spraying or misting) to minimize both erosion and dust; therefore, DOE does not expect significant visual impacts from construction activities.

5.2.4.3 Operational Impacts

No Action Alternative – Under this alternative, a new Calcine Retrieval and Transport System would be the only new facility. The New Waste Calcining Facility calciner would be placed in standby mode in June 2000, and would not be upgraded and returned to service; therefore, no further stack emissions would occur from calcining operations. Using emission levels from calcining operations prior to June 2000 as the baseline for no impacts, this alternative would not exceed the Bureau of Land Management Visual Resource Management Class III or Class IV objectives of the INEEL or the Class I or Class II objectives of adjacent lands.

Continued Current Operations Alternative – Under this alternative, ongoing HLW management activities would continue and there would be two new facilities (see Table 5.2-1). Section 5.2.6, Air Resources, discusses in greater detail emissions associated with on-going HLW management activities at INTEC. Maximum Achievable Control Technology upgrades to the calciner as well as abatement devices on other processing equipment would reduce emissions affecting visibility. These improvements could be partially offset by an increase in visibility related emissions from fuel-burning steam generator equipment, but no perceptible change in the visual resource is expected to occur.

Separations Alternative – This alternative would have the highest number of new facilities (see Table 5.2-1). The dimensions of the new facilities would not significantly exceed the dimensions of the existing facilities. New emissions stacks, if any, are not expected to exceed the height of the existing INTEC main stack.

Stack emissions would result from operation of an offgas treatment process and a Separations Organic Incinerator. These emissions would be limited to the requirements set by their respective permits. Section 5.2.6, Air Resources, discusses emission levels in greater detail. New facilities and emissions resulting from implementation of this alternative would not exceed the Bureau of Land Management Visual Resource Management Class III or Class IV objectives of the INEEL or the Class I or Class II objectives of adjacent lands.

Non-Separations Alternative – This alternative would have the second highest number of new facilities (see Table 5.2-1). The new facilities would not significantly exceed the dimensions of the existing facilities. New emissions stacks, if any, are not expected to exceed the height of the existing INTEC main stack. Stack emissions would result from operation of the waste immobilization plant. These emissions would be limited to the requirements set by their respective permits. Section 5.2.6, Air Resources, discusses emission levels in greater detail. New facilities and emissions resulting from implementation of this alternative would not exceed the Bureau of Land Management Visual Resource Management Class III or Class IV objectives of the INEEL, or the Class I or Class II objectives of adjacent lands.

Minimum INEEL Processing Alternative – This alternative would have approximately the same number of new facilities as the Non-Separations Alternative (see Table 5.2-1). The new facilities would not significantly exceed the dimensions of the existing facilities. New emissions stacks, if any, are not expected to exceed the height of the existing calciner stack. Stack emissions would result from operation of the new facilities. These emissions would be limited to the requirements set by the facility permit. Section 5.2.6, Air Resources, discusses emission levels in greater detail. New facilities and emissions resulting from implementation of this alternative would not exceed the Bureau of Land Management Visual Resource Management Class III or Class IV objectives of the INEEL, or the Class I or Class II objectives of adjacent lands. In addition, two new facilities could be built within the 200-East Area of the Hanford Site. The dimensions of the new facilities, including stacks, would not exceed the dimensions of the existing 200-East Area facilities.

5.2.5 GEOLOGY AND SOILS

This section presents potential impacts to geological resources from implementing the proposed waste processing alternatives described in Chapter 3. Potential impacts were assessed by reviewing project plans for the nine proposed options to determine impacts to geologic resources and soils. Potential impacts to the Snake River Plain aquifer, a unique hydrogeological resource, are discussed in Section 5.2.7. Because one of the alternatives (Minimum INEEL Processing) involves shipment of mixed HLW to the Hanford Site for treatment, possible impacts to geological resources at Hanford were also evaluated (see Appendix C.8). Unless otherwise noted, the discussion of impacts presented in this section specifically applies to INEEL.

Most of the waste processing activities would take place inside the perimeter fence at INTEC, an area that has been dedicated to industrial use for more than 40 years. Table 5.2-1 of Section 5.2.1 lists new facilities that would be built inside and outside of the INTEC perimeter fence and acreage of new areas that would be disturbed. No mineral deposits or unique geologic resources have been found in the INTEC area (see Section 4.6.2); therefore, no impacts are expected to these resources under any of the alternatives. Most of the impacts to soils are expected to be associated with construction activities (e.g., excavating, earthmoving, and grading). Waste management facilities would be designed with safeguards to minimize operational impacts (e.g., spills of toxic substances) to soils. Consequently, no operational impacts are discussed.

Potential seismic activity was discussed in Section 4.6. Potential impacts to HLW facilities from seismic events and volcanism are evaluated in Section 5.2.14, Facility Accidents, and thus are not discussed further in this section.

5.2.5.1 No Action

Under this alternative, DOE would build a Calcine Retrieval and Transport System to move calcine from bin set 1 to bin set 6 or 7. No other new facilities would be required; therefore, there would be minimal impact to soils and no impact to geologic resources.

5.2.5.2 Continued Current Operations Alternative

Under this alternative, current HLW processing activities would continue, and several INTEC facilities, including the New Waste Calcining Facility, would be upgraded or expanded. DOE would build a Newly Generated Liquid Waste Treatment Facility and a Calcine Retrieval and Transport System to move calcine from bin set 1 to bin set 6 or 7. No other new facilities would be required; therefore, there would be minimal impact to soils and no impact to geologic resources.

5.2.5.3 Separations Alternative

Full Separations Option – Under this option, a number of new waste management and support facilities would be built within the developed portion of INTEC. If low-level waste Class A type grout is disposed of in an onsite land disposal facility, a Low-Activity Waste Disposal Facility would be built approximately 2,000 feet east of the INTEC Coal-Fired Steam Generating Facility, outside the existing security perimeter fence. The total area of the Low-Activity Waste Disposal Facility, support facilities, and open buffer zone would be approximately 22 acres. Soil would be excavated for new structures extending beneath the ground surface including the Low-Activity Waste Disposal Facility. Because the INTEC area is relatively flat and rainfall in the region is light (annual precipitation averages less than 9 inches), the potential for erosion is small. DOE would employ standard soil conservation measures (e.g., reseeding disturbed areas) in construction areas to limit soil loss and further reduce impacts. This area does not contain any unique geologic resources.

Planning Basis Option – This option is similar to the Full Separations Option, but differs in the way that mixed transuranic waste/SBW is managed and in the way that the low-level waste fraction is disposed of (see Chapter 3). The same new waste processing facilities would be required under this option, but low-level waste Class A type grout would be disposed of offsite at a commercial radioactive waste disposal facility. As noted in the previous section, the potential for erosion is small in the INTEC area because it lies in a flat floodplain in a region that receives limited rainfall.

Transuranic Separations Option – New facilities for this option would include the Transuranic Separations Facility, Class C Grout Plant, New Analytical Laboratory, and the Waste Treatment Pilot Plant. As previously described, a Low-Activity Waste Disposal Facility would be required if the low-level waste fraction is disposed of onsite. This option would have the same potential impacts on geologic resources and soils as described for the Full Separations Option.

5.2.5.4 Non-Separations Alternative

None of the three options comprising this alternative would require new construction outside of INTEC. Table 5.2-1 of Section 5.2.1 lists new facilities that would be built inside the developed portion of the INTEC under each of the three Non-Separations Alternative options. There would be some soil excavation for these new facilities, but as noted earlier in this section the potential for erosion is small in the area of the INTEC. No impacts to geologic resources are expected.

5.2.5.5 Minimum INEEL Processing Alternative

Under this alternative, several new facilities would be built within the INTEC to package calcine for shipment to the Hanford Site. If DOE disposes of the vitrified low-level waste fraction (returned from the Hanford Site) in an onsite land disposal facility, a Low-Activity Waste Disposal Facility would be built approximately 2,000 feet east of the INTEC Coal-Fired Steam Generating Facility outside the existing perimeter fence (see Section 5.2.5.3). At the Hanford Site, new Canister Storage Buildings (under the Interim Storage Scenario) and a Calcine Dissolution Facility would be built in the 200-East Area. Soil would be excavated for foundations of buildings at both INTEC and Hanford, but impacts to soils would be small and impacts to geologic resources would not be expected at either site.

5.2.6 AIR RESOURCES

Air pollutant emissions associated with construction and operation of facilities to support the waste processing alternatives could affect the air resources in the region of the INEEL. DOE characterized air emission rates and calculated maximum consequences at onsite and offsite locations from projects associated with proposed waste processing alternatives. The assessments include emissions from stationary sources (facility stacks); fugitive sources from construction activities; and mobile sources (trucks, cranes, tractors, etc.) that would operate in support of projects under each waste processing alternative. The types of emissions assessed are the same as those in the baseline assessment in Section 4.7, Air Resources, namely, radionuclides, criteria pollutants (carbon monoxide, nitrogen dioxide, sulfur dioxide, respirable particulate matter, and lead), and toxic air pollutants. In addition, DOE characterized emissions of volatile organic compounds (which can lead to the formation of ozone), carbon dioxide (which has been implicated in potential global warming) and fluorides (which can accumulate in forage and feed products).

This section summarizes the assessment methodology and describes the potential effects of construction activities and the operation of proposed facilities on air quality at and around the INEEL. Results of air quality assessments are presented in terms of expected radiation dose and nonradiological pollutant concentration levels which are compared to applicable standards. This section also discusses related impacts, such as potential for visibility degradation and air quality impacts due to project-induced secondary growth. Appendix C.2 contains additional details on assessment methods, assumptions, and related information.

Appendix C.8 describes the potential emissions and impacts that would occur at the Hanford Site as a result of the Minimum INEEL Processing Alternative. For purposes of comparison, the listings of emissions and impacts by alternative presented in this chapter also include the emissions and impacts that would be incurred at the Hanford Site. Unless otherwise indicated, however, the discussions of methodology, emissions and impacts presented in this chapter specifically apply to projected conditions at INEEL.

5.2.6.1 Methodology

DOE assessed the consequences of air pollutant emissions using methods and data that are considered acceptable for regulatory compliance determination by Federal and State agencies and are designed to allow for a reasonable prediction of the impacts of proposed facilities. For the most part, the methodology parallels that used in the SNF & INEL EIS (DOE 1995). In a few cases, however, it was necessary to employ more current methods (e.g., use of more recent versions of computer codes). The principal components of the air resource assessment methodology include source term estimation and characterization of release parameters, which are used in conjunction with local meteorological data and computerized dispersion modeling codes to simulate transport and dispersion of air contaminants. The radiological assessments were performed using the GENII computer code, Version 1.485 3-Dec-90 (Napier et al. 1998), while the nonradiological assessments were performed using the ISCST-3 atmospheric dispersion code, Version 96113 (EPA 1995). A description of the assessment methodology is presented in Appendix C.2.

5.2.6.2 Construction Emissions and Impacts

This section describes the emission rates and impacts that are expected to result from construction of facilities associated with waste processing alternatives. Construction emissions would result primarily from the disturbance of land, which generates fugitive dust, and from the combustion of fossil fuels in construction equipment. As specified by Sections 650 and 651 of Rules for the Control of Air Pollution in Idaho (IDHW 1997), all reasonable precautions would be taken to prevent the generation of fugitive dust. Dust generation would be mitigated by the application of water, use of soil additives, and possibly administrative controls (such as halting construction during high-wind conditions).

Table 5.2-6 presents construction-related emissions estimated for each waste processing alternative at INEEL and the Hanford Site. These emissions are presented as total tons and tons per year. The total ton value represents emissions over the entire construction period of each project associated with a given alternative. The tons per year value is the sum of annual emission rates for each project associated with an alternative. No correction has been applied to account for the fact that not all projects would occur simultaneously; thus, the annual emission rates specified are inherently conservative. These emissions do not include those from construction activities associated with facility disposition (for example, placement of landfill caps), which are addressed in Section 5.3.4.

The primary impact of construction activities involves the generation of fugitive dust, which includes respirable particulate matter. While dust generation would be mitigated by the application of water and soil additives (see Section 5.5, Mitigation Measures), 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 localized impacts to air quality.

Among the alternatives, the highest construction emissions are associated with the Full Separations Option. Under this option, DOE estimates that annual average concentrations of respirable particulate matter would be approximately 1 and 5 percent of the applicable standard at the maximum INEEL boundary and public road locations, respectively. Over shorter periods (24-hour averaging time), respirable particulate levels could reach about 55 percent of the standards at the INEEL boundary. However, it is typical of major construction activities to intermittently produce relatively high levels of fugitive dust in the vicinity of the activity, and short-term, localized levels of particulate matter, which, if not mitigated, could exceed applicable standards. Levels of other criteria pollutants are predicted to be a small fraction of applicable standards. Portions of Bannock and Power counties in Idaho, near the region of influence, are in a non-attainment area for particulate matter.

Construction activities at the Hanford Site (for the Minimum INEEL Processing Alternative) are estimated to produce nitrogen dioxide levels which are about 8 percent of the Federal and State of Washington ambient air standard. All other pollutants would be less than 1 percent of the applicable standard. Respirable particulate matter would not exceed 16 percent of federal or state standards.

5.2.6.3 Radionuclide Emissions and Impacts from Operations

Waste processing and related activities would result in releases of small quantities of radionuclides to the atmosphere at INTEC. For waste processing, these releases would occur in a controlled fashion through filtered exhaust release points. Radionuclide emission rates have been estimated for facilities needed to support waste processing alternatives on the basis of process design, proposed operations, and radionuclide concentrations in the waste to be treated or stored. The specific methods and assumptions

Table 5.2-6. Total and annualized construction-related criteria air pollutant emissions and fugitive dust generation for waste processing alternatives.

Pollutant	Units	No Action Alternative	Continued Current Operations Alternative	Separations Alternative: Full Separations Option	Separations Alternative: Planning Basis Option	Separations Alternative: Transuranic Separations Option	Non-Separations Alternative: Hot Isostatic Pressed Waste Option	Non-Separations Alternative: Direct Cement Waste Option	Non-Separations Alternative: Early Vitrification Option	Minimum INEEL Processing Alternative: At INEEL	Minimum INEEL Processing Alternative: At Hanford
Fossil fuel combustion											
Carbon monoxide	tons	7.8	27	350	330	360	280	330	260	210	120
	tons/year	1.6	8.1	110	110	110	82	91	72	54	20
Sulfur dioxide	tons	1.2	4.3	55	53	58	44	52	41	34	0.16
	tons/year	0.2	1.3	18	17	17	13	14	11	8.6	0.027
Particulate matter	tons	0.4	1.5	20	19	20	16	19	15	12	110
	tons/year	0.1	0.5	6.4	6.1	5.9	4.6	5.1	4.0	3.0	19
Nitrogen dioxide	tons	6.7	23	300	290	310	240	280	220	180	120
	tons/year	1.3	6.9	97	93	90	70	78	61	46	20
Volatile organic compounds	tons	1.4	4.9	62	60	65	50	59	47	38	NA[a]
	tons/year	0.3	1.4	20	19	19	15	16	13	9.7	NA
Fugitive dust generation											
Particulate matter (dust)	tons	110	210	2,800	680	2,600	670	910	550	2,600	1,300
	tons/year	22	46	490	200	430	190	240	150	420	220

a. NA = Not analyzed in the TWRS EIS.

used are documented in the Project Data Sheets prepared for each facility (referenced in Appendix C.6). Appendix C.2 provides a description of the general methods used for emissions estimation. The emission rates for individual projects are itemized in Appendix C.2 and summarized by alternative in Table 5.2-7.

DOE calculated radiation doses associated with radionuclide emissions from the proposed waste projects for (a) the maximally exposed individual at an offsite location; (b) the offsite entire population (adjusted for future growth) within a 50-mile radius of the INTEC; and (c) onsite workers at the INEEL areas of highest predicted radioactivity level. The term “noninvolved worker” is used hereafter to describe the worker who is incidentally exposed to the highest onsite concentrations (see Appendix C.2 for further explanation of this receptor). Figure 5.2-2 presents the results of this dose assessment according to alternative. The annual doses presented represent the maximum value calculated over any one year that waste processing occurs.

In all cases, the dose to the maximally exposed offsite individual is a very small fraction of that received from natural background sources and is well below the EPA airborne emissions dose limit of 10 millirem per year (40 CFR 61.92). The highest predicted noninvolved worker doses would occur at the Central Facilities Area and would represent a very small fraction of the occupational dose limit of 5,000 millirem per year (10 CFR 835.202). No applicable standards exist for collective population dose; however, DOE policy requires that doses resulting from radioactivity in effluents be reduced to the levels which are as low as reasonably achievable. The radiological health effects associated with these doses are presented in Section 5.2.10, Health and Safety.

The highest dose to the maximally-exposed offsite individual would be about 0.002 millirem per year, which would occur under the Continued Current Operations Alternative, Planning Basis Option, Hot Isostatic Pressed Waste Option, or Direct Cement Waste Option. The highest collective dose to the surrounding population would be about 0.1 person-rem per year and would also occur under the Continued Current Operations Alternative, Planning Basis Option, Hot Isostatic Pressed Waste Option, or Direct Cement Waste Option. Doses for all other options would be lower. Offsite doses would be mainly attributable to intake of iodine-129 through the food-chain pathway. Emissions of this isotope would result primarily from the calcining of mixed transuranic waste/SBW and management of mixed transuranic waste (newly generated liquid waste and Tank Farm heel waste). The noninvolved worker would receive about 0.0001 millirem per year under the Planning Basis Option or Minimum INEEL Processing Alternative. This dose would be primarily attributable to inhalation of plutonium and americium released from ion exchange treatment of mixed transuranic waste (SBW and newly generated liquid waste), as well as calcine retrieval operations. When added to doses from existing INEEL sources and other foreseeable projects, both onsite and offsite doses remain a small fraction of applicable standards. The highest dose to an offsite individual at the Hanford Site (for the Minimum INEEL Processing Alternative) would be about 1.7×10^{-5} millirem per year.

When the cumulative effects of baseline sources, foreseeable increases to the baseline, and sources associated with waste processing alternatives are considered, onsite and offsite doses remain very small fractions of applicable limits.

5.2.6.4 Nonradiological Emissions and Impacts from Operations

Nonradiological pollutants would be emitted by major facilities and by fossil fuel-burning support equipment (such as boilers, water heaters, and diesel-fueled generators). Criteria and toxic air pollutant emissions have been estimated for each project based on the amount of fossil fuel that would be burned to meet the anticipated energy requirements and the characteristics of chemical processing materials and systems. Emissions are estimated from fuel consumption rates using emission factors recommended by the EPA for fuel-burning equipment (EPA 1998). Fuel usage estimates and chemical process emissions are documented in the Project Data Sheets and supporting Engineering Data Files for each

Table 5.2-7. Radionuclide emission rates (curies per year) for waste processing alternatives.[a]

			Separations Alternative			Non-Separations Alternative			Minimum INEEL Processing Alternative	
Radionuclide	No Action Alternative	Continued Current Operations Alternative	Full Separations Option	Planning Basis Option	Transuranic Separations Option	Hot Isostatic Pressed Waste Option	Direct Cement Waste Option	Early Vitrification Option	At INEEL	At Hanford[b]
Americium-241	-	-	1.6×10^{-8}	1.6×10^{-8}	1.6×10^{-8}	-	-	-	2.0×10^{-5}	1.5×10^{-7}
Cobalt-60	1.3×10^{-7}	1.2×10^{-6}	2.9×10^{-8}	1.1×10^{-6}	8.2×10^{-9}	1.2×10^{-6}	1.2×10^{-6}	1.3×10^{-7}	9.9×10^{-6}	–
Cesium-134	8.2×10^{-8}	6.3×10^{-6}	3.7×10^{-9}	6.2×10^{-4}	4.8×10^{-8}	6.3×10^{-6}	6.3×10^{-6}	9.3×10^{-8}	1.0×10^{-7}	–
Cesium-137	2.4×10^{-4}	2.7×10^{-3}	2.3×10^{-3}	4.7×10^{-3}	2.3×10^{-3}	0.10	4.9×10^{-3}	2.5×10^{-3}	2.5×10^{-3}	1.2×10^{-4}
Europium-154	2.0×10^{-7}	1.1×10^{-6}	1.1×10^{-9}	9.5×10^{-7}	1.0×10^{-9}	1.1×10^{-6}	1.1×10^{-6}	2.0×10^{-7}	1.0×10^{-5}	–
Europium-155	–	–	4.9×10^{-10}	4.9×10^{-10}	4.9×10^{-10}	–	–	–	1.8×10^{-9}	–
Hydrogen-3 (tritium)	9.0	23.0	45.0	68.0	45.0	23.0	23.0	54.0	32.0	–
Iodine-129	0.031	0.089	1.5×10^{-3}	0.059	4.2×10^{-4}	0.089	0.089	0.032	0.031	9.1×10^{-11}
Nickel-63	–	–	6.9×10^{-12}	6.9×10^{-12}	6.9×10^{-12}	–	–	–	2.6×10^{-10}	–
Promethium-147	–	–	–	–	–	–	–	–	5.2×10^{-5}	–
Plutonium-238	6.2×10^{-6}	1.1×10^{-5}	3.2×10^{-5}	3.7×10^{-5}	3.2×10^{-5}	4.3×10^{-5}	4.3×10^{-5}	3.8×10^{-5}	9.1×10^{-5}	1.8×10^{-7}
Plutonium-239	1.0×10^{-7}	6.7×10^{-7}	2.4×10^{-10}	5.7×10^{-7}	2.2×10^{-10}	6.7×10^{-7}	6.7×10^{-7}	1.1×10^{-7}	3.2×10^{-6}	2.6×10^{-8}
Plutonium-241	–	–	5.6×10^{-8}	5.6×10^{-8}	5.6×10^{-8}	–	–	–	2.3×10^{-9}	8.6×10^{-8}
Ruthenium-106	2.4×10^{-6}	6.6×10^{-5}	1.6×10^{-6}	6.5×10^{-5}	4.6×10^{-7}	7.7×10^{-5}	6.6×10^{-5}	2.5×10^{-6}	2.4×10^{-6}	–
Antimony-125	1.5×10^{-6}	1.2×10^{-5}	7.4×10^{-7}	1.1×10^{-5}	5.5×10^{-7}	1.2×10^{-5}	1.2×10^{-5}	1.5×10^{-6}	5.3×10^{-6}	–
Samarium-151	–	–	2.0×10^{-7}	2.0×10^{-7}	2.0×10^{-7}	–	–	–	2.8×10^{-5}	–
Strontium-90/Yttrium-90	2.1×10^{-5}	3.3×10^{-4}	5.8×10^{-3}	6.1×10^{-3}	5.8×10^{-3}	6.2×10^{-3}	6.2×10^{-3}	5.8×10^{-3}	7.5×10^{-3}	8.0×10^{-5}
Technetium-99	–	–	1.8×10^{-5}	1.8×10^{-5}	1.8×10^{-5}	1.7×10^{-4}	–	–	8.0×10^{-7}	6.0×10^{-8}

a. This table lists only those radionuclides that contribute materially to the total radiation dose associated with airborne radionuclide emissions. Trace quantities of other radionuclides (including carbon-14 and some isotopes of uranium) could also be emitted in some options; however, they would not contribute significantly to the radiation dose. See Appendix C.2 for basis of emissions estimates.

b. Values adapted from Project Data Sheets in Appendix C.8. Emissions of specific radionuclides listed for the Calcine Dissolution Facility were increased by a factor of 2 to account for total radioactivity of calcine (including activity of unspecified radionuclides).

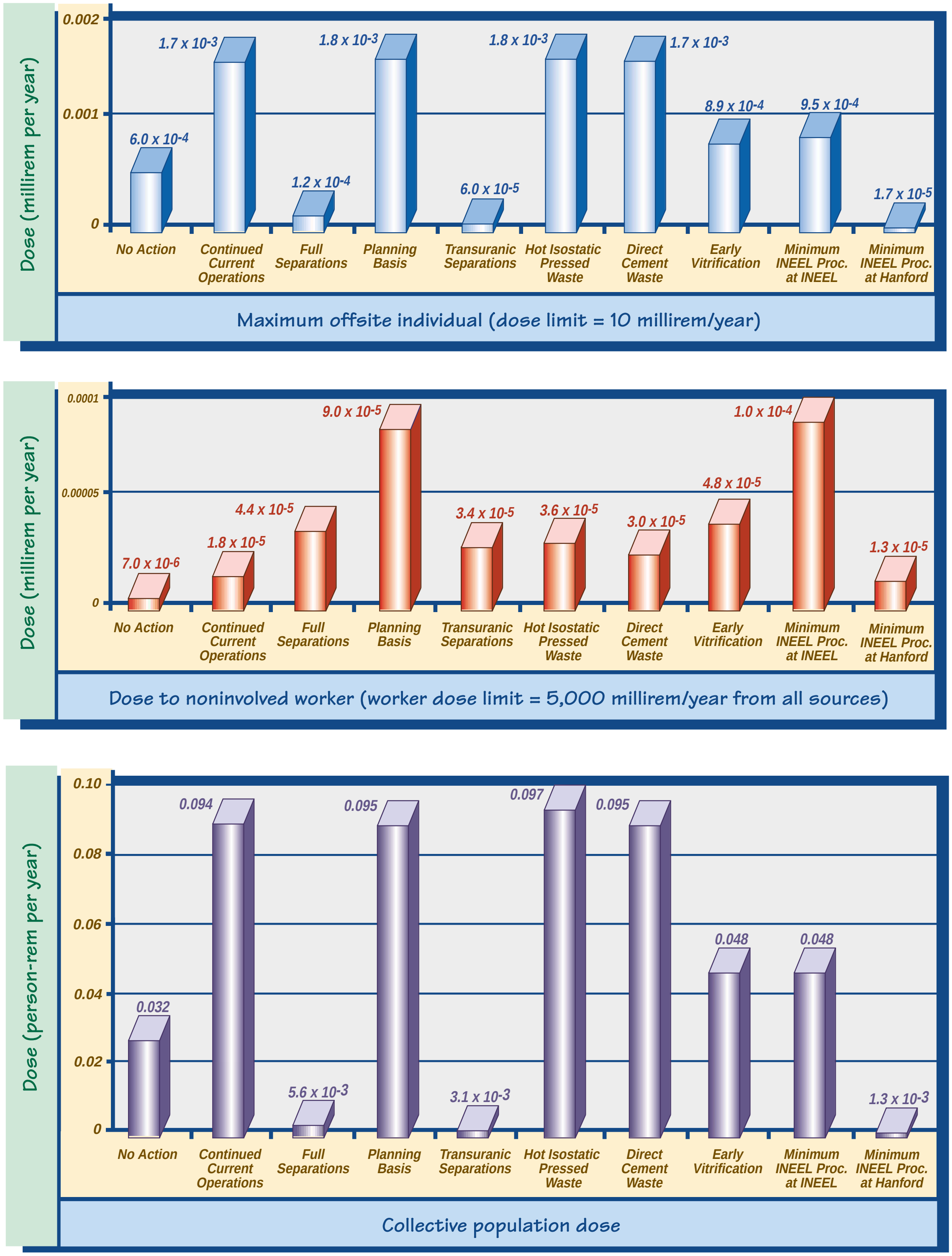


FIGURE 5.2-2.
Comparison of air pathway doses by alternative.

project (referenced in Appendix C.6). The emission rates for individual projects estimated in this fashion are itemized in Appendix C.2, Air Resources, and are summarized in this section by alternative.

Estimated criteria and toxic air pollutant emission rates by alternative are presented in Table 5.2-8 and illustrated in Figure 5.2-3. Criteria air pollutant emission rates are presented as tons per year and are compared to the "significance level" threshold specified by the State of Idaho and the EPA. These emissions result primarily from fossil fuel combustion to produce steam needed for chemical processes and building heating, ventilation and air conditioning. Additionally, emissions result from operation of equipment with internal combustion engines, and from some chemical processing steps. In general, these emissions are lower than those required for steam production. One notable exception is the emission of nitrogen dioxide which historically has been emitted in substantial amounts as a byproduct of the waste calcining process. Although fossil fuel emissions from steam production are assigned to the specific projects which comprise the various alternatives, they would actually occur at the steam production facility. For current operations, the primary steam-producing facility is the Coal-Fired Steam Generating Facility, while backup is provided by oil-fired boilers located in the Service Building Power House. Steam requirements for the waste processing alternatives could be provided either by the Coal-Fired Steam Generating Facility or by a future diesel fuel-fired boiler facility. In either case, the projected criteria pollutant emission rates associated with steam production would not exceed the maximum baseline levels previously assessed (see Section 4.7.4.2). Nevertheless, DOE has assessed impacts associated with these emissions for purposes of comparison between the alternatives.

Toxic air pollutants are produced both by fossil fuel combustion and as byproducts of chemical processing operations. DOE estimated principal carcinogenic (cancer-causing) and noncarcinogenic emissions from fuel burning using the EPA-recommended emission factors listed in Appendix C.2, Table C.2-4. Emissions from chemical processing were estimated by analyzing the material flow through processes associated with each of the alternatives (Kimmitt 1998). Toxic emission rates are listed in Appendix C.2, Tables C.2-12 and C.2-13.

DOE has performed quantitative air quality impact assessments for sources of nonradiological air pollutants, and the impacts are reported below as concentrations at a reference location, averaged over timeframes (hourly, annual, etc.) that correspond to the averaging times specified by regulatory standards. Other potential nonradiological consequences, including the potential for ozone formation, visual resource impairment, climate change (global warming), stratospheric ozone depletion, acidic deposition, and impacts on soils and vegetation are described qualitatively later in this chapter.

The primary goal of the nonradiological impact assessment is to present information which will define the maximum expected impacts while at the same time facilitate comparisons of impacts between waste processing alternatives. Toward this end, only summary information is presented, and minimal emphasis is placed on the contributions of baseline conditions which could obscure the relative impacts of alternatives. Impact results of a more comprehensive and detailed nature can be found in Appendix C.2. The results described in this section focus on the predicted maximum impacts on or around the INEEL (in terms of percentage of applicable standard) for each alternative/option. These impacts include:

- The maximum predicted criteria air pollutant concentrations at ambient air locations (INEEL boundary, public roads, and Craters of the Moon Wilderness Area), which are compared to State of Idaho Ambient Air Quality Standards

- The maximum predicted carcinogenic air pollutant concentrations at the INEEL boundary and Craters of the Moon Wilderness Area, which are compared to State of Idaho Acceptable Ambient Concentrations for Carcinogens

- The maximum predicted noncarcinogenic toxic air pollutant concentrations at ambient air locations (INEEL boundary, public roads, and Craters of the

Table 5.2-8. Projected nonradiological pollutant emission rates (tons per year) for the proposed waste processing alternatives.

Pollutant	Significance Threshold[a] (tons/yr)	No Action Alternative	Continued Current Operations Alternative	Separations Alternative: Full Separations Option	Separations Alternative: Planning Basis Option	Separations Alternative: Transuranic Separations Option	Non-Separations Alternative: Hot Isostatic Pressed Waste Option	Non-Separations Alternative: Direct Cement Waste Option	Non-Separations Alternative: Early Vitrification Option	Minimum INEEL Processing Alternative: At INEEL	Minimum INEEL Processing Alternative: At Hanford
Carbon monoxide	100	1.7	8.1	21	26	13	10	9.5	3.5	3.2	300
Sulfur dioxide	40	23	79	183	257	110	107	97	51	11	27
Particulate matter (PM-10)	25	0.6	1.3	4.7	5.7	2.5	2.1	1.8	0.9	0.4	NA[b]
Oxides of nitrogen	40	6.4	31	62	90	39	92	36	12	5.0	18
Volatile organic compounds	40	0.1	1.0	2.4	2.9	1.6	1.1	1.1	0.2	0.5	NA
Lead	0.6	<0.001	<0.001	0.003	0.004	0.002	0.001	0.001	<0.001	<0.001	NA
Total toxic air pollutants	–	0.6	0.3	1.6	1.5	1.0	0.9	0.9	0.3	0.1	NA

a. Significance level specified by State of Idaho (IDHW 1997) and the EPA; net emissions increases above this level are considered “major” and are subject to additional analyses and air pollution control requirements.
b. NA = Not analyzed in the TWRS EIS.

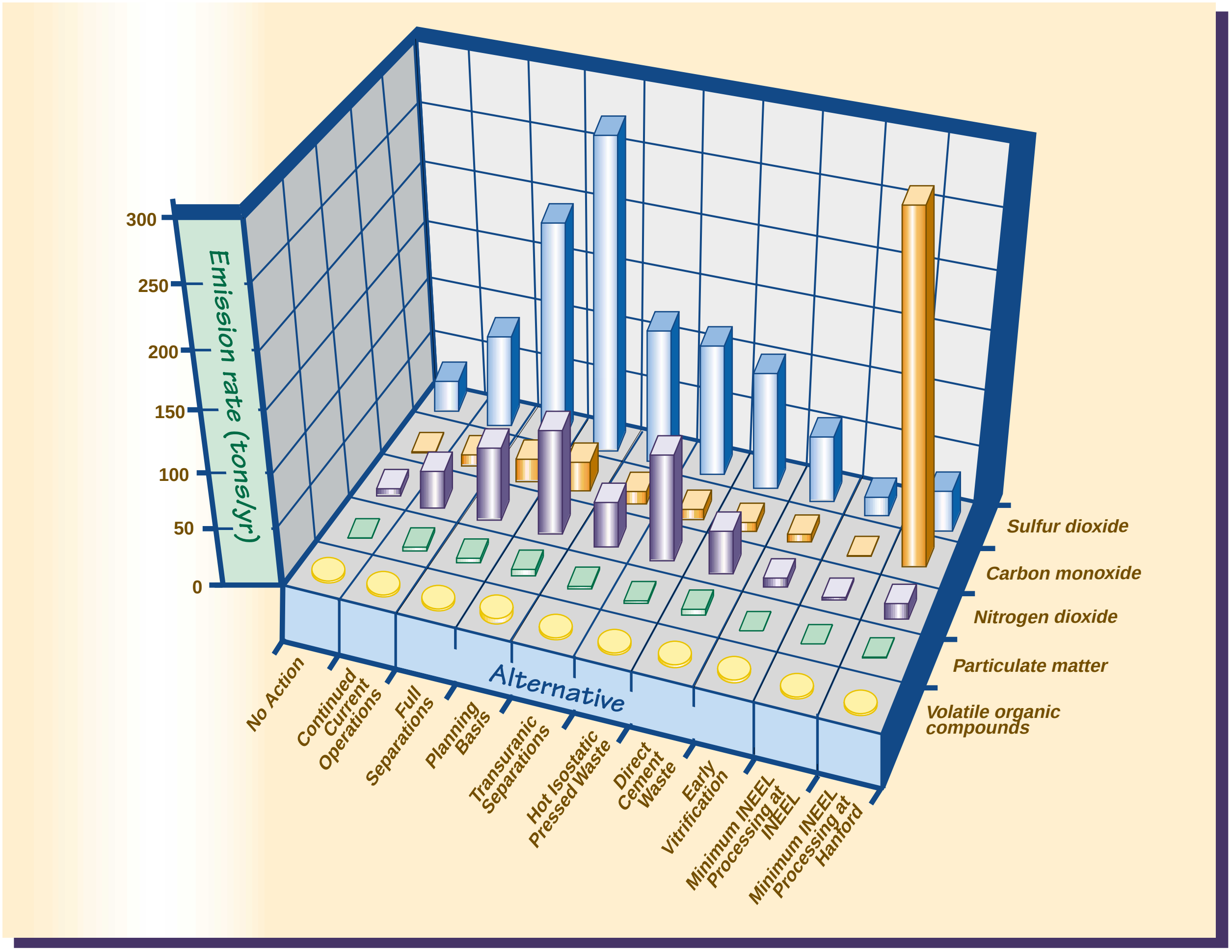


FIGURE 5.2-3.
Comparison of criteria pollutant emission rate estimates by waste processing alternative.

Moon Wilderness Area), which are compared to State of Idaho Acceptable Ambient Concentrations

- The maximum predicted toxic air pollutant concentrations at major INEEL facility areas (e.g., INTEC and Central Facilities Area), which are compared to occupational exposure limits.

Information related to impacts at Hanford is presented in Appendix C.8. Other impacts, including regulatory compliance evaluations of the Prevention of Significant Deterioration increment consumption, impacts on visibility and vegetation, and other air quality-related values are described in Sections 5.2.6.5 and 5.2.6.6. The human health risks associated with these impacts are discussed in Section 5.2.10, Health and Safety. Cumulative impacts that consider projected future changes in air resources (i.e., in addition to baseline levels and alternative impacts), as well as impacts over the entire life cycle of the waste processing alternatives, are described in Section 5.4.7.

The analysis of waste processing alternatives assumes that new oil-fired boilers would be required, either to replace or to serve as backup for the existing Coal-Fired Steam Generating

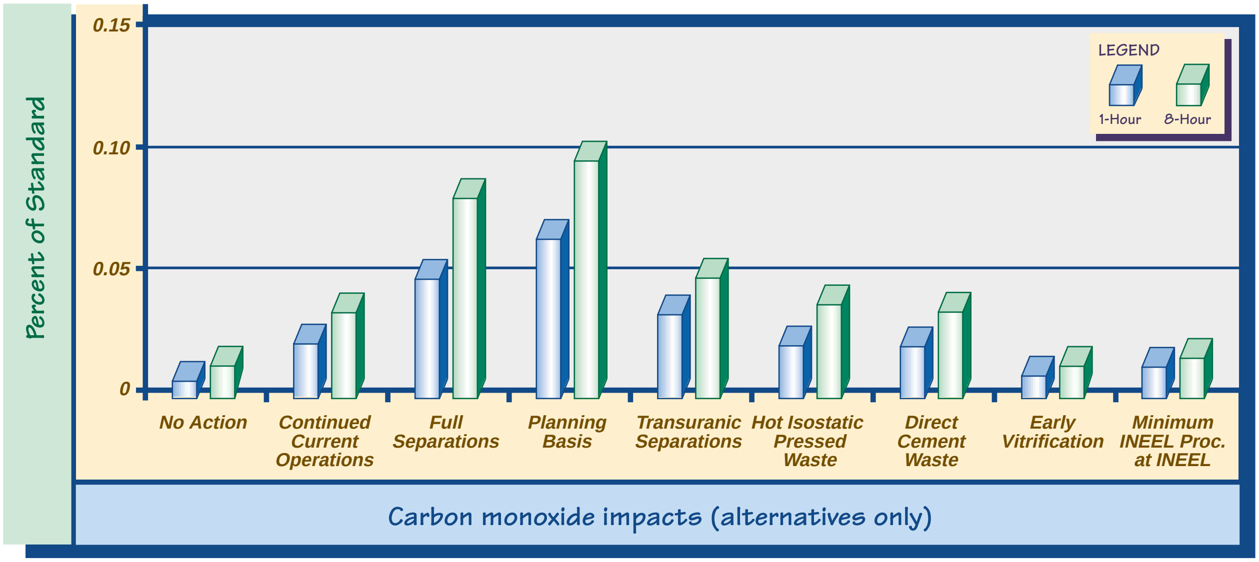
Facility and Power House boilers, and that the sulfur content of the fuel would be 0.5 percent or less. For criteria pollutants, it should be noted that resultant ambient concentrations are bounded in all cases by the maximum baseline conditions described in Section 4.7. The maximum baseline case assumes that all INEEL sources (including the Coal-Fired Steam Generating Facility and Power House) emit pollutants at maximum operating capacity or allowed by permits. Since the Coal-Fired Steam Generating Facility and Power House have the capacity to meet the steam requirements for waste processing alternatives, emission rates and ambient levels are not expected to exceed the levels previously characterized for the maximum baseline. It should also be noted that some changes in the criteria air pollutant baseline are expected. For example, baseline levels of nitrogen dioxide are expected to decrease since the New Waste Calcining Facility calciner (the largest INEEL source of nitrogen dioxide emissions) would not operate beyond 2000 without upgrades to comply with the anticipated Maximum Achievable Control Technology rule. The Maximum Achievable Control Technology upgrades are expected to reduce nitrogen dioxide emission rates to less than 1 percent of previously observed levels (Kimmitt 1993; DOE 1998).

Nevertheless, DOE has assessed the combined effects of emissions from existing facilities and facilities required to support the waste processing alternatives. These evaluations were performed using actual facility emissions data for 1996 and 1997 (Table 4-10) and projected emission rates for facilities required to support the waste processing alternatives (Table 5.2-8). The projected criteria pollutant impacts are presented graphically in Figure 5.2-4. The charts on the top of the page show that these impacts, without consideration of baseline levels, vary somewhat by alternative but are small fractions of applicable standards in all cases. The charts on the bottom show that when the predominant effects of baseline sources are considered, there is little difference between alternatives and all levels remain well below standards.

Figure 5.2-5 illustrates the projected impacts of toxic air pollutant emissions. The highest impacts are projected for those options which involve the greatest amount of fossil fuel combustion, most notably those under the Separations Alternative. The maximum carcinogenic impacts are for nickel while the highest noncarcinogenic impacts are for vanadium. Both of these substances are produced by fuel oil combustion. All levels at both ambient air locations are well below applicable standards, and levels to which noninvolved INEEL workers would be exposed are small fractions of occupational exposure limits. Detailed results for these and other toxic air pollutants are presented in Appendix C.2.

5.2.6.5 Prevention of Significant Deterioration Increment Consumption

Prevention of Significant Deterioration regulations (commonly referred to as PSD) require that proposed major projects or modifications, together with minor sources that become operational after Prevention of Significant Deterioration regulations baseline dates are established, be assessed for their incremental contribution to increases of ambient pollutant levels. Prevention of Significant Deterioration regulations requirements for the State of Idaho are specified in IDAPA 16.01.01.579-581. In essence, a proposed major project, when considered with other regulated sources in the general impact area, may not contribute to increases in pollutant levels above specified "increments." Increments for EPA Class I and II areas have been established for specific averaging times associated with concentrations of nitrogen dioxide, sulfur dioxide, and particulate matter. The INEEL area is designated Class II by Prevention of Significant Deterioration regulations, while the nearest Class I area is Craters of the Moon Wilderness Area. Previous Prevention of Significant Deterioration regulations permits for INEEL site projects have consumed a portion of the available Class I and II increments (see Section 4.7.4). Prevention of Significant Deterioration regulations requirements also



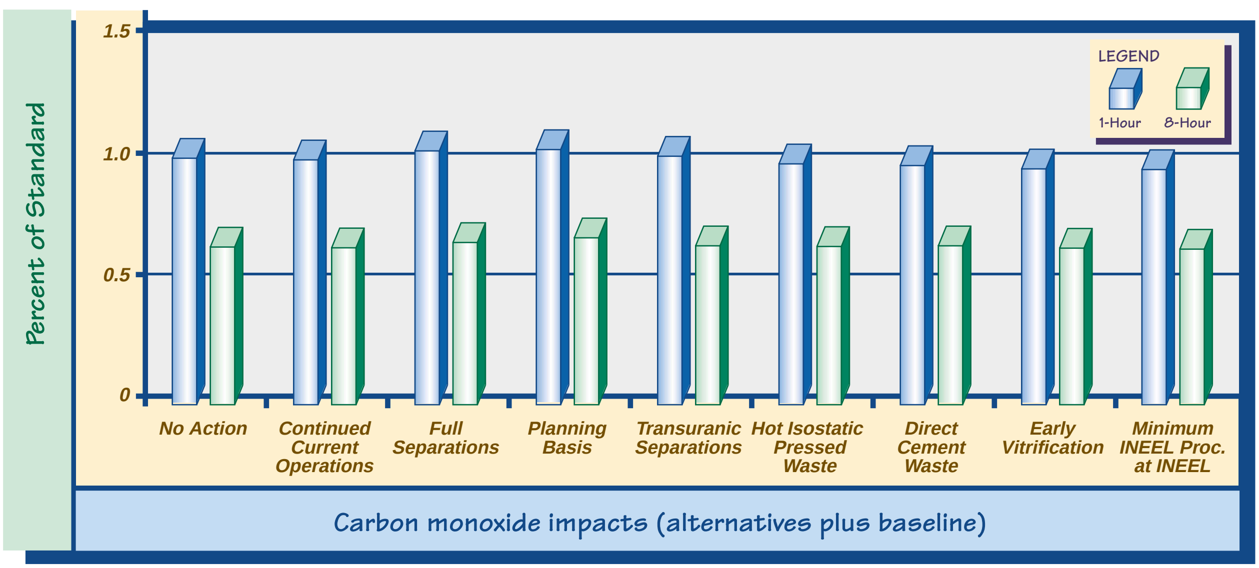
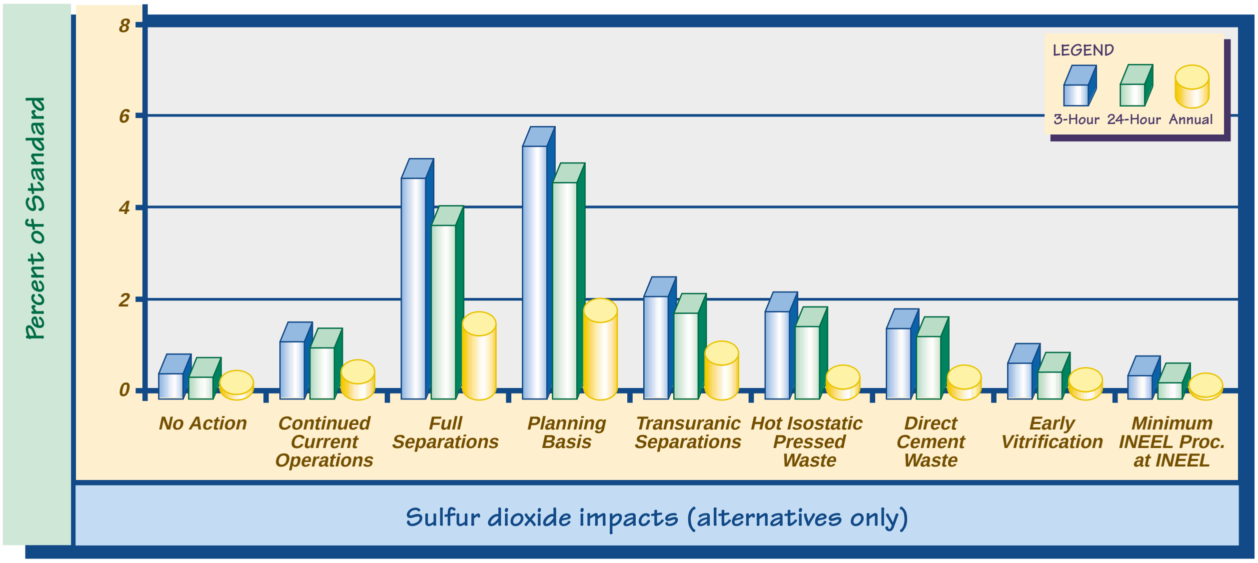


FIGURE 5.2-4. (1 of 4)
Comparison of criteria air pollutant impacts by alternative.



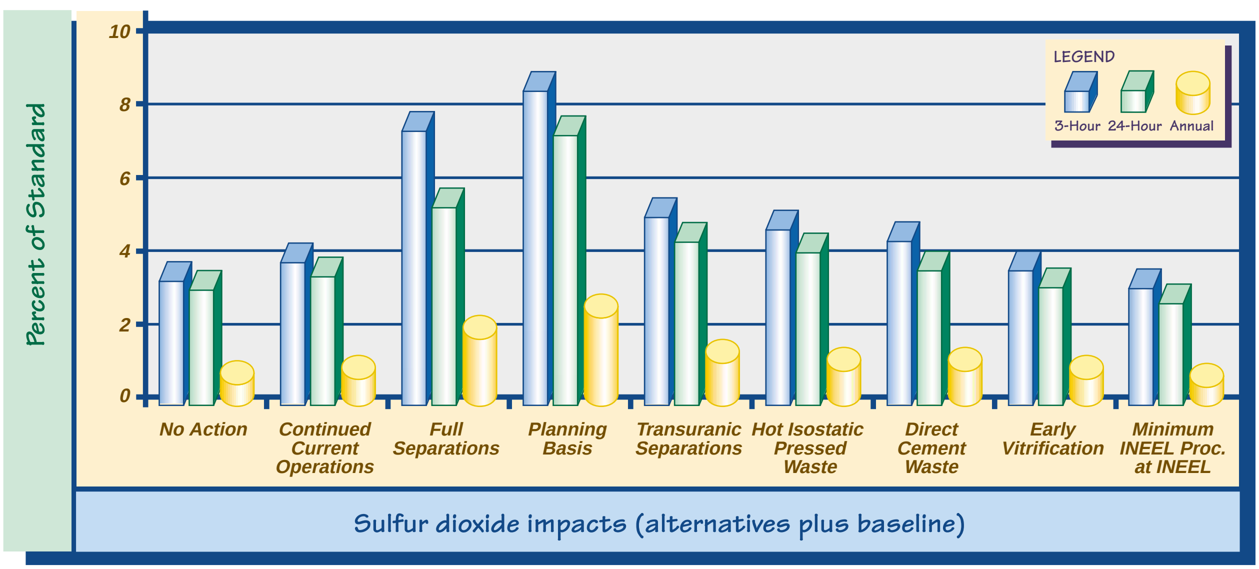
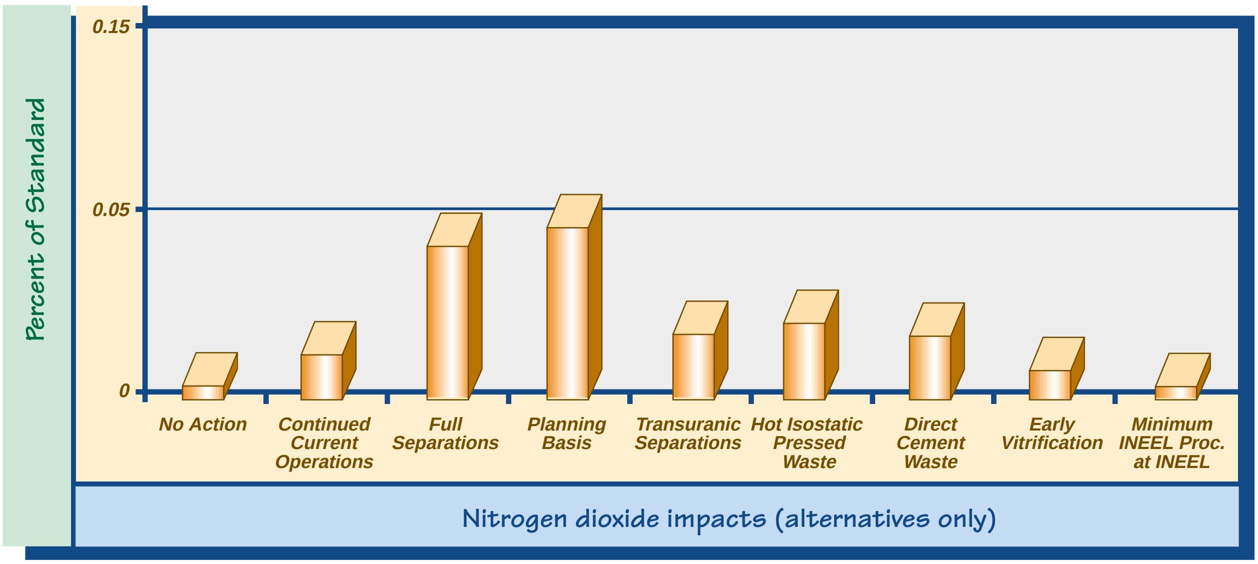


FIGURE 5.2-4. (2 of 4)
Comparison of criteria air pollutant impacts by alternative.



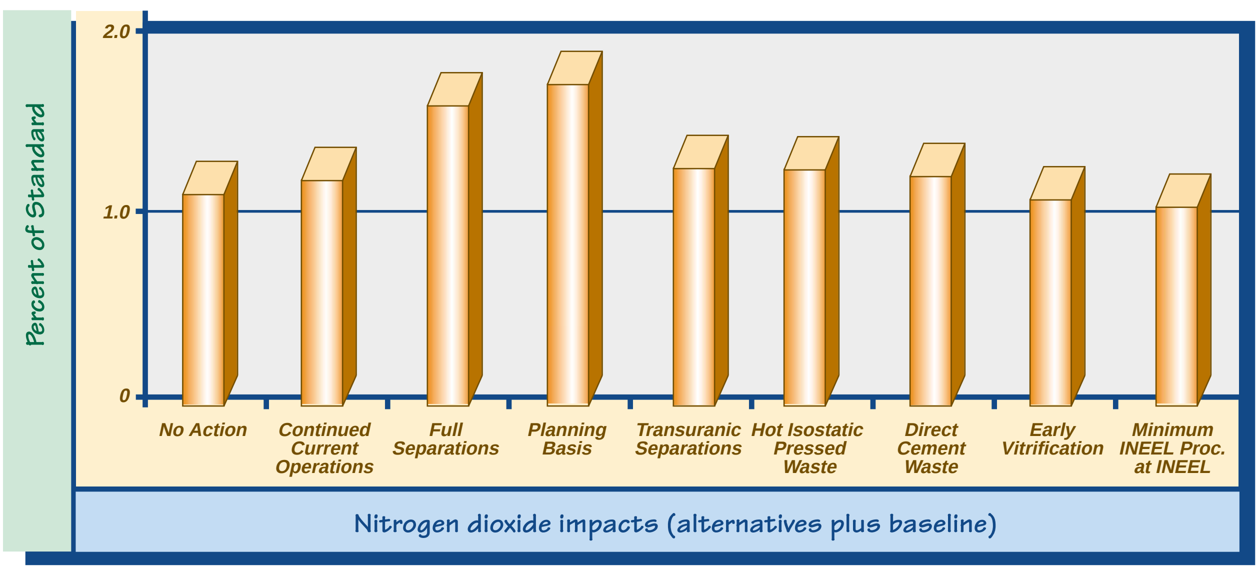
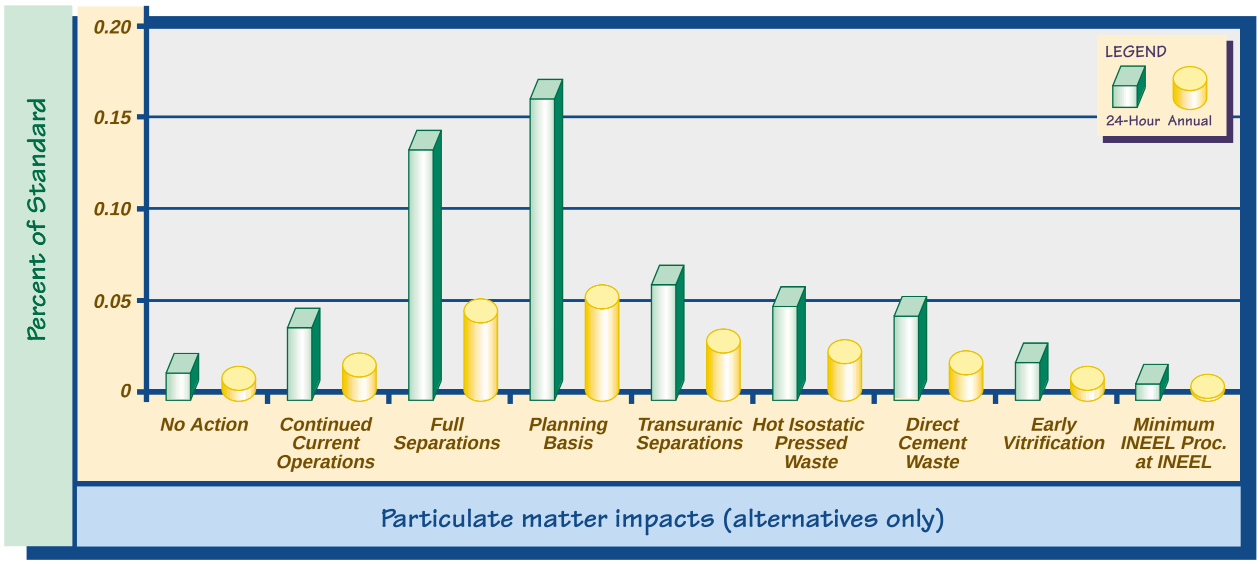


FIGURE 5.2-4. (3 of 4)
Comparison of criteria air pollutant impacts by alternative.



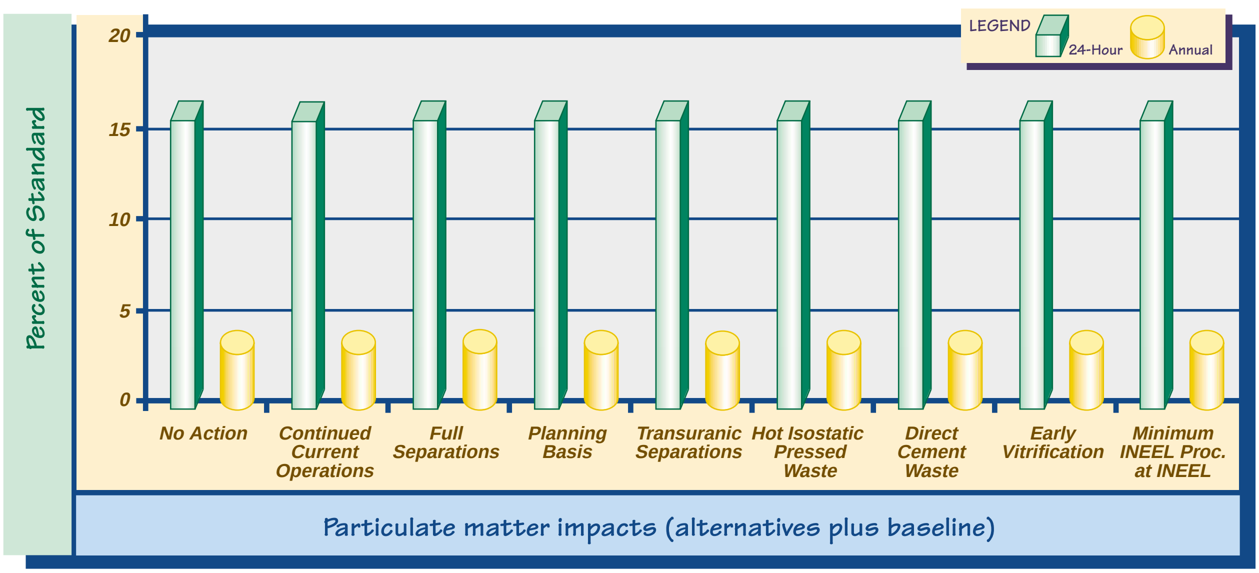
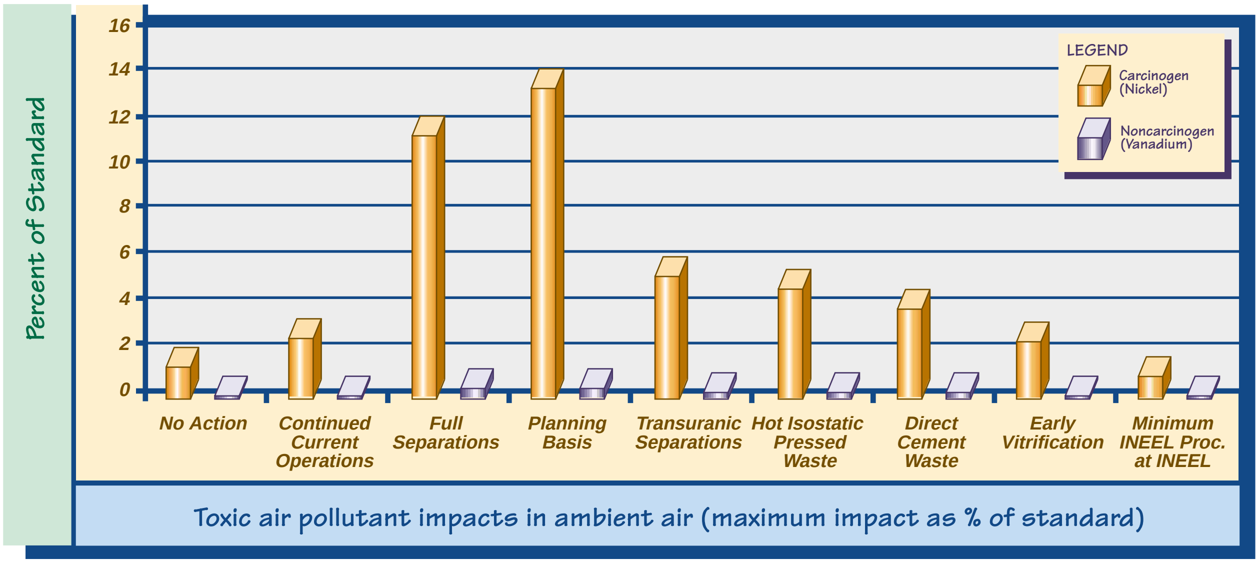


FIGURE 5.2-4. (4 of 4)
Comparison of criteria air pollutant impacts by alternative.



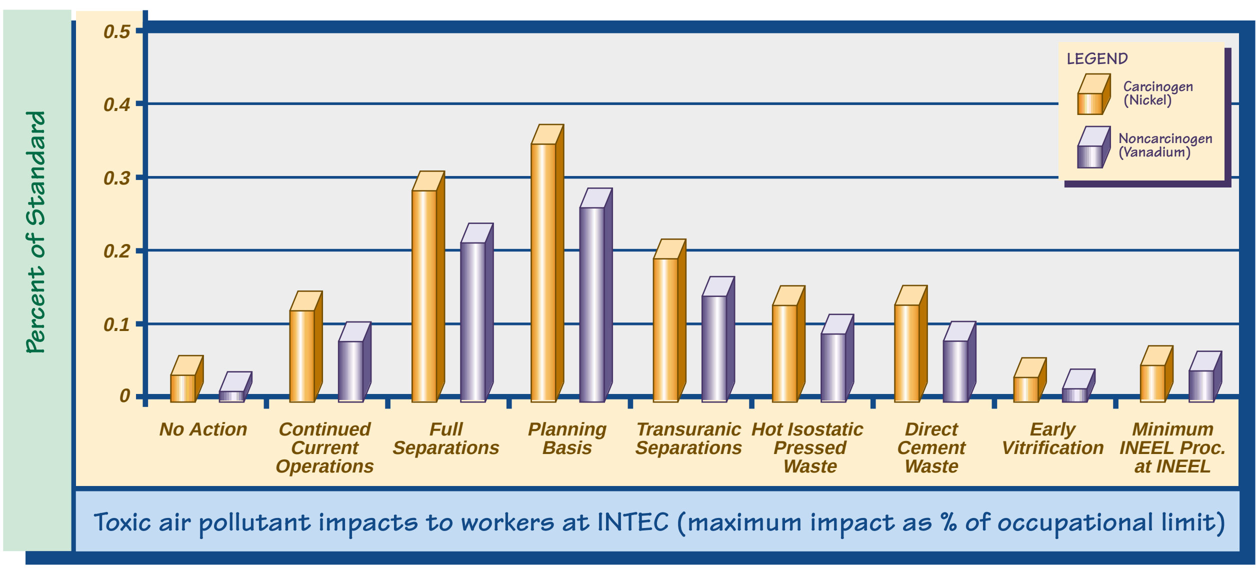


FIGURE 5.2-5.
Comparison of toxic air impacts by alternative.

apply for radionuclides if the projected radiation dose exceeds 0.1 millirem per year. Prevention of Significant Deterioration regulations issues related to the Hanford Site are discussed in Appendix C.8.

The degree to which waste processing alternatives would consume PSD increment depends on whether new fossil fuel burning equipment would be installed to meet project energy requirements. If waste processing steam demand is met by the existing steam plant and Power House, there would be little or no change in increment consumption. The steam plant is regulated under the Prevention of Significant Deterioration program as a sulfur dioxide and particulate matter (but not nitrogen dioxide) increment-consuming source. The Power House is not an increment-consuming source for any of these pollutants, since it was placed in operation prior to the baseline dates that subject a source to regulation under the Prevention of Significant Deterioration program. Current plans call for installation of two new diesel-fired boilers to replace aging Power House boilers. It is likely (although it has not been specifically determined) that these boilers will represent “replacement in kind.” As such, they may not be subject to regulation under the Prevention of Significant Deterioration program and therefore, the amount of PSD increment consumed would not differ from the baseline case. Nevertheless, the amount of increment consumption has been assessed for a scenario in which steam for operation of projects associated with waste processing alternatives is provided by new diesel-fueled boilers that would be regulated under the Prevention of Significant Deterioration program. The results are presented in Table 5.2-9.

With the exception of sulfur dioxide, the Prevention of Significant Deterioration program increment consumption does not differ much among the alternatives. This is due to the effects of existing sources and other foreseeable projects, including the planned Advanced Mixed Waste Treatment Facility and remediation activities at the Radioactive Waste Management Complex, including the OU7-10 Staged Interim Action (formerly the Pit 9 Project). Sources located comparatively close to ambient air areas are likely to affect increment consumption to a greater degree than sources at INTEC. For example, the Radioactive Waste Management Complex is much closer than INTEC to Craters of the Moon Wilderness Area.

Sulfur dioxide increment consumption is influenced by some waste processing alternatives since the analysis assumes that fuel oil with 0.5 percent sulfur content would be burned to meet steam requirements. All projected concentrations, both at Craters of the Moon Wilderness Area and at INEEL road and boundary locations, are well within allowable increments.

For radiological Prevention of Significant Deterioration assessments, the projected radiation dose to the maximally-exposed offsite individual is about 0.002 millirem per year for the options involving calcining of mixed transuranic waste/SBW and management of mixed transuranic waste (newly generated liquid waste and Tank Farm heel waste). In all cases, the projected dose is well below the significance level of 0.1 millirem per year.

5.2.6.6 Other Air-Quality-Related Values

The air resources assessments of waste processing alternatives included an evaluation of projected impacts with respect to other air quality related values, including (a) potential for ozone formation (b) degradation of visibility at Craters of the Moon Wilderness Area and Fort Hall Indian Reservation, (c) impacts to soil and vegetation, (d) impacts due to secondary growth (indirect or induced impacts), (e) stratospheric ozone depletion, (f) acidic deposition, (g) global warming, and (h) secondary particulate matter formation. The findings of these assessments are identified below and detailed in Appendix C.2.

Ozone Formation – The Clean Air Act designates ozone as a criteria air pollutant and establishes a National Ambient Air Quality Standard of 0.12 parts per million (235 micrograms per cubic meter) for a 1-hour averaging period. Recently, a more restrictive ozone standard of 0.08 parts per million for an 8-hour averaging time has been promulgated, and this new standard will apply at INEEL. Ozone, unlike the other criteria pollutants, is not emitted directly from facility sources but is formed in the atmosphere through photochemical reactions involv-

Table 5.2-9. Prevention of Significant Deterioration increment consumption for the combined effects of baseline sources, waste processing alternatives, and other planned future projects.[a]

		Highest percentage of allowable PSD increment consumed									
				Separations Alternative			Non-Separations Alternative			Minimum INEEL Processing Alternative	
Pollutant	Averaging time	No Action Alternative	Continued Current Operations Alternative	Full Separations Option	Planning Basis Option	Transuranic Separations Option	Hot Isostatic Pressed Waste Option	Direct Cement Waste Option	Early Vitrification Option	At INEEL	At Hanford
Class I area (Craters of the Moon)											
Sulfur dioxide	3-hour	26%	29%	32%	36%	29%	30%	30%	27%	25%	NA
	24-hour	39%	43%	47%	53%	44%	44%	44%	40%	39%	NA
	Annual	4.7%	5.1%	6.1%	6.6%	5.4%	5.4%	5.3%	4.9%	4.6%	NA
Particulate matter	24-hour	8.8%	8.8%	9.0%	9.0%	8.9%	8.9%	8.8%	8.8%	8.8%	NA
	Annual	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	NA
Nitrogen dioxide	Annual	2.3%	2.5%	2.7%	2.9%	2.6%	2.9%	2.5%	2.4%	2.3%	NA
Class II area (INEEL boundary and public roads)											
Sulfur dioxide	3-hour	19%	20%	25%	27%	22%	21%	21%	20%	19%	NA
	24-hour	20%	21%	27%	29%	23%	22%	22%	20%	19%	NA
	Annual	10%	10%	12%	12%	11%	10%	10%	10%	9.5%	NA
Particulate matter	24-hour	28%	28%	29%	29%	29%	28%	28%	28%	28%	NA
	Annual	0.6%	0.6%	0.7%	0.7%	0.7%	0.7%	0.6%	0.6%	0.6%	NA
Nitrogen dioxide	Annual	6.2%	6.3%	6.8%	6.9%	6.5%	6.7%	6.4%	6.3%	6.2%	NA

a. Assumes that steam for operation of projects associated with waste processing alternatives is provided by new oil-burning boilers that would be regulated under PSD; baseline emissions do not include those from the Coal-Fired Steam Generating Facility, which would not operate under this scenario.

NA = Not analyzed in the TWRS EIS. PSD = Prevention of Significant Deterioration.

ing nitrogen oxides and volatile organic compounds (also referred to as non-methane hydrocarbons). Therefore, the regulation of ozone is affected by the control of emissions of ozone-producing compounds or precursors, that is, nitrogen oxides and volatile organic compounds. Under the fuel-burning scenario assumed for air analysis, some of the waste would exceed the non-methane volatile organic compound significance level established by the State of Idaho.

Visibility Degradation – Emissions of fine particulate matter and nitrogen dioxide can result in an impairment of visual resources. Emission rates for these pollutants under the waste processing alternatives are not expected to exceed levels currently or previously experienced by INEEL sources; therefore, the "visual impact" of these alternatives is already reflected in existing baseline conditions. Nevertheless, conservative visibility screening analysis has been performed to evaluate the relative potential for visibility impacts between alternatives. This analysis included a quantitative assessment of contrast and color shift parameters and comparison of results against numerical criteria which define potential objectionable impacts. The views analyzed were at Craters of the Moon Wilderness Area and Fort Hall Indian Reservation. The results of the visibility analysis indicate that emissions from each of the waste processing alternatives would not result in deleterious impacts on scenic views at Craters of the Moon Wilderness Area or Fort Hall Indian Reservation (including the view to Middle Butte, an important cultural resource to the Shoshone-Bannock Tribes). The highest results were obtained for the Hot Isostatic Pressed Waste and Planning Basis Options. For color shift, the highest calculated value at Craters of the Moon was about 0.5, compared to an acceptability criterion of 2.0. For contrast, the highest calculated value was 0.004, compared to an acceptability criterion of 0.05. Values at Fort Hall were about one-half the Craters of the Moon values. The calculated values conservatively assume that no abatement systems are present on the fossil fuel-burning equipment used to generate steam; if air pollution control systems are employed (which is a reasonable assumption), these values would decrease in rough proportion to the removal efficiency of the control equipment.

Impacts to Soils and Vegetation – Due to the relatively minor increases 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. The National Park Service has issued interim guidelines for protection of sensitive resources relative to air quality concerns (DOI 1994). The highest projected levels of sulfur dioxide and nitrogen dioxide at ambient air locations from any of the waste processing alternatives would be well below the National Park Service guidelines at Craters of the Moon National Monument.

The State of Idaho has established air quality standards intended to limit the concentration of fluoride in vegetation used for feed and forage. Monitoring of fluoride levels would be required unless analysis shows that fluoride concentrations in ambient air, averaged over 24-hour periods, would not exceed 0.25 micrograms per cubic meter. Fluoride emission rates would be highest under the Planning Basis Option. The maximum 24-hour averaged level at any grazing area within or beyond the INEEL boundary is estimated at less than 0.003 micrograms per cubic meter, or about 1 percent of the monitoring threshold. These levels do not include contributions from baseline or other sources. From this, it can be reasonably concluded that fluoride levels in feed and forage would be within the Idaho standards for any of the alternatives. The state may or may not require monitoring to ensure compliance with these standards.

Impacts Due to Secondary Growth – Only minor growth in employee population would result from the construction and operation of the facilities associated with the proposed waste processing alternatives/options. This growth is not expected to be of a magnitude which could result in any air quality impacts due to general commercial, residential, industrial, or other growth.

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 certain stratospheric ozone-depleting substances. Ozone-depleting substances would be produced or emitted by the proposed waste processing facilities in very small quantities, and there would be no effect on stratospheric ozone depletion.

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. One form of acidic deposition is commonly referred to as acid rain. Under the Planning Basis Option, emissions of sulfur dioxide from combustion of fuel oil (with an assumed sulfur content of 0.5 percent by weight) could reach levels of about 240 tons per year, while emissions of nitrogen dioxide could reach about 90 tons per year. Emissions would be similar or less under other options (Figure 5.2-3). These estimates do not represent net increases in emissions; rather, they are based on the assumption that No. 2 diesel fuel would be burned to produce steam at a future facility that would replace existing (coal and oil-fired) steam generating facilities. Minor amounts of sulfuric and nitric acids would also be emitted. Emissions of the magnitude projected are not expected to contribute significantly to acidity levels in precipitation in the region nor would they have effects over greater distances, such as may occur with very tall stacks associated with large utility power plants.

Global Warming – Emissions of carbon dioxide, methane, nitrogen oxides, and chlorofluorocarbons (commonly known as greenhouse gases) are associated with potential for atmospheric global warming. Of these, carbon dioxide is by far the most significant greenhouse gas emitted in the U.S. The greatest carbon dioxide emission rates for waste processing alternatives – about 50,000 tons per year – would be experienced for operation of facilities under the Planning Basis Option. This level represents a very small part (less than 0.001 percent) of total U.S. carbon dioxide emissions, which are over 5.5 billion tons per year (USA 1997). Methane, which is present in emissions of unburned hydrocarbons, is also an important greenhouse gas. As in the case of carbon dioxide, maximum annual methane emissions under any of the waste processing alternatives would be a small part of the annual U.S. emissions (about 0.1 tons vs. 34 million tons).

Secondary Particulate Matter Formation – The emissions data and evaluation results presented earlier in this section included data and results for particulate matter. Those data and results apply only to "primary" particulate matter, which refers to particles directly emitted to the atmosphere in particulate form. Particulate matter may be formed in the atmosphere from reactions between gas-phase precursors in the exhaust stream, and this is referred to as "secondary" particulate matter. This secondary particulate matter can either form new particles or add particulate matter to pre-existing particles. Secondary particulate matter is usually characterized by small particle sizes and thus can make up a significant fraction of very fine particulate matter (i.e., particulate matter with a particle size less than 2.5 microns, for which no standard has been implemented).

Predicting the amount of secondary particulate matter formation is difficult. Secondary particulate matter usually takes several hours or days to form, and the resultant concentrations are not necessarily proportional to the amount of precursors emitted (STAPPA and ALAPCO 1996). Of the pollutants that are expected to exist in waste processing facility exhaust streams, sulfur dioxide and nitrogen oxides are precursors for some types of secondary particles. Air pollution program officials have used values of 10 percent for the conversion of gaseous sulfur dioxide into secondary sulfate aerosol, and 5 percent for conversion of gaseous nitrogen oxides into secondary nitrate aerosol (STAPPA and ALAPCO 1996). If conversion values of this magnitude are assumed for projected waste management alternatives, and considering the relatively long time required for conversion, the previously described particulate matter-related impacts (i.e., consumption of Prevention of Significant Deterioration regulations increment at Craters of the Moon or around the INEEL, and compliance with 24-hour and annual average ambient standards) would increase by no more than a few percent. Since all projected concentrations are well below applicable ambient air quality standards, increases of this magnitude would not alter the regulatory compliance status of these alternatives.

5.2.6.7 Air Resource Impacts from Alternatives Due to Mobile Sources

The ambient air quality impacts at offsite receptor locations due to the INEEL bus fleet operations, INEEL fleet light- and heavy-duty vehicles, privately owned vehicles, and heavy-duty commercial vehicles servicing the INEEL site facilities were assessed in the SNF & INEL EIS. The mobile source impacts associated with the proposed waste processing alternatives are bounded by those associated with the Preferred Alternative described in the SNF & INEL EIS. The assessment in that EIS indicated that the Preferred Alternative would result in some minor increase in service vehicles and employee vehicles, especially during construction activities. The peak cumulative impacts (baseline plus future projects) were due almost entirely to existing traffic conditions and were found to be well below applicable standards. The proposed waste processing alternatives in the Idaho HLW & FD EIS are expected to have little or no impact on traffic volume at the INEEL and would produce only a small increase in vehicular-induced air quality impacts.

5.2.7 WATER RESOURCES

This section presents potential water resource impacts from implementing the proposed waste processing alternatives described in Chapter 3. Section 5.2.14 discusses potential impacts to INEEL water resources from accidents or unusual natural phenomena such as earthquakes. Appendix C.9 discusses potential long-term impacts to INEEL water resources from facility closure.

Because one of the alternatives (Minimum INEEL Processing) would involve shipment of mixed HLW to the Hanford Site for treatment, possible impacts to water resources at Hanford were also evaluated (see Appendix C.8). Unless otherwise noted, however, the discussion of impacts presented in this section applies specifically to INEEL.

5.2.7.1 Methodology

DOE assessed potential impacts by reviewing project plans for the five proposed alternatives to determine (1) water use by alternative, (2) liquid effluents that could affect local water resources, and (3) the potential for impacts from flooding. Each alternative was then evaluated with respect to its impacts on surface and subsurface water quality and water use. Previous groundwater computer modeling of the vadose zone and saturated contaminant transport shows that existing plumes would not greatly affect the regional groundwater quality because contaminants would not migrate offsite in concentrations above the EPA drinking water standards (DOE 1995). A more recent study (Rodriguez et al. 1997) predicts that without remediation, chromium, mercury, tritium, iodine-129, neptunium-237, and strontium-90 would reach or exceed EPA drinking water standards in the aquifer beneath INEEL before the year 2095. Iodine-129 was predicted to migrate to the southern border of INEEL at the concentration of the drinking water standard (1 picocurie per liter). Section 5.4, Cumulative Impacts, discusses potential impacts of these contaminants.

The primary assumption for evaluating consequences to water resources for each alternative was that there would be no future routine discharge of radioactive liquid effluents that would result in offsite radiation doses. Activities proposed for each alternative have been analyzed to identify potential waste streams and water use (see Sections 5.2.12 and 5.2.13). There are no radioactive discharges directly into the Snake River Plain aquifer from existing operations. Routine deep well injection of radioactive waste at INTEC was discontinued in 1984. The well was permanently closed and sealed in accordance with Idaho Department of Water Resources regulations in 1989. The sewage treatment plant accepts sanitary wastes from INTEC facilities. Liquid effluent discharges from INTEC facilities to the percolation ponds and sewage treatment plant are monitored for compliance with the conditions of their respective wastewater and land application permits (see Section 4.8). It is not known what contaminants may be present in the process effluent; however, it is assumed that under normal operating conditions the radioactive and chemical discharges would not result in off-INTEC impacts and are subject to permitting requirements.

5.2.7.2 Construction Impacts

Potential construction impacts evaluated for water resources include water use and impacts to surface water quality from stormwater runoff. Estimated water use during construction by alternative is presented in Table 5.2-28 of Section 5.2.12. Options under the Separations Alternative have the highest water use, followed by the Non-Separations Alternative, Minimum INEEL Processing Alternative, the Continued Current Operations Alternative, and the No Action Alternative with the lowest water use. INEEL activities withdraw an average of 1.6 billion gallons of water from the Snake River Plain aquifer each year (DOE 1997), most of which is returned. Total use of groundwater from the Snake River Plain aquifer for all uses (agricultural irrigation, domestic water use, etc.) averages 470 billion gallons each year (DOE 1995). INEEL activities represent 0.4 percent of the total withdrawal from the aquifer. Water use during construction for any alternative represents a minor increase in water withdrawal over current use.

Construction activities at INEEL are managed in accordance with the *INEEL Storm Water Pollution Prevention Plan for Construction Activities* (DOE 1998a). This plan requires the use of best management practices to minimize stormwater runoff and the potential pollution of surface waters. The *INEEL Storm Water Pollution Prevention Plan for Industrial Activities* (DOE 1998b) requires monitoring at INEEL facilities. Stormwater monitoring at INTEC is discussed in Section 4.8.1.4. Stormwater measurements above benchmark levels established in the *LMITCO Storm Water Monitoring Program Plan* (LMITCO 1998) must be investigated and corrected. A temporary increase in sediment loads in stormwater runoff may be expected during construction. Because options under the Separations Alternative have the most construction activities, the highest potential for stormwater pollution is associated with this alternative. This alternative is followed in order of decreasing potential impact by the Non-Separations Alternative, Minimum INEEL Processing Alternative, Continued Current Operations Alternative, and the No Action Alternative. However, in every case, because of the construction best management practices, low annual rainfall, small quantities of runoff, and flat ground slopes, DOE expects impact to surface water to be minimal.

As described in Section 4.8, INTEC stormwater runoff is prevented from reaching the Big Lost River by drainage ditches and berms that divert runoff to a borrow pit and depressions scattered around the INTEC area. Water collects in these depressions and infiltrates the ground surface, providing recharge to the aquifer.

5.2.7.3 Operational Impacts

Potential operational impacts evaluated for water resources include water use, impacts to surface water quality from stormwater runoff, and the potential for flooding. As previously discussed, it is assumed there would be no future routine discharge of radioactive liquid effluents that would result in offsite radioactive doses. Under normal operating conditions for all alternatives, there would be no radioactive and chemical discharges to the soil or directly to the aquifer that would result in offsite impacts. Potential releases from accidents are evaluated in Section 5.2.14.

Water use by alternative is summarized in Table 5.2-29 (Section 5.2.12). As with construction, the increased operational water use would represent a very small increase over the annual average water withdrawal of 1.6 billion gallons at INEEL and 470 billion gallons for the entire Snake River Plain aquifer. The highest operational water use is expected under the Hot Isostatic Pressed Waste Option, followed by the Planning Basis Option, Direct Cement Waste Option, Continued Current Operations Alternative, and Transuranic Separations Option. Other options and alternatives would use considerably less water.

Stormwater runoff from INTEC is monitored in accordance with the *INEEL Storm Water Pollution Prevention Plan for Industrial Activities* (DOE 1998b). This plan includes provisions for spill control and cleanup, facility inspections to identify and correct potential sources of stormwater pollution, and best management practices at each facility to minimize the potential for polluting stormwater. Stormwater measurements above benchmark levels established in the *LMITCO Storm Water Monitoring Program Plan* (LMITCO 1998) must be investigated and corrected. Based on best management practices, monitoring requirements, and historical measurements of contaminants in INTEC stormwater runoff (Section 4.8), operational impacts to surface water are expected to be minimal under every alternative.

As discussed in Section 4.8.1.3, flood studies prepared by the U.S. Geological Survey and Bureau of Reclamation conclude that some inundation at INTEC could occur for a 100-year return period flood. For the two independent 100-year flood studies, the results differ only by a factor of two. If, as a result of this EIS, DOE decides to build facilities within the flood plain at INTEC, then some form of mitigation would be necessary to assure that INTEC facilities would not be impacted by localized flooding. A Mitigation Action Plan would be prepared, if necessary, under the Record of Decision for this EIS. However, before such facilities are constructed, future evaluations and comparative analyses regarding the extent of the 100-year flood at INTEC may be conducted and used by DOE to determine a more accurate basis for potential inundation.

In a previous study (Koslow and Van Haaften 1986), a probable maximum flood combined with an overtopping failure of Mackay Dam resulted in a larger flood than was presented in Berenbrock and Kjelstrom (1998) for a 100-year event. The peak water velocity in the INTEC vicinity was estimated at 2.7 feet per second, which would produce minimal erosion. However, as noted in Appendix C.4, the probable maximum flood could affect bin set 1, causing the bin set to lose its integrity. This is a design basis bounding event and is discussed in Appendix C.4. In addition, the Technical Resource Document (DOE 1998c) shows that under probable maximum flood conditions, one or more 300,000 gallon waste tanks could float. However, if they do float, the analysis predicts that they would remain stable and upright, and floating one or more of the tanks is not a bounding event relative to environmental impacts.

5.2.8 ECOLOGICAL RESOURCES

5.2.8.1 Methodology

This section presents the potential impacts on ecological resources from implementing the proposed waste processing alternatives described in Chapter 3. Potential impacts were qualitatively assessed by reviewing project plans for the five proposed alternatives to determine if: (1) project activities are likely to produce changes in ecological resources and (2) project plans conform to existing major laws, regulations, and DOE Orders related to protection of ecological resources (e.g., protected species, wetlands). Because one of the alternatives (Minimum INEEL Processing) would involve shipment of mixed HLW to the Hanford Site for treatment, possible impacts to Hanford's ecological resources were also evaluated (see Appendix C.8 for a detailed discussion of at-Hanford impacts). Unless otherwise noted, however, the discussion of impacts in this section applies specifically to the INEEL.

Most of the activities associated with HLW management would take place inside the perimeter fence at INTEC, an area that has been dedicated to industrial use for more than 40 years. Potentially-affected areas (sites and facilities to be used or constructed and surrounding habitat where effluents, emissions, light, or noise may be present) were identified in Chapter 3, Alternatives. Ecological resources of the INEEL are discussed in Section 4.9. The assessment of potential effects is based upon an evaluation of the location, scope, and intensity of construction and waste processing activities in relation to ecological resources. In addition, the potential effects associated with the No Action Alternative serve as a basis of comparison for the other alternatives.

5.2.8.2 Construction Impacts

Construction-related disturbances of various types (such as earthmoving and noise) associated with the development of new INTEC facilities would be a primary source of ecological impacts and could result in displacement of individual animals, habitat loss, and habitat degradation. Table 5.2-1 in Section 5.2.1 lists new facilities and acreage that would be disturbed for the five proposed waste processing alternatives.

Because INTEC is a heavily-developed industrial area with most natural vegetation removed, its value as wildlife habitat is marginal. No state or Federally-listed species are known to occur in the area. With the exception of the intermittent streams and spreading areas and the engineered percolation ponds and waste treatment lagoons described in Section 4.8 (Water Resources), there are no aquatic habitats on the INEEL or near INTEC. None of the alternatives evaluated in this EIS would affect jurisdictional wetlands.

Because options under the Separations Alternative would have the most construction activity, this alternative would have the greatest potential for construction-related disturbances to plant and animal communities in areas adjacent to INTEC. This alternative would be followed in order of decreasing potential impacts by the Non-Separations Alternative, Minimum INEEL Processing Alternative, Continued Current Operations Alternative, and the No Action Alternative.

Under two of the alternatives, the Separations Alternative and the Minimum INEEL Processing Alternative, DOE could elect to dispose of the grouted low-level waste fraction in a new Low-Activity Waste Disposal Facility. The new disposal facility would be built approximately 2,000 feet east of the INTEC Coal-Fired Steam-Generating Facility, outside the existing perimeter fence. Although undisturbed, this site is adjacent to INTEC, thus its development would not require the conversion of high-quality wildlife habitat to industrial use. Further, the site's proximity to INTEC would mean that minimal expansion of infrastructure and utilities would be required (Kiser et al. 1998). The new Low-Activity Waste Disposal Facility would include a 367-foot by 379-foot reinforced concrete structure for disposal of the grouted low-level waste fraction, several small support facilities (e.g., a security guardhouse), and an

Burrowing owl with young.

open buffer zone (See Chapter 3, Alternatives, and Appendix C.6 for more details). Development of the disposal facility would disturb approximately 22 acres of open land adjacent to INTEC.

Potential construction impacts would be related to activities such as excavating, loading, and hauling soils from the Low-Activity Waste Disposal Facility; grading excavated areas; developing access roads; and building reinforced concrete disposal facilities. The potential effects of clearing approximately 22 acres of shrub-steppe vegetation (see Section 4.9.1) could include a local reduction in plant productivity and invasion by non-native annual plants such as Russian thistle and cheatgrass.

Construction of the Low-Activity Waste Disposal Facility could result in loss of nesting habitat for ground-nesting birds. Small mammals (ground squirrels) and reptiles (snakes and lizards) that live in burrows for much of the year would be subjected to displacement or mortality. Noise, night lights, and increased vehicle activity during the construction phase could disturb wildlife within sight or sound of construction activities and transportation routes. This could result in displacement of some animals and abandonment of nest or burrow sites. Because the area proposed for the Low-Activity Waste Disposal Facility is adjacent to INTEC, it has minimal value as wildlife habitat. This would reduce the extent of animal displacement and mortality.

Once filled to capacity, the Low-Activity Waste Disposal Facility would be equipped with an engineered cap sloping from centerline to ground level with a four percent grade (Kiser et al. 1998). The cap would be revegetated with selected native plants to prevent erosion and improve the appearance of the closed facility.

Under the Minimum INEEL Processing Alternative, two new facilities would be built within the 200-East Area of the Hanford Site. These facilities would be located in a previously-undisturbed area with little value as wildlife habitat due to its proximity to existing waste management facilities. The required acreage would be relatively small (52 acres) and would not result in significant habitat fragmentation. Impacts to biodiversity would be small and local in scope. See Appendix C.8 for a more detailed analysis of impacts at the Hanford site.

5.2.8.3 Operational Impacts

The operation of HLW facilities at INTEC could, depending on the waste processing alternative selected, result in increased levels of human activity (movement of personnel and vehicles, noise, night lighting) and increased emissions of hazardous and radioactive air pollutants over the period of waste processing.

Because operations-phase disturbances to wildlife would be directly related (or proportional to) operational employment levels, direct employment levels under the various wastes processing alternatives (see Section 5.2.2) were assumed to reflect the relative amount of disturbance. Direct employment would be highest under the Direct Cement Waste Option, followed in descending order by the Planning Basis Option, Hot Isostatic Pressed Waste Option, Full Separations Option, Early Vitrification Option and Minimum INEEL Processing Alternative, Transuranic Separations Option, and Continued Current Operations Alternative. However, as noted in the discussion of socioeconomic impacts, none of the waste processing alternatives is expected to generate significant numbers of new jobs at INTEC, so there would be no marked increase in operational employment levels at INTEC. As a result, operations-related disturbances to wildlife using shrub-steppe habitat adjacent to INTEC would not increase over the period of analysis.

Waste processing and related activities would result in emissions of nonradiological and radiological air pollutants to the atmosphere at INTEC. These emissions are discussed in detail in Section 5.2.6 and discussed here in the context of potential exposures of plants and animals. As noted in Section 5.2.6.6, minor increases in ambient concentrations of criteria pollutants (e.g., sulfur dioxide and nitrogen dioxide) would be expected, particularly under the Separations Alternative options, but no impacts to local soils or vegetation, including the native sagebrush community, would be expected. The National Park Service has issued interim guidelines for protection of sensitive resources relative to air quality concerns (DOI 1994). For sulfur dioxide, the Park Service recommendation to maximize protection of all plant species is to maintain levels below 40 to 50 parts per billion (ppb) for a 24-hour averaging time, and 8 to 12 ppb for annual average levels. The lower ends of these ranges correspond to about 100 and 20 micrograms per cubic meter, respectively. The guideline for annual average nitrogen dioxide is less than 15 ppb, which corresponds to about 28 micrograms per cubic meter.

The highest projected levels of sulfur dioxide and nitrogen dioxide at ambient air locations from any of the waste processing alternatives would be well below these guidelines under any of the alternatives. When the combined effects of baseline and alternative impacts are considered (see Table C.2-14), the maximum 24-hour sulfur dioxide level would be about 28 micrograms per cubic meter (5 percent of the guideline) along public roads and about half that (less than 3 percent of the guideline) at the INEEL boundary. The maximum annual average sulfur dioxide level would not exceed about 3 percent of the guideline along public roads and would be less than 1 percent at any offsite location. For nitrogen dioxide, the highest public road level would be about 1.8 micrograms per cubic meter, or roughly 2 percent of the guideline. These maximum concentrations would occur under the Planning Basis Option (Separations Alternative), and would be somewhat less for other alternatives. Levels of both pollutants at Craters of the Moon Wilderness Area - the nearest area at which the Park Service guidelines are intended to apply - would be roughly one-seventh to one-tenth of the maximum offsite levels cited above.

A number of toxic air pollutants would be produced by waste processing operations and fossil fuel combustion. These pollutants can be transported to downwind locations and deposited on surface soils. Plant and animal communities on INEEL could be at risk from the accumulation of these chemical contaminants in surface soils. Animals can be exposed directly to contaminants in surface soils (e.g., incidental ingestion of soils) or indirectly through foodchain exposure (e.g., ingestion of contaminated prey). Plants can be exposed via root contact and subsequent uptake of contaminants in soils or deposition onto the plants themselves. Hence, DOE assessed the impacts of aerial deposition of chemical contaminants from INTEC emissions on ecological receptors in areas surrounding the facility.

DOE assessed the potential impacts to ecological receptors from air emissions associated with waste processing alternatives. A conservative screening approach was used to assess the maximum concentrations of contaminants of potential concern in surface soils that could result from airborne releases and deposition of these substances. Contaminants of potential concern include radionuclides released from waste treatment operations, and toxic air pollutants produced by both fossil fuel combustion and waste treatment operations. The specific contaminants are the same as those assessed for air resources impacts, as described in Section 5.2.6 and Appendix C.2. The assessment involved identifying the area (within the INEEL) of highest predicted impact and estimating the annual deposition rates and total deposition for contaminants of potential concern.

Ibrahim and Morris (1997) found plutonium in detectable concentration to a soil depth of 21 centimeters at the Radioactive Waste Management Complex on the INEEL. However, 50 percent of the plutonium was in the first 3 centimeters, 75 percent was in the first 10 centimeters, and about 88 percent was in the first 15 centimeters. This is a fairly typical pattern for fallout radionuclides, with most radioactivity occurring in the first few centimeters of soil and an exponential decrease below that. For analysis purposes in this EIS, it was assumed that all contaminants would be uniformly distributed through the first 5 centimeters of soil after an operational period ending in 2035. In general, radionuclides adhere or bind to soil particles, and these soil particles are distributed throughout the soil by means of frost heave, penetration of the soil by vertebrate and invertebrate animals, plant roots, and through snow melt and rain. It was also assumed that there would be no loss of contaminants due to radioactive decay, chemical breakdown, weathering, or plant uptake over the period of deposition.

To determine if the predicted concentrations of chemical (nonradiological) contaminants in surface soils pose a potential risk to plant and animal communities, soil concentrations were compared to ecologically-based screening levels (Table 5.2-10). These screening levels represent concentrations of chemicals in surface soils above which adverse effects to plants and animals could occur. These include the lowest ecologically-based screening levels used in the Waste Area Group 3 ecological risk assessment (Rodriquez et al. 1997); screening benchmarks for surface soils developed by Oak Ridge National Laboratory (ORNL) (Efroymson et al. 1997a,b); U.S. Fish and Wildlife Service "A" screening levels (Beyer 1990); and Dutch Ministry of Housing, Spatial Planning and the Environment (MHSP&E 1994) "Target" values. No screening levels were exceeded for any chemical under any waste processing alternative. In general, predicted surface soil concentrations were several orders of magnitude lower than their screening levels, suggesting that plant and animal communities would not be at risk.

Chemical (nonradiological) contaminant deposition rates would be low under all waste processing alternatives, limiting direct exposure to above-ground plant structures. Most native plants have deep roots to survive desert conditions, which would reduce root exposure to chemicals in shallow surface soils and limit their uptake. Direct contact with contaminants in surface soils is a possible exposure route for animals but would probably be limited because fur, feathers, and chitinous skeletons provide a barrier against dermal exposure. The scarcity of surface water in the area would reduce exposure from ingestion of contaminants in drinking water, and the low airborne concentrations would result in minimal inhalation exposure. Incidental ingestion of contaminants in surface soils and exposure through the foodchain are likely exposure routes. However, the low concentrations predicted in surface soils would minimize potential risks from these exposure routes. For these reasons, potential risks to plant and animal communities on INEEL from airborne deposition of INTEC chemical contaminants would be low under any waste processing alternative.

Potential radionuclide exposure of plants and animals in areas surrounding INTEC may increase slightly due to waste processing activities; however, potential radionuclide emissions from INTEC facilities would result in doses to humans that are well below regulatory limits (Section 5.2.6) and are not expected to affect biotic populations and communities in the area. The long-term exposure and intake by plants and animals in areas adjacent to INTEC are surveyed and reported annually in the INEEL Site Environmental Report in accordance with DOE Order 5400.1. Any measurable change in exposure or uptake due to waste processing activities would be identified by the environmental surveillance program and assessed to determine possible long-term impacts.

For potential radiological impacts, DOE estimated the deposition and resulting soil concentration of the principal radionuclides that would be released from the waste processing alternatives. The specific radionuclides considered are those which either (a) are emitted in greatest quantities or (b) have the greatest potential for radiological impacts (see Section 5.2.6). Predicted soil concentrations, shown in Table 5.2-11, are within historical ranges of concentrations in soils around INTEC (Morris 1993; Rodriguez et al. 1997) and below ecologically-based screening levels for radionuclides developed for the Waste Area Group 3 Remedial Investigation/Feasibility Study (Rodriquez et al. 1997).

Because INTEC is a heavily-developed industrial area with most natural vegetation removed, its value as wildlife habitat is marginal. No state or Federally-listed species is known to occur in the area. No currently listed threatened and endangered species or critical habitat would be affected by the alternatives evaluated in this EIS. In November 1997, as part of an informal consultation under Section 7 of the Endangered Species Act, DOE requested assistance from the U.S. Fish and Wildlife Service in identifying any threatened or endangered species or critical habitat that might be affected by the actions analyzed in this EIS. In a letter dated December 16, 1997, the U.S. Fish and Wildlife Service replied that it

Table 5.2-10. Maximum concentrations of contaminants in soils outside of INTEC compared to ecologically-based screening levels (in milligrams per kilogram).

Contaminant	Highest predicted concentration	Option or alternative	Minimum WAG 3 EBSL[a]	ORNL soil phytotoxicity benchmark[b]	ORNL micro-organisms benchmark[c]	ORNL earthworm benchmark[c]	USFWS "A" screening value[d]	Dutch Ministry target screening value[e]
Antimony	7.9×10^{-3}	Planning Basis	0.767	5	NA	NA	NA	NA
Arsenic	2.0×10^{-3}	Planning Basis	0.901	10	100	60	20	29
Barium compounds	3.9×10^{-3}	Planning Basis	0.108	500	3.0×10^{3}	NA	200	200
Beryllium	4.2×10^{-5}	Planning Basis	0.734	10	NA	NA	NA	NA
Cadmium compounds	6.0×10^{-4}	Planning Basis	2.63×10^{-3}	4	20	20	1	0.8
Chromium (hexavalent)	3.7×10^{-4}	Planning Basis	0.167	1	NA	0.4	NA	NA
Chromium (as Cr)	1.3×10^{-3}	Planning Basis	3.25	NA	NA	NA	100	100
Cobalt	9.0×10^{-3}	Planning Basis	0.467	20	1.0×10^{3}	NA	20	20
Copper	2.6×10^{-3}	Planning Basis	2.17	100	100	50	50	36
Lead	2.3×10^{-3}	Planning Basis	0.072	50	900	500	50	85
Manganese (as Mn)	4.5×10^{-3}	Planning Basis	14.4	500	100	NA	NA	NA
Mercury	1.8×10^{-4}	Planning Basis	6.3×10^{-3}	0.3	30	0.1	0.5	0.3
Molybdenum	1.2×10^{-3}	Planning Basis	5.57	2	200	NA	10	10
Nickel	0.13	Planning Basis	2.77	30	90	200	50	35
Selenium	1.0×10^{-3}	Planning Basis	0.083	1	100	70	NA	NA
Silver	2.8×10^{-10}	Transuranic Separations	1.39	2	50	NA	NA	NA
Thallium	8.5×10^{-10}	Transuranic Separations/ Early Vitrification	0.117	1	NA	NA	NA	NA
Vanadium	0.048	Planning Basis	0.255	2	20	NA	NA	NA
Zinc	0.044	Planning Basis	6.37	50	100	200	200	140

a. From WAG 3 RI/BRA/FS (Rodriguez et al. 1997).
b. From Efroymson et al. (1997a).
c. From Efroymson et al. (1997b).
d. From Beyer (1990).
e. From MHSP&E (1994).
EBSL = ecologically-based screening level; NA = Not available; ORNL = Oak Ridge National Laboratory; USFWS = U.S. Fish and Wildlife Service; WAG = Waste Area Group.

Table 5.2-11. Maximum concentrations of radionuclides in soils outside of INTEC compared to background and ecologically-based screening levels (in picoCuries per gram).

Radionuclides	Background concentration[a]	WAG 3 EBSL[a]	No Action Alternative	Continued Current Operations Alternative	Full Separations Option	Planning Basis Option	Transuranic Separations Option	Hot Isostatic Pressed Waste Option	Direct Cement Waste Option	Early Vitrification Option	Minimum INEEL Processing Alternative at INEEL
Americium-241	0.011	355	ND	ND	1.3×10^{-9}	6.1×10^{-10}	2.2×10^{-9}	ND	ND	ND	2.7×10^{-6}
Antimony-125	NA	6,020	5.7×10^{-8}	4.5×10^{-7}	5.9×10^{-8}	4.7×10^{-7}	7.3×10^{-8}	4.5×10^{-7}	4.5×10^{-7}	1.8×10^{-7}	7.1×10^{-7}
Cesium-134	NA	1,950	3.1×10^{-9}	2.4×10^{-7}	2.9×10^{-10}	2.4×10^{-7}	6.5×10^{-9}	2.4×10^{-7}	2.4×10^{-7}	1.1×10^{-8}	1.4×10^{-8}
Cesium-137	0.82	4,950	9.1×10^{-6}	1.0×10^{-4}	1.8×10^{-4}	1.9×10^{-4}	3.0×10^{-4}	3.6×10^{-3}	1.9×10^{-4}	2.9×10^{-4}	3.3×10^{-4}
Cobalt-60	NA	1,180	4.9×10^{-9}	4.6×10^{-8}	2.3×10^{-9}	4.8×10^{-8}	1.1×10^{-9}	4.6×10^{-8}	4.6×10^{-8}	1.5×10^{-8}	1.3×10^{-6}
Europium-154	NA	2,480	7.5×10^{-9}	4.3×10^{-8}	8.6×10^{-11}	4.3×10^{-8}	1.4×10^{-10}	4.3×10^{-8}	4.3×10^{-8}	2.3×10^{-8}	1.3×10^{-6}
Europium-155	NA	32,500	ND	ND	3.9×10^{-11}	1.9×10^{-11}	6.5×10^{-11}	ND	ND	ND	2.4×10^{-10}
Iodine-129	NA	47,600	1.2×10^{-2}	3.3×10^{-2}	1.2×10^{-3}	3.4×10^{-2}	5.6×10^{-4}	3.3×10^{-2}	3.3×10^{-2}	3.7×10^{-2}	4.1×10^{-2}
Nickel-63	NA	NA	ND	ND	5.4×10^{-13}	2.6×10^{-13}	9.1×10^{-13}	ND	ND	ND	3.5×10^{-11}
Plutonium-238	0.049	355	2.3×10^{-7}	4.2×10^{-7}	2.6×10^{-6}	1.6×10^{-6}	4.3×10^{-6}	1.6×10^{-6}	1.6×10^{-6}	4.4×10^{-6}	1.2×10^{-5}
Plutonium-239	0.10	379	3.9×10^{-9}	2.5×10^{-8}	1.9×10^{-11}	2.5×10^{-8}	2.9×10^{-11}	2.5×10^{-8}	2.5×10^{-8}	1.2×10^{-8}	4.3×10^{-7}
Plutonium-241	NA	373,000	ND	ND	4.4×10^{-9}	2.1×10^{-9}	7.4×10^{-9}	ND	ND	ND	3.1×10^{-10}
Promethium-147	NA	NA	ND	ND	ND	ND	ND	ND	ND	ND	6.9×10^{-6}
Ruthenium-106	NA	194,000	8.9×10^{-8}	2.5×10^{-6}	1.3×10^{-7}	2.5×10^{-6}	6.2×10^{-8}	2.9×10^{-6}	2.5×10^{-6}	2.9×10^{-7}	3.1×10^{-7}
Samarium-151	NA	NA	ND	ND	1.6×10^{-8}	7.6×10^{-9}	2.7×10^{-8}	ND	ND	ND	3.3×10^{-6}
Strontium-90	0.49	3,340	7.8×10^{-7}	1.3×10^{-5}	4.6×10^{-4}	2.3×10^{-4}	7.8×10^{-4}	2.3×10^{-4}	2.3×10^{-4}	6.8×10^{-4}	9.9×10^{-4}
Technetium-99	NA	487	ND	ND	1.4×10^{-6}	6.9×10^{-7}	2.4×10^{-6}	6.4×10^{-6}	ND	ND	1.1×10^{-7}
Tritium	NA	343,000	ND	ND	ND	ND	ND	ND	ND	ND	ND

a. From WAG 3 RI/BRA/FS (Rodriguez et al. 1997).

EBSL = ecologically-based screening level; NA = Not available; ND = Not detectable; WAG = Waste Area Group.

was their preliminary determination that the proposed action was unlikely to impact any species listed under the Endangered Species Act. In January 1999, DOE sent a second letter to the U.S. Fish and Wildlife Service asking if any conditions had changed with respect to threatened or endangered species or critical habitats that might occur in the general vicinity of INTEC. In a letter dated February 11, 1999, the U.S. Fish and Wildlife Service reiterated that it was their preliminary determination that, given the general nature of the proposal, the project would be unlikely to impact any listed species. Based upon the analyses conducted for this EIS, DOE has determined that the activities analyzed for this EIS are not likely to adversely affect listed species or critical habitat, and, accordingly no further action is necessary.

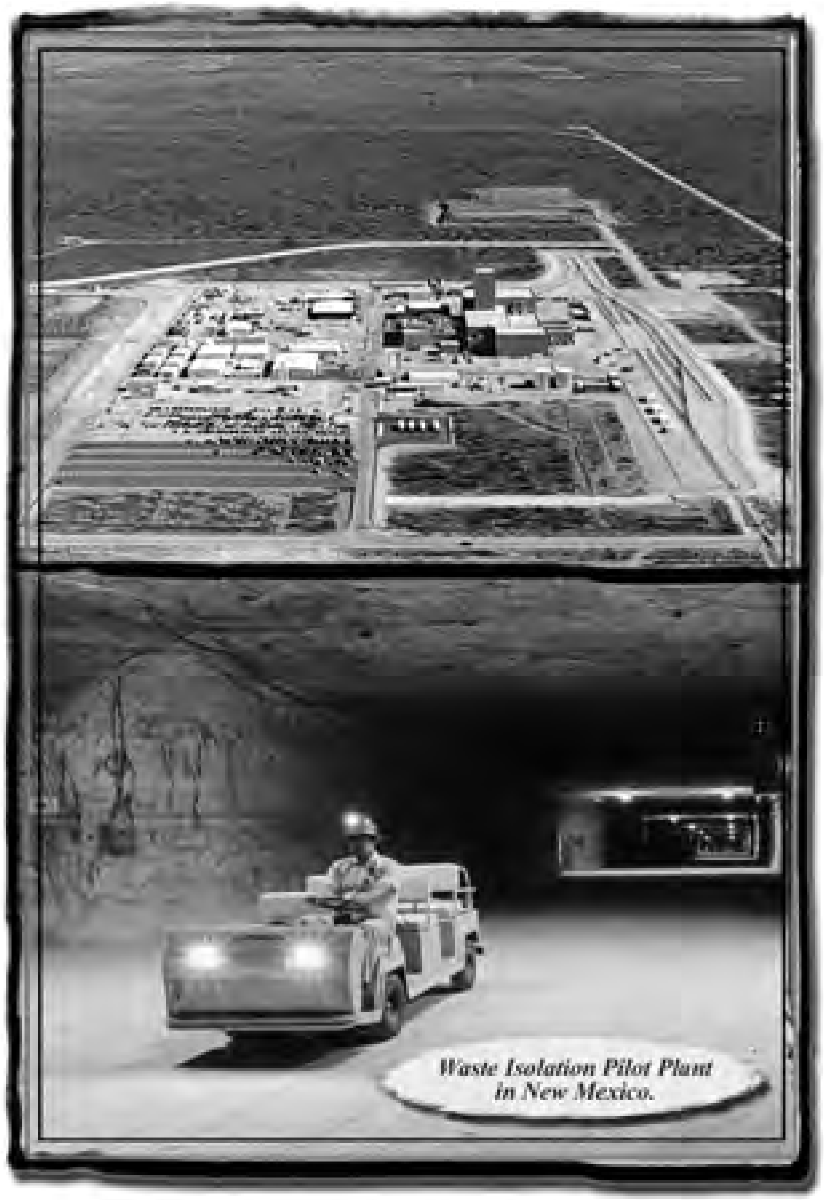
With the exception of intermittent streams, spreading areas, playas, engineered percolation and evaporation ponds, and waste treatment lagoons there are no aquatic habitats on the INEEL or in the vicinity of INTEC. Before any of these potential wetlands is altered, a wetland determination would be completed to determine if mitigation is required.

5.2.9 TRAFFIC AND TRANSPORTATION

This section presents the estimated impacts of transporting radioactive materials for each of the waste processing alternatives described in Chapter 3. Transportation of hazardous and radioactive materials on highways and railways outside the boundaries of INEEL is an integral component of HLW management and affects decisions to be made within the scope of this EIS. The different waste forms that are analyzed include remote-handled transuranic waste, grouted low-level waste fraction, solidified high-level waste fraction, vitrified high-level waste fraction, hot isostatic pressed HLW, cementitious HLW, vitrified HLW, vitrified transuranic waste, calcine and cesium ion-exchange resin, contact-handled transuranic waste, and vitrified low-level waste fraction.

Although transportation of road-ready HLW to a geologic repository is beyond the scope of DOE's Proposed Action (see Chapter 2), DOE has, in this EIS, analyzed HLW transportation for two reasons. First, transporting HLW for disposal is an action that logically follows the Proposed Action (40 CFR 1508.25). Second, waste processing alternatives would result in large differences in the number of shipments, resulting in transportation impacts that would have to be considered by the decision-maker.

DOE has assumed that all HLW will ultimately be disposed of in a geologic repository. The Government has not yet selected a geologic repository for HLW disposal. However, only one site, Yucca Mountain in Nevada, is currently under consideration. Therefore, for purposes of analysis, the transportation impacts for HLW shipment are based on the assumption that Yucca Mountain is the destination. The routes between INEEL and Yucca Mountain selected in this EIS are surrogates for those that DOE may ultimately select. DOE has not yet determined when it would make decisions concerning the transportation of spent nuclear fuel and HLW to the Yucca Mountain site. The Yucca Mountain EIS includes information, such as the comparative impacts of heavy-haul truck and rail transportation, alternative intermodel (rail to truck) transfer station locations associated with heavy-haul truck routes, and alternative rail transport corridors in Nevada. It is uncertain at this time when DOE would make transportation-related decisions. Therefore, the Idaho HLW & FD EIS uses a bounding rail distance analysis for Idaho HLW to a repository for purposes of illustration of impacts and to demonstrate that impacts were considered.



In addition to transportation of HLW for ultimate disposal, this EIS analyzes waste that could be transported to DOE's Hanford Site in Richland, Washington; DOE's Waste Isolation Pilot Plant in New Mexico; for purposes of analysis in this EIS a commercial radioactive disposal site operated by Envirocare of Utah, Inc.; and a commercial radioactive waste disposal site operated by Chem-Nuclear Systems. The Envirocare site is located 80 miles west of Salt Lake City, Utah. The Chem-Nuclear Systems site is in Barnwell County, South Carolina. There would be no waste shipped offsite in the No Action Alternative; therefore, this alternative is not explicitly discussed in this section.

This section summarizes the methods of analysis and potential impacts related to the transportation of these materials and traffic from construction and operations under normal (incident-free) and accident conditions. The impacts are presented by alternative and include accident numbers, fatality numbers, radiation doses, and health effects. This section also presents the impacts of changes in the level of traffic on roads near INEEL from the waste processing alternatives. Because one of the alternatives (Minimum INEEL Processing) involves shipment of mixed HLW to the Hanford Site for treatment, possible traffic and transportation changes at the Hanford Site are presented in Appendix C.8.

5.2.9.1 Methodology

This section summarizes the methods of analysis used in determining the environmental risks and consequences of transporting wastes. Data on the total number of shipments and inventory information were taken from project data sheets identified in Appendix C.6 and other INEEL documents. Details of the analysis can be found in Appendix C.5.

Methodology for Traffic Impact Analysis - DOE assessed potential traffic impacts based on changes in INEEL employment (numbers of employees) associated with each alternative (see Section 5.2.2). The impacts associated with each alternative were evaluated relative to baseline or historic traffic volumes. Changes in traffic volume under the various alternatives were also used to assess potential changes in level of service to the major roads.

The level-of-service impact is a qualitative measure of operational conditions within a traffic stream as perceived 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 (TRB 1985).

For purposes of evaluating impacts of increased or decreased 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 procedure 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 changes in traffic 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.

Methodology for Vehicle-Related Transportation Analysis - DOE's analysis of potential vehicle-related impacts included expected accidents, expected fatalities from accidents, and impacts from vehicle emissions. Vehicle-related accidents are accidents not related to transportation of waste or materials but simply related to number of miles traveled by vehicles and the risk of accidents occurring based on the increase in miles traveled. Mileage through states along a given route were multiplied by state-specific accident and fatality rates (Saricks and Tompkins 1999) to determine the potential numbers of route-specific accidents and fatalities.

DOE estimated impacts from vehicle emissions using an impact factor for particulate and sulfur dioxide truck emissions (Rao et al. 1982). The impact factor, 1.0×10^{-7} latent fatalities per kilometer, estimates the expected number of latent fatalities per urban kilometer traveled. No impact factors are available for suburban or rural zones; therefore, expected latent fatalities based on vehicle emissions are presented for urban areas only.

The analysis assumes that vehicle-related transportation impacts are independent of the cargo that is being hauled. All vehicle-related transportation impacts were calculated assuming round-trip distances to account for the return trip.

Methodology for Cargo-Related Incident-Free Transportation Analysis - DOE determined radiological impacts for workers and the general public during normal, incident-free transportation. For truck shipments, the occupational receptors were the drivers of the shipment. For rail shipments, the occupational receptors were workers in close proximity to the shipping containers during the inspection or classification of railcars. The general population included persons along the route within 800 meters of the transport link (off-link), persons sharing the transport link (on-link), and persons at stops. All radiological impacts were calculated using the RADTRAN 4 computer code (Neuhauser and Kanipe 1992).

A dose rate of 10 millirem per hour at a distance of 2 meters from the transport vehicle was assumed for all waste shipments. This dose rate is the maximum permitted under 49 CFR 173.441 for exclusive use shipments.

Assessment of the Health Effects of Ionizing Radiation

This EIS presents the consequences of exposure to radiation even though the effects of radiation exposure under most of the circumstances evaluated in this EIS are small. This introductory section 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 depend 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. 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 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 360 millirem 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.

Radiation can also cause a variety of ill-health effects in people. The most significant ill-health effect from environmental and occupational radiation exposures is induction of latent cancer fatalities (LCFs). 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 dose to an exposed population (or population dose) is calculated by summing the estimated doses received by each member of the exposed population. The total dose received by the exposed population over a given

Assessment of the Health Effects of Ionizing Radiation (continued)

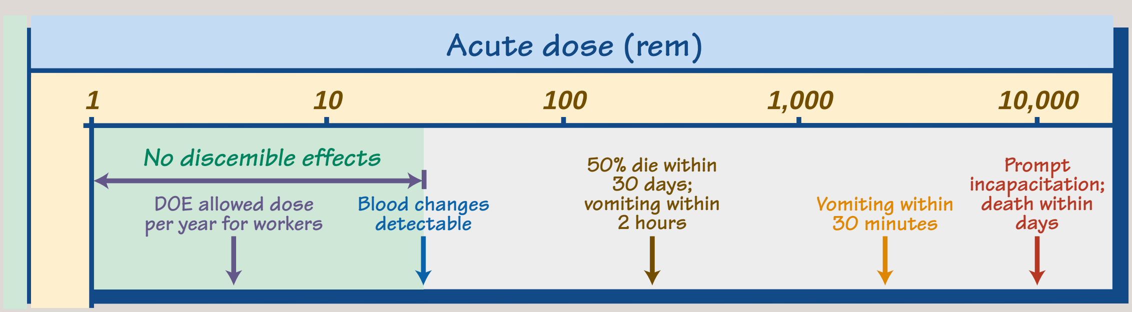
period of time is measured in person-rem. For example, if 1,000 people each received a dose of 1 millirem (0.001 rem), the collective dose would be 1,000 persons x 0.001 rem = 1.0 person-rem. Alternatively, the same collective dose (1.0 person-rem) would result from 500 people each of whom received a dose of 2 millirem.

DOE calculated latent cancer fatalities by multiplying the collective radiation dose values by the dose-to-risk conversion factors from the International Commission on Radiological Protection (ICRP 1991). DOE has adopted these risk factors of 0.0005 and 0.0004 latent cancer fatality for each person-rem of radiation exposure to the general public and worker population respectively for doses less than 20 rem. The factor for the population is slightly higher due to the presence of infants and children who are more sensitive to radiation than the adult worker population.

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 to a total dose per individual of 0.001 rem (1 millirem), the collective dose would be 100 person-rem, and the corresponding estimated number of latent cancer fatalities would be 0.05 (100,000 persons x 0.001 rem x 0.0005 latent cancer fatality per person-rem = 0.05 latent cancer fatality).

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, nobody (0 people) would incur a latent cancer fatality from the 0.001 rem dose each member would have received. In a small fraction of the groups, one latent fatal cancer would result; in exceptionally few groups, two or more latent fatal cancers would occur. The average number of deaths over all the groups would be 0.05 latent fatal cancer (just as the average of 0, 0, 0, and 1 is ¼, or 0.25). The most likely outcome is zero latent cancer fatalities.

Large radiation doses (i.e., at levels substantially greater than the DOE worker dose limit) may cause acute (or immediate) health effects. The figure below shows a diagram of these acute radiation effects on human health.



DOE based the calculation of impacts 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 a specific material over a specific route. The unit risk factors have units of person-rem per shipment and may be combined with the total number of shipments to determine the dose for a series of shipments between a given origin and destination. RADTRAN 4 was used to develop new unit risk factors for all waste types. 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).

Methodology for Cargo-Related Transportation Accident Analysis - For 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 range 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 accident risk using the RADTRAN 4 computer code. Using this methodology, a high-consequence accident would not necessarily have significant risk if the probability of that accident is very low.

Differences in waste types translate into different radioactive material release characteristics under accident conditions; thus, analyses were performed for each waste type. Characterization data for the representative waste types were developed based on project data sheets identified in Appendix C.6.

Accident severity categories for radioactive waste transportation accidents are described in NUREG/CR-4829 (Fischer et al. 1987) and NUREG-0170 (NRC 1977). 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. Transportation accidents are grouped into accident severity categories, ranging from high-probability events with low consequences to low-probability events with high consequences. 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. Representative release fractions were identified for each of the representative waste types based on the *Final Waste Management Programmatic Environmental Impact Statement for Managing Treatment, Storage, and Disposal of Radioactive and Hazardous Waste* (DOE 1997), and those release fractions used for vitrified HLW in the Yucca Mountain EIS (McSweeney 1999).

Radioactive material released to the atmosphere is transported by wind. The amount of dispersion, or dilution, of the radioactive material concentrations in 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 radioactive waste shipment. For accident risk assessment, DOE assumed neutral weather conditions (Pasquill Stability Class D) (Doty et al. 1976).

Collective doses were calculated for populations within 80 kilometers of an 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), 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 standard risk factors recommended by the International Commission on Radiological Protection (ICRP 1991).

As a complementary analysis to RADTRAN 4, DOE used the RISKIND (Yuan et al. 1995) computer program developed by Argonne National Laboratory to estimate the radiological consequences to exposed individuals under hypothetical transportation accident conditions. The RISKIND program was originally developed for the DOE Office of Civilian Radioactive Waste Management to analyze the potential radiological health consequences to individuals or specific population subgroups exposed to spent nuclear fuel shipments. In its current configuration, RISKIND supports transportation analysis of radioactive waste forms other than spent nuclear fuel.

The Nuclear Regulatory Commission (Fischer et al. 1987) has estimated that because of the rigorous design specifications for the shipping packages used by DOE, the packages will withstand at least 99.4 percent of the truck or rail accidents analyzed in this EIS without sustaining damage sufficient to have any radiological significance. The remaining 0.6 percent of accidents that could potentially breach the shipping package are represented by a spectrum of accident severities and radioactive release conditions. The RISKIND consequence assessment deals strictly with this small fraction of accidents that could cause the shipping packages to release some or all of their radioactive contents.

Whereas the RADTRAN 4 accident risk assessment considers the entire range of accident severities and their probabilities, the RISKIND assessment is intended to provide an estimate of the potential impacts posed by two transportation accidents differing only in the amount of radioactive material released. Because the RISKIND assessment was performed in a consequence-only mode (i.e., independent of accident probability), uncertainties regarding the severity, occurrence, or location of an accident were removed from the analysis. Thus, the consequence results provide information addressing public concern about the magnitude of an accident impact by assuming that an accident was to occur near them. Information about the configuration and use of RISKIND for this analysis can be found in Appendix C.5.

5.2.9.2 Construction Impacts

As noted in Chapter 4, the existing principal highway (Highway 20) between Idaho Falls and INEEL is designated as Level-of-Service A, which 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.

Based on predicted employment levels during the construction phase (see Section 5.2.2) for the alternatives described in Chapter 3, DOE would not expect the level of service designation for Highway 20 to change. DOE analyzed the impacts of increased traffic in the INEEL area in the SNF & INEL EIS (DOE 1995). The SNF & INEL EIS, which analyzed larger traffic increases as compared to this EIS, also concluded there would be no change in level of service.

5.2.9.3 Operational Impacts

This section describes for each alternative the potential impacts from traffic and transportation during the operational phase. It considers the baseline INEEL employment, current levels of service for onsite and offsite roads in the region of influence, and data from previous DOE analyses, the types and quantities of materials and waste generated, and the method of transportation for each. The analysis presents a comparison between the traffic accidents and deaths, occupational exposures, the maximum individual risk and collective radiation dose. Transportation of waste would occur by truck or rail depending on alternative, waste form, and destination. DOE analyzed the impacts of both incident-free and accident conditions.

Traffic Impacts - As noted previously, the highway (Highway 20) between Idaho Falls and INEEL is designated as Level-of-Service A, which represents free flow.

Based on predicted operational employment levels under the alternatives described in Chapter 3 and results in the SNF & INEL EIS, DOE does not expect the level of service designation for Highway 20 to change.

Vehicle-Related Transportation Impacts - This section describes the transportation impacts that are not related to radioactive material being shipped but to the movement of the vehicles on the highway or railroad. The three types of impacts addressed are impacts from vehicle emissions, estimated number of traffic accidents, and estimated number of traffic and air emissions fatalities from the waste shipments.

Tables 5.2-12 and 5.2-13 present the total vehicle-related impacts for each option over the project campaign. Table 5.2-12 presents information based on shipments by truck, and Table 5.2-13 presents information based on shipments by rail. These numbers are a function of total round trip distances, number of shipments, and state-specific accident and fatality rates.

For truck shipments, DOE expects the Transuranic Separations Option to result in the highest number of accidents and fatalities, 25 and 0.98, respectively. This option is also expected to produce the highest number of accident and fatalities for rail shipments, 0.69 and 0.13. The maximum values associated with this option are due to the long distances both truck and rail shipments of low-level waste Class C type grout must move between INEEL and Barnwell, S.C.

Impacts from emissions were only evaluated for truck shipments and are shown in Table 5.2-12. The Direct Cement Waste Option would result in the greatest expected latent fatalities from emissions (0.10). The large number of trips through urban areas required between INTEC and the geologic repository for transporting the cementitious HLW accounts for the maximum number of latent fatalities under this option. See Appendix C.5 for more details on route mileage and shipment numbers.

Incident-Free Transportation Impacts - The impacts of incident-free transport of radioactive waste are summarized in Tables 5.2-14 for truck and 5.2-15 for rail. These tables present the collective dose to workers and public individuals.

For truck shipments, the Direct Cement Waste Option yielded the largest collective doses. This option was estimated to cause a total of 2.9×10^{3} person-rem to members of the public, from which 1.5 latent fatalities were predicted. As with the latent fatalities due to emissions, the maximum doses are due to the large number of shipments required for the cementitious HLW. The minimum impact would result from the Continued Current Operations Alternative, which was estimated to produce a total dose of 25 person-rem to members of the public, from which 0.013 latent cancer fatality would be expected. This option would provide the smallest impact because a relatively small amount of waste would be shipped offsite. The highest worker impacts would occur under the Direct Cement Waste Option (530 person-rem).

For rail shipments, the Transuranic Separations Option would yield the largest collective dose of 15 person-rem to members of the public, from which 7.6×10^{-3} latent cancer fatality were predicted. The Continued Current Operations Alternative would result in the smallest impact with a total dose of 0.18 person-rem from which 9.1×10^{-5} latent cancer fatality would be expected. The highest worker impacts would occur under the Direct Cement Waste Option (160 person-rem).

Transportation Accident Impacts - The impacts from the transportation impact analysis are shown in Table 5.2-16 for truck shipments and Table 5.2-17 for rail shipments. Each value in the tables (except the maximum individual dose) represents the sum of consequence (population dose or latent cancer fatalities) times probability for a range of possible accidents. The maximum individual dose impacts are consequence values obtained from the RISKIND code.

For truck shipments, the Transuranic Separations Option would result in the highest doses. This option would result in 190 person-rem (0.093 latent cancer fatality) for truck shipments. For rail shipments, the highest dose of 74 person-rem (0.037 latent cancer fatality) would result from the Transuranic Separations Option.

Table 5.2-12. Estimated fatalities from truck emissions and accidents (vehicle-related impacts).

Waste form	Origin	Destination	Number of accidents	Number of fatalities	LFs from emissions[a]
Continued Current Operations Alternative					
RH-TRU	INTEC	WIPP	0.23	8.9×10^{-3}	6.8×10^{-4}
Full Separations Option					
LLW Class A Type Grout	INTEC	Envirocare	1.5	0.075	7.7×10^{-3}
Vitrified HLW	INTEC	NGR	0.60	0.027	4.3×10^{-3}
Total			2.1	0.087	0.012
Solidified MHLW fraction[b]	INTEC	Hanford	0.048	3.3×10^{-3}	8.2×10^{-5}
Planning Basis Option					
LLW Class A Type Grout	INTEC	Envirocare	1.6	0.084	8.6×10^{-3}
Vitrified HLW	INTEC	NGR	0.60	0.027	4.3×10^{-3}
RH-TRU	INTEC	WIPP	0.23	8.9×10^{-3}	6.8×10^{-4}
Total			2.5	0.12	0.014
Transuranic Separations Option					
RH-TRU	INTEC	WIPP	0.47	0.018	1.4×10^{-3}
LLW Class C Type Grout	INTEC	Barnwell	25	0.96	0.093
Total			25	0.98	0.094
Hot Isostatic Pressed Waste Option					
HIP HLW	INTEC	NGR	4.4	0.20	0.031
RH-TRU	INTEC	WIPP	0.23	8.9×10^{-3}	6.8×10^{-4}
Total			4.6	0.21	0.032
Direct Cement Waste Option					
Cementitious HLW	INTEC	NGR	14	0.63	0.099
RH-TRU	INTEC	WIPP	0.23	8.9×10^{-3}	6.8×10^{-4}
Total			14	0.64	0.10
Early Vitrification Option					
Vitrified HLW	INTEC	NGR	9.0	0.41	0.065
Vitrified RH-TRU	INTEC	WIPP	0.76	0.029	2.2×10^{-3}
Total			9.8	0.44	0.067
Minimum INEEL Processing Alternative					
Calcine and Cs resin	INTEC	Hanford	2.3	0.16	4.0×10^{-3}
CH-TRU	INTEC	WIPP	2.3	0.086	6.6×10^{-3}
Vitrified HLW	Hanford	INTEC	0.40	0.027	6.7×10^{-4}
Vitrified HLW	INTEC	NGR	0.48	0.022	3.4×10^{-3}
Vitrified LLW fraction	Hanford	INTEC	0.39	0.026	6.6×10^{-4}
Vitrified LLW fraction	INTEC	Envirocare	0.21	0.011	1.1×10^{-3}
Total			6.1	0.33	0.016

a. Calculated for travel through urban areas only.
b. Stand-alone project.

CH-TRU = contact-handled transuranic waste; Cs = cesium; HIP = Hot Isostatic Pressed; LLW = low-level waste; LF = latent fatality; MHLW = mixed high-level waste; NGR = National Geologic Repository; RH-TRU = remote-handled transuranic waste; WIPP = Waste Isolation Pilot Plant.

Table 5.2-13. Estimated fatalities from rail accidents (vehicle-related impacts).

Waste form	Origin	Destination	Number of accidents	Number of fatalities
Continued Current Operations Alternative				
RH-TRU	INTEC	WIPP	0.011	2.1×10^{-3}
Full Separations Option				
LLW Class A Type Grout	INTEC	Envirocare	0.074	2.1×10^{-3}
Vitrified HLW	INTEC	NGR	0.016	4.8×10^{-3}
Total			0.090	0.026
Solidified MHLW fraction[a]	INTEC	Hanford	6.5×10^{-3}	8.6×10^{-4}
Planning Basis Option				
LLW Class A Type Grout	INTEC	Envirocare	0.083	0.024
Vitrified HLW	INTEC	NGR	0.016	4.8×10^{-3}
RH-TRU	INTEC	WIPP	0.011	2.1×10^{-3}
Total			0.11	0.030
Transuranic Separations Option				
RH-TRU	INTEC	WIPP	0.022	4.3×10^{-3}
LLW Class C Type Grout	INTEC	Barnwell	0.67	0.13
Total			0.69	0.13
Hot Isostatic Pressed (HIP) Waste Option				
HIP HLW	INTEC	NGR	0.12	0.035
RH-TRU	INTEC	WIPP	0.011	2.1×10^{-3}
Total			0.13	0.038
Direct Cement Waste Option				
Cementitious HLW	INTEC	NGR	0.37	0.11
RH-TRU	INTEC	WIPP	0.011	2.1×10^{-3}
Total			0.38	0.11
Early Vitrification Option				
Vitrified HLW	INTEC	NGR	0.24	0.073
Vitrified RH-TRU	INTEC	WIPP	0.036	7.0×10^{-3}
Total			0.28	0.080
Minimum INEEL Processing Alternative				
Calcine and Cs resin	INTEC	Hanford	0.16	0.021
CH-TRU	INTEC	WIPP	0.11	0.021
Vitrified HLW	Hanford	INTEC	0.027	3.5×10^{-3}
Vitrified HLW	INTEC	NGR	0.016	4.8×10^{-3}
Vitrified LLW fraction	Hanford	INTEC	0.052	7.0×10^{-3}
Vitrified LLW fraction	INTEC	Envirocare	0.018	5.2×10^{-3}
Total			0.38	0.062

a. Stand-alone project.

CH-TRU = contact-handled transuranic waste; Cs = cesium; MHLW = mixed high-level waste; HIP = Hot Isostatic Pressed; LLW = low-level waste; NGR = National Geologic Repository;
RH-TRU = remote-handled transuranic waste; WIPP = Waste Isolation Pilot Plant.

Table 5.2-14. Estimated cargo-related incident-free transportation impacts – truck.

Waste form	Origin	Destination	Workers[a]		Public: Stops[b]		Public: Sharing route		Public: Along route		Public: Total public effects	
			Person-rem	LCF	Person-rem	LCF	Person-rem	LCF	Person-rem	LCF	Person-rem	LCF
Continued Current Operations Alternative												
RH-TRU	INTEC	WIPP	4.5	1.8×10^{-3}	24	0.012	1.1	5.7×10^{-4}	0.27	1.3×10^{-4}	25	0.013
Full Separations Alternative												
LLW Class A Type Grout	INTEC	Envirocare	34	0.013	16	8.1×10^{-3}	11	5.3×10^{-3}	2.9	1.5×10^{-3}	30	0.015
Vitrified HLW	INTEC	NGR	23	9.1×10^{-3}	110	0.057	7.6	3.8×10^{-3}	2.0	1.0×10^{-3}	120	0.062
Total			56	0.023	130	0.065	18	9.1×10^{-3}	5.0	2.5×10^{-3}	150	0.077
Solidified MHLW fraction[c]	INTEC	Hanford	11	4.4×10^{-3}	60	0.030	2.4	1.2×10^{-3}	0.62	3.1×10^{-4}	63	0.032
Planning Basis Option												
LLW Class A Type Grout	INTEC	Envirocare	37	0.015	18	9.0×10^{-3}	12	5.9×10^{-3}	3.3	1.6×10^{-3}	33	0.017
Vitrified HLW	INTEC	NGR	23	9.1×10^{-3}	110	0.057	7.6	3.8×10^{-3}	2.0	1.0×10^{-3}	120	0.062
RH-TRU	INTEC	WIPP	4.5	1.8×10^{-3}	24	0.012	1.1	5.7×10^{-4}	0.27	1.3×10^{-4}	25	0.013
Total			64	0.026	160	0.078	21	0.010	5.6	2.8×10^{-3}	180	0.091
Transuranic Separations Option												
RH-TRU	INTEC	WIPP	8.9	3.6×10^{-3}	48	0.024	2.3	1.1×10^{-3}	0.53	2.7×10^{-4}	50	0.025
LLW Class C Type Grout	INTEC	Barnwell	78	0.031	380	0.19	26	0.013	7.4	3.7×10^{-3}	410	0.21
Total			87	0.035	430	0.21	28	0.014	7.9	3.9×10^{-3}	460	0.23
Hot Isostatic Pressed Waste Option												
HIP HLW	INTEC	NGR	170	0.066	840	0.42	56	0.028	15	7.4×10^{-3}	910	0.45
RH-TRU	INTEC	WIPP	4.5	1.8×10^{-3}	24	0.012	1.1	5.7×10^{-4}	0.27	1.3×10^{-4}	25	0.013
Total			170	0.068	860	0.43	60	0.028	15	7.5×10^{-3}	930	0.47
Direct Cement Waste Option												
Cementitious HLW	INTEC	NGR	520	0.21	2.7×10^{3}	1.3	180	0.088	47	0.023	2.9×10^{3}	1.4
RH-TRU	INTEC	WIPP	4.5	1.8×10^{-3}	24	0.012	1.1	5.7×10^{-4}	0.27	1.3×10^{-4}	25	0.013
Total			530	0.21	2.7×10^{3}	1.3	180	0.088	47	0.023	2.9×10^{3}	1.5

Table 5.2-14. (continued).

Waste form	Origin	Destination	Workers[a] Person-rem	Workers[a] LCF	Public: Stops[b] Person-rem	Public: Stops[b] LCF	Public: Sharing route Person-rem	Public: Sharing route LCF	Public: Along route Person-rem	Public: Along route LCF	Public: Total effects Person-rem	Public: Total effects LCF
Early Vitrification Option												
Vitrified HLW	INTEC	NGR	340	0.14	1.7×10^{3}	0.87	120	0.057	31	0.015	1.9×10^{3}	0.94
Vitrified RH-TRU	INTEC	WIPP	15	5.8×10^{-3}	78	0.039	3.7	1.9×10^{-3}	0.87	4.4×10^{-3}	82	0.041
Total			360	0.14	1.8×10^{3}	0.90	120	0.059	31	0.016	2.0×10^{3}	0.98
Minimum INEEL Processing Alternative												
Calcine and Cs resin	INTEC	Hanford	120	0.049	670	0.34	26	0.013	7.0	3.5×10^{-3}	710	0.35
CH-TRU	INTEC	WIPP	28	0.011	91	0.046	4.4	2.2×10^{-3}	1.0	5.1×10^{-4}	96	0.048
Vitrified HLW	Hanford	INTEC	21	8.4×10^{-3}	110	0.057	4.5	2.2×10^{-3}	1.2	5.9×10^{-4}	120	0.060
Vitrified HLW	INTEC	NGR	27	0.011	140	0.068	9.0	4.5×10^{-3}	2.4	1.2×10^{-3}	150	0.074
Vitrified LLW fraction	Hanford	INTEC	5.2	2.1×10^{-3}	28	0.014	1.1	5.5×10^{-4}	0.29	1.5×10^{-4}	29	0.015
Vitrified LLW fraction	INTEC	Envirocare	2.6	1.1×10^{-3}	1.3	6.3×10^{-4}	0.83	4.1×10^{-4}	0.23	1.1×10^{-4}	2.3	1.2×10^{-3}
Total			210	0.083	1.1×10^{3}	0.52	46	0.023	12	6.0×10^{-3}	1.1×10^{3}	0.55

a. Occupational Exposure: Exposure to waste transportation crews (2 individuals at 10 meters).
b. Stops: Exposure to individuals while shipments are at rest stops (50 individuals at 20 meters).
c. Stand-alone project.

CH-TRU = contact-handled transuranic waste; Cs = cesium; MHLW = mixed high-level waste; HIP = Hot Isostatic Pressed; NGR = National Geologic Repository; RH-TRU = remote-handled transuranic waste; LLW = low-level waste; LCF = latent cancer fatality (public: 5.0×10^{-4} LCF/person-rem; worker: 4.0×10^{-4} LCF/person-rem); WIPP = Waste Isolation Pilot Plant.

Table 5.2-15. Estimated cargo-related incident-free transportation impacts – rail.

			Workers[a]		Public							
					Stops[b]		Sharing route		Along route		Total effects	
Waste form	Origin	Destination	Person-rem	LCF	Person-rem	LCF	Person-rem	LCF	Person-rem	LCF	Person-rem	LCF
Continued Current Operations Alternative												
RH-TRU	INTEC	WIPP	3.3	1.3×10^{-3}	0.023	1.1×10^{-5}	0.012	5.8×10^{-6}	0.15	7.4×10^{-5}	0.18	9.1×10^{-5}
Full Separations Option												
LLW Class A Type Grout	INTEC	Envirocare	31	0.012	8.8×10^{-3}	4.4×10^{-6}	0.051	2.5×10^{-5}	0.70	3.5×10^{-4}	0.76	3.8×10^{-4}
Vitrified HLW	INTEC	NGR	7.0	2.8×10^{-3}	0.028	1.4×10^{-5}	0.017	8.4×10^{-6}	0.19	9.4×10^{-5}	0.23	1.2×10^{-4}
Total			38	0.015	0.037	1.8×10^{-5}	0.067	3.4×10^{-5}	0.89	4.4×10^{-4}	0.99	5.0×10^{-4}
Solidified MHLW fraction[c]	INTEC	Hanford	4.0	1.6×10^{-3}	9.1×10^{-3}	4.5×10^{-6}	5.4×10^{-3}	2.7×10^{-6}	0.062	3.1×10^{-5}	0.076	3.8×10^{-5}
Planning Basis Option												
LLW Class A Type Grout	INTEC	Envirocare	35	0.014	9.8×10^{-3}	4.9×10^{-6}	0.056	2.8×10^{-5}	0.78	3.9×10^{-4}	0.84	4.2×10^{-4}
Vitrified HLW	INTEC	NGR	7.0	2.8×10^{-3}	0.028	1.4×10^{-5}	0.017	8.4×10^{-6}	0.19	9.4×10^{-5}	0.23	1.2×10^{-4}
RH-TRU	INTEC	WIPP	3.3	1.3×10^{-3}	0.023	1.1×10^{-5}	0.012	5.8×10^{-6}	0.15	7.4×10^{-5}	0.18	9.1×10^{-5}
Total			45	0.018	0.060	3.0×10^{-5}	0.085	4.2×10^{-5}	1.1	5.6×10^{-4}	1.3	6.3×10^{-4}
Transuranic Separations Option												
RH-TRU	INTEC	WIPP	6.6	2.6×10^{-3}	0.046	2.3×10^{-5}	0.023	1.2×10^{-5}	0.30	1.5×10^{-4}	0.36	1.8×10^{-4}
LLW Class C Type Grout	INTEC	Barnwell	130	0.053	1.8	9.2×10^{-4}	0.79	4.0×10^{-4}	12	6.1×10^{-3}	15	7.4×10^{-3}
Total			140	0.055	1.9	9.4×10^{-4}	0.82	4.1×10^{-4}	12	6.2×10^{-3}	15	7.6×10^{-3}
Hot Isostatic Pressed Waste Option												
HIP HLW	INTEC	NGR	51	0.020	0.20	1.0×10^{-4}	0.12	6.1×10^{-5}	1.4	6.8×10^{-4}	1.7	8.5×10^{-4}
RH-TRU	INTEC	WIPP	3.3	1.3×10^{-3}	0.023	1.1×10^{-5}	0.012	5.8×10^{-6}	0.15	7.4×10^{-5}	0.18	9.1×10^{-5}
Total			54	0.022	0.23	1.1×10^{-4}	0.13	6.7×10^{-5}	1.5	7.6×10^{-4}	1.9	9.4×10^{-4}
Direct Cement Waste Option												
Cementitious HLW	INTEC	NGR	160	0.065	0.64	3.2×10^{-4}	0.39	1.9×10^{-4}	4.3	2.2×10^{-3}	5.4	2.7×10^{-3}
RH-TRU	INTEC	WIPP	3.3	1.3×10^{-3}	0.023	1.1×10^{-5}	0.012	5.8×10^{-6}	0.15	7.4×10^{-5}	0.18	9.1×10^{-5}
Total			160	0.066	0.67	3.3×10^{-4}	0.40	2.0×10^{-4}	4.5	2.2×10^{-3}	5.6	2.8×10^{-3}

Table 5.2-15. (continued).

					Public							
			Workers[a]		Stops[b]		Sharing route		Along route		Total effects	
Waste form	Origin	Destination	Person-rem	LCF	Person-rem	LCF	Person-rem	LCF	Person-rem	LCF	Person-rem	LCF
Early Vitrification Option												
Vitrified HLW	INTEC	NGR	110	0.042	0.42	2.1×10^{-4}	0.25	1.3×10^{-4}	2.8	1.4×10^{-3}	3.5	1.8×10^{-3}
Vitrified RH-TRU	INTEC	WIPP	11	4.3×10^{-3}	0.074	3.7×10^{-5}	0.038	1.9×10^{-5}	0.48	2.4×10^{-4}	0.59	3.0×10^{-4}
Total			120	0.047	0.50	2.5×10^{-4}	0.29	1.5×10^{-4}	3.3	1.7×10^{-3}	4.1	2.1×10^{-3}
Minimum INEEL Processing Alternative												
Calcine and Cs resin	INTEC	Hanford	49	0.020	0.24	1.2×10^{-4}	0.14	7.2×10^{-5}	1.6	8.1×10^{-4}	2.0	1.0×10^{-3}
CH-TRU	INTEC	WIPP	8.3	3.3×10^{-3}	0.044	2.2×10^{-5}	0.020	1.0×10^{-5}	0.28	1.4×10^{-4}	0.35	1.7×10^{-4}
Vitrified HLW	Hanford	INTEC	8.3	3.3×10^{-3}	0.041	2.0×10^{-5}	0.024	1.2×10^{-5}	0.28	1.4×10^{-4}	0.34	1.7×10^{-4}
Vitrified HLW	INTEC	NGR	8.2	3.3×10^{-3}	0.041	2.1×10^{-5}	0.025	1.2×10^{-5}	0.28	1.4×10^{-4}	0.34	1.7×10^{-4}
Vitrified LLW fraction	Hanford	INTEC	9.3	3.7×10^{-3}	0.024	1.2×10^{-5}	0.015	7.3×10^{-6}	0.17	8.3×10^{-5}	0.21	1.0×10^{-4}
Vitrified LLW fraction	INTEC	Envirocare	8.0	3.2×10^{-3}	1.9×10^{-3}	9.4×10^{-7}	0.011	5.4×10^{-6}	0.15	7.5×10^{-5}	0.16	8.1×10^{-5}
Total			91	0.037	0.39	2.0×10^{-4}	0.24	1.2×10^{-4}	2.8	1.4×10^{-3}	3.4	1.7×10^{-3}

a. Occupational Exposure: Exposure to waste transportation crews (5 individuals at 152 meters).
b. Stops: Exposure to individuals while shipments are at rest stops (100 individuals at 20 meters).
c. Stand-alone project.
CH-TRU = contact-handled transuranic waste; Cs = cesium; HLW = high-level waste; HIP = Hot Isostatic Pressed; MHLW = mixed high-level waste; NGR = National Geologic Repository; RH-TRU = remote-handled transuranic waste; LLW = low-level waste; LCF = latent cancer fatality (public: 5.0×10^{-4} LCF/person-rem; worker: 4.0×10^{-4} LCF/person-rem); WIPP = Waste Isolation Pilot Plant.

Table 5.2-16. Cargo-related impacts from truck transportation accidents.

Waste form	Origin	Destination	Population Risk[a] Dose (person-rem)	Population Risk[a] Latent cancer fatalities	Maximum Individual Dose (rem)[b]
Continued Current Operations Alternative					
RH-TRU	INTEC	WIPP	0.099	5.0×10^{-5}	6.1×10^{-5}
Full Separations Option					
LLW Class A Type Grout	INTEC	Envirocare	0.18	8.8×10^{-5}	2.4×10^{-5}
Vitrified HLW	INTEC	NGR	$\underline{3.0\times10^{-3}}$	$\underline{1.5\times10^{-6}}$	$\underline{7.4\times10^{-5}}$
Total			0.18	8.9×10^{-5}	7.4×10^{-5}
Solidified MHLW fraction[c]	INTEC	Hanford	3.9	2.0×10^{-3}	0.18
Planning Basis Option					
LLW Class A Type Grout	INTEC	Envirocare	0.19	9.7×10^{-5}	2.4×10^{-5}
Vitrified HLW	INTEC	NGR	3.0×10^{-3}	1.5×10^{-6}	7.4×10^{-5}
RH-TRU	INTEC	WIPP	<u>0.099</u>	$\underline{5.0\times10^{-5}}$	$\underline{6.1\times10^{-5}}$
Total			0.30	1.5×10^{-4}	7.4×10^{-5}
Transuranic Separations Option					
RH-TRU	INTEC	WIPP	0.20	9.9×10^{-5}	6.1×10^{-5}
LLW Class C Type Grout	INTEC	Barnwell	<u>190</u>	<u>0.093</u>	$\underline{2.3\times10^{-3}}$
Total			190	0.093	2.3×10^{-3}
Hot Isostatic Pressed Waste Option					
HIP HLW	INTEC	NGR	3.0×10^{-3}	1.5×10^{-6}	1.6×10^{-5}
RH-TRU	INTEC	WIPP	<u>0.099</u>	$\underline{5.0\times10^{-5}}$	$\underline{6.1\times10^{-5}}$
Total			0.10	5.1×10^{-5}	6.1×10^{-5}
Direct Cement Waste Option					
Cementitious HLW	INTEC	NGR	46	0.023	8.8×10^{-3}
RH-TRU	INTEC	WIPP	<u>0.099</u>	$\underline{5.0\times10^{-5}}$	$\underline{6.1\times10^{-5}}$
Total			46	0.023	8.8×10^{-3}
Early Vitrification Option					
Vitrified HLW	INTEC	NGR	2.9×10^{-3}	1.5×10^{-6}	5.8×10^{-5}
Vitrified RH-TRU	INTEC	WIPP	$\underline{6.5\times10^{-5}}$	$\underline{3.2\times10^{-8}}$	$\underline{8.3\times10^{-6}}$
Total			3.0×10^{-3}	1.5×10^{-6}	5.8×10^{-5}
Minimum INEEL Processing Alternative					
Calcine and Cs resin	INTEC	Hanford	36	0.018	0.095
CH-TRU	INTEC	WIPP	0.81	4.1×10^{-4}	7.7×10^{-6}
Vitrified HLW	Hanford	INTEC	1.1×10^{-3}	5.6×10^{-7}	7.4×10^{-5}
Vitrified HLW	INTEC	NGR	2.7×10^{-3}	1.4×10^{-6}	7.4×10^{-5}
Vitrified LLW fraction	Hanford	INTEC	4.4×10^{-5}	2.2×10^{-8}	1.1×10^{-5}
Vitrified LLW fraction	INTEC	Envirocare	$\underline{4.3\times10^{-5}}$	$\underline{2.2\times10^{-8}}$	$\underline{1.1\times10^{-5}}$
Total			37	0.018	0.095

a. Each population risk value is the sum of the consequence (population dose or latent cancer fatalities) times the probability for a range of possible accidents.
b. The maximum individual dose total is the highest value in the group of results.
c. Stand-alone project.
CH-TRU = contact handled transuranic waste; Cs = cesium; HIP = Hot Isostatic Pressed; LLW = low-level waste; MHLW = mixed high-level waste; RH-TRU = remote handled transuranic waste; WIPP = Waste Isolation Pilot Plant.

Table 5.2-17. Cargo-related impacts from rail transportation accidents.

Waste form	Origin	Destination	Population Risk[a]: Dose (person-rem)	Population Risk[a]: Latent cancer fatalities	Maximum Individual Dose (rem)[b]
Continued Current Operations Alternative					
RH-TRU	INTEC	WIPP	4.3×10^{-3}	2.1×10^{-6}	1.2×10^{-4}
Full Separations Option					
LLW Class A Type Grout	INTEC	Envirocare	0.035	1.8×10^{-5}	4.6×10^{-5}
Vitrified HLW	INTEC	NGR	$\underline{1.5\times10^{-4}}$	$\underline{7.5\times10^{-8}}$	$\underline{1.4\times10^{-4}}$
Total			0.035	1.8×10^{-5}	1.4×10^{-4}
Solidified MHLW fraction[c]	INTEC	Hanford	0.79	4.0×10^{-4}	0.36
Planning Basis Option					
LLW Class A Type Grout	INTEC	Envirocare	0.039	2.0×10^{-5}	4.6×10^{-5}
Vitrified HLW	INTEC	NGR	1.5×10^{-4}	7.5×10^{-8}	1.4×10^{-4}
RH-TRU	INTEC	WIPP	$\underline{4.3\times10^{-3}}$	$\underline{2.1\times10^{-6}}$	$\underline{1.2\times10^{-4}}$
Total			0.044	2.2×10^{-5}	1.4×10^{-4}
Transuranic Separations Option					
RH-TRU	INTEC	WIPP	8.5×10^{-3}	4.3×10^{-6}	1.2×10^{-4}
LLW Class C Type Grout	INTEC	Barnwell	<u>74</u>	<u>0.037</u>	$\underline{6.7\times10^{-3}}$
Total			74	0.037	6.7×10^{-3}
Hot Isostatic Pressed Waste Option					
HIP HLW	INTEC	NGR	1.6×10^{-4}	7.8×10^{-8}	2.4×10^{-5}
RH-TRU	INTEC	WIPP	$\underline{4.3\times10^{-3}}$	$\underline{2.1\times10^{-6}}$	$\underline{1.2\times10^{-4}}$
Total			4.4×10^{-3}	2.2×10^{-6}	1.2×10^{-4}
Direct Cement Waste Option					
Cementitious HLW	INTEC	NGR	2.5	1.3×10^{-3}	0.018
RH-TRU	INTEC	WIPP	$\underline{4.3\times10^{-3}}$	$\underline{2.1\times10^{-6}}$	$\underline{1.2\times10^{-4}}$
Total			2.5	1.3×10^{-3}	0.018
Early Vitrification Option					
Vitrified HLW	INTEC	NGR	1.5×10^{-4}	7.6×10^{-8}	1.2×10^{-4}
Vitrified RH-TRU	INTEC	WIPP	$\underline{4.3\times10^{-6}}$	$\underline{2.2\times10^{-9}}$	$\underline{9.1\times10^{-6}}$
Total			1.6×10^{-4}	7.8×10^{-8}	1.2×10^{-4}
Minimum INEEL Processing Alternative					
Calcine and Cs resin	INTEC	Hanford	5.7	2.8×10^{-3}	0.18
CH-TRU	INTEC	WIPP	5.1×10^{-4}	2.6×10^{-7}	8.2×10^{-6}
Vitrified HLW	Hanford	INTEC	2.0×10^{-4}	1.0×10^{-7}	1.4×10^{-4}
Vitrified HLW	INTEC	NGR	1.4×10^{-4}	7.0×10^{-8}	1.4×10^{-4}
Vitrified LLW fraction	Hanford	INTEC	8.1×10^{-6}	4.0×10^{-9}	1.2×10^{-5}
Vitrified LLW fraction	INTEC	Envirocare	$\underline{6.7\times10^{-6}}$	$\underline{3.3\times10^{-9}}$	$\underline{1.2\times10^{-5}}$
Total			5.7	2.8×10^{-3}	0.18

a. Each population risk value is the sum of the consequence (population dose or latent cancer fatalities) times the probability for a range of possible accidents.
b. The maximum individual dose total is the highest value in the group of results.
c. Stand-alone project.
CH-TRU = contact handled transuranic waste; Cs = cesium; HIP = Hot Isostatic Pressed; LLW = low-level waste; MHLW = mixed high-level waste; RH-TRU = remote handled transuranic waste; WIPP = Waste Isolation Pilot Plant.

Transportation Accident Radiological Consequences - The results of the RISKIND consequence analyses are included in the last column of Tables 5.2-16 and 5.2-17 for moderate severity truck and rail accidents, respectively, under neutral atmospheric stability conditions. Consequence results for extreme severity truck and rail accidents may be found in Appendix C.5 along with the results under stable atmospheric stability conditions.

Under moderate truck accident severity conditions, the maximum individual effective dose ranges from 7.7×10^{-6} rem (contact-handled transuranic waste) to 0.2 rem (solidified mixed HLW fraction). For moderate severity rail accidents, the effective dose ranges from 8.2×10^{-6} rem (contact-handled transuranic waste) to 0.4 rem (solidified mixed HLW fraction).

5.2.9.4 Traffic Noise

As noted in Section 4.10, noise generated by INEEL operations is not propagated at detectable levels offsite, because all major facility areas are at least 3 miles away from the site boundary. INEEL-related noise that affects the public is dominated by transportation noise sources, such as buses, private vehicles, delivery trucks, construction trucks, aircraft, and freight trains.

The SNF & INEL EIS (DOE 1995) noted that (barring mission changes) baseline INEEL employment was expected to decline over the 1995 to 2005 period. Direct construction phase and operations phase employment resulting from implementation of the various waste processing alternatives (Section 5.2.2) is expected to offset these job losses to some extent but is not expected to result in significant numbers of new jobs. Therefore, the overall noise level resulting from site transportation during construction and operations for all waste processing alternatives is expected to be lower than the baseline. The number of trucks carrying waste and spent nuclear fuel under any alternative is expected to be, at most, a few per day (see Appendix C.5, Traffic and Transportation). Noise from these trucks would represent a small addition to the existing noise from several hundred buses (about 300 routes) that travel to and from the INEEL each day. In summary, no environmental impact due to noise traffic is expected from any of the waste processing alternatives being considered.

5.2.10 HEALTH AND SAFETY

This section presents potential health and safety impacts to INEEL workers and the offsite public from implementing the waste processing alternatives described in Chapter 3. The estimates of health impacts are based on projected radioactive and nonradioactive releases to the environment and radiation exposure to facility workers. As discussed in Section 5.2.7, releases to surface water would be minimal and would not be expected to result in adverse health impacts. This section also summarizes worker illness, injury, and fatality incidence rates based on historical INEEL occupational safety data.

Because one of the alternatives (Minimum INEEL Processing) would involve shipment of mixed HLW to the Hanford Site for processing, this section briefly describes potential health and safety impacts to workers and the offsite public from treating INEEL waste at the Hanford Site. A more detailed discussion of health and safety impacts from treating INEEL waste at the Hanford Site is presented in Appendix C.8.

5.2.10.1 Methodology

DOE used data on airborne emissions of radioactive materials (Section 5.2.6) to calculate radiation dose to the noninvolved worker and maximally exposed offsite individual and the collective dose to the population residing within 50 miles of INTEC. The radiation dose values for the various alternatives were then multiplied by the dose-to-risk conversion factors, which are based on the 1993 *Limitations of Exposure to Ionizing Radiation* (NCRP 1993). DOE has adopted these risk factors of 0.0005 and 0.0004 latent cancer fatality (LCF) for each person-rem of radiation exposure to the general public and worker population, respectively, for doses less than 20 rem. The factor for the population is slightly higher due to the presence of infants and children who are more sensitive to radiation than the adult worker population.

DOE used radiation dose information provided in the project data sheets (see Appendix C.6) for projects comprising each option to estimate the potential health effects to involved workers (i.e., workers performing construction and operations under each alternative) from construction and operations activities. Radiation dose was calculated as annual average and total campaign dose summed for the projects to estimate health effects by option.

For nonradiological health impacts from atmospheric releases, DOE used toxic air pollutant emissions data for each project under an alternative to estimate air concentrations at the INEEL site boundary. For the evaluation of occupational health effects, the modeled chemical concentration was compared with the applicable occupational standard which provides levels at which no adverse effects are expected, yielding a hazard quotient. The hazard quotient is a ratio between the calculated concentration in air and the applicable standard. For noncarcinogenic toxic air pollutants, if the hazard quotient is less than 1, then no adverse health effects would be expected. If the hazard quotient is greater than 1, additional investigation would be warranted. For carcinogenic toxic air pollutants, risks are estimated as the incremental probability of an individual developing cancer over a lifetime as a result of exposure to the potential carcinogen.

5.2.10.2 Radiological and Nonradiological Construction Impacts

Under all alternatives there would be some amount of radiation exposure to construction workers. Construction workers involved in upgrade and expansion of HLW facilities would be exposed to low levels of radioactive contamination. For more information on specific projects for each alternative, see Appendix C.6.

Table 5.2-18 provides summaries of the number of involved workers, annual average collective dose, total collective dose, and estimated increase in number of LCFs for the total construction phase for each alternative. Most of the waste processing alternatives result in similar levels of total collective worker dose ranging from 72 to 120 person-rem. The highest collective dose of 120 person-rem occurs under Full Separations Option, Planning Basis Option, Transuranic Separations Options, and Minimum INEEL Processing Alternative. The corresponding increase in number of latent cancer fatalities for any of these options would be 0.05.

Nonradiological emissions associated with construction activities would result primarily from the disturbance of land, which generates fugitive dust, and from the combustion of fossil fuels in construction equipment. As stated in Section 5.2.6, dust generation would be mitigated by the application of water, use of soil additives, and possibly administrative controls. Emissions of criteria pollutants from construction equipment may also cause localized impacts to air quality. Construction-related impacts to workers from criteria pollutant emissions are expected to fall within applicable standards (see Section 5.2.6).

5.2.10.3 Radiological and Nonradiological Operational Impacts

Radiological Air Emissions - As stated in Section 5.2.6, Air Resources, waste processing and related activities at INTEC would result in releases of radionuclides to the atmosphere. No future discharge of radioactive liquid effluents that would result in offsite radiation doses would occur under any of the alternatives (see Section 5.2.7). Therefore, DOE only calculated potential health effects from airborne releases of radioactivity.

Table 5.2-19 provides summaries of radiation doses and health impacts from atmospheric emissions from the waste processing options. Health effects are presented for (a) the maximally exposed individual at an offsite location; (b) noninvolved onsite workers at the INEEL areas of highest predicted radioactivity level; and (c) the offsite population (adjusted for future growth) within a 50-mile radius of the INTEC. The annual doses represent the maximum value predicted over any one year the waste processing occurs. Doses over periods which involve only interim storage of waste would be much less. The annual average project doses were multiplied by the project duration and summed for all projects within a given option to determine the integrated dose and resultant health effects for each option. Modeling indicated that the dose due to ground contamination did not contribute significantly to the total dose for the primary nuclides and pathways of concern.

In all cases for air emissions, the dose to the maximally exposed offsite individual is a small fraction of that received from natural background sources and is well below the EPA airborne emissions dose limit of 10 millirem per year (40 CFR 61.92). The highest annual dose of 0.0018 millirem to the maximally-exposed offsite individual would occur from the Planning Basis and Hot Isostatic Pressed Waste Options. This estimated annual maximally exposed offsite individual dose is slightly higher than the estimated doses for the Continued Current

Table 5.2-18. Estimated radiological impacts to involved workers by alternative during construction activities.

			Separations Alternative			Non-Separations Alternative			Minimum INEEL Processing Alternative	
Receptor	No Action Alternative	Continued Current Operations Alternative	Full Separations Option	Planning Basis Option	Transuranic Separations Option	Hot Isostatic Pressed Waste Option	Direct Cement Option	Early Vitrification Option	At INEEL	At Hanford[a]
Annual average number of involved workers	21	21	96	96	96	90	90	90	96	NA[b]
Annual average collective dose (person-rem)[c]	15	15	24	24	24	23	23	23	24	NA[b]
Total construction phase worker dose (person-rem)[d]	72	72	120	120	120	110	110	110	120	NA[b]
Total increase in number of latent cancer fatalities	0.03	0.03	0.05	0.05	0.05	0.05	0.05	0.05	0.05	NA[b]

a. Construction activities associated with this alternative would consist of building three canister storage buildings and a calcine dissolution facility. As shown in Appendix C.8, Sections C.8.5.1 and C.8.5.2, there would be no radiological dose associated with construction of these facilities.
b. NA = Not applicable
c. Doses are average values over any single year during which construction occurs.
d. Total construction phase dose is based on the average annual dose for each project that comprises each alternative multiplied by the duration for each project and then summed for each alternative.

Table 5.2-19. Estimated public and occupational radiological impacts from atmospheric emissions.

Receptor	No Action Alternative	Continued Current Operations Alternative	Separations Alternative: Full Separations Option	Separations Alternative: Planning Basis Option	Separations Alternative: Transuranic Separations Option	Non-Separations Alternative: Hot Isostatic Pressed Waste Option	Non-Separations Alternative: Direct Cement Waste Option	Non-Separations Alternative: Early Vitrification Option	Minimum INEEL Processing Alternative: At INEEL	Minimum INEEL Processing Alternative: At Hanford[a]
Maximally exposed offsite individual dose (millirem/year)[b]	6.0×10^{-4}	1.7×10^{-3}	1.2×10^{-4}	1.8×10^{-3}	6.0×10^{-5}	1.8×10^{-3}	1.7×10^{-3}	8.9×10^{-4}	9.5×10^{-4}	2.8×10^{-5}
Integrated maximally exposed offsite individual dose (millirem)[c]	0.022	0.019	2.5×10^{-3}	6.3×10^{-3}	1.3×10^{-3}	0.021	0.019	0.031	0.024	5.0×10^{-5}
Estimated probability of latent cancer fatality for the maximally exposed offsite individual	1.0×10^{-8}	1.0×10^{-8}	1.2×10^{-9}	3.2×10^{-9}	6.5×10^{-10}	1.0×10^{-8}	1.0×10^{-8}	1.5×10^{-8}	1.0×10^{-8}	2.5×10^{-11}
Noninvolved worker dose (millirem/year)[d]	7.0×10^{-6}	1.8×10^{-5}	4.4×10^{-5}	9.0×10^{-5}	3.4×10^{-5}	3.6×10^{-5}	3.0×10^{-5}	4.8×10^{-5}	1.0×10^{-4}	1.3×10^{-5}
Integrated noninvolved worker dose (millirem)[c]	2.5×10^{-4}	2.0×10^{-4}	9.2×10^{-4}	8.6×10^{-4}	7.1×10^{-4}	5.8×10^{-4}	3.6×10^{-4}	1.3×10^{-3}	1.4×10^{-3}	2.3×10^{-5}
Estimated probability of latent cancer fatality for the noninvolved worker	1.0×10^{-10}	3.6×10^{-8}	2.2×10^{-9}	4.0×10^{-8}	1.2×10^{-9}	4.0×10^{-8}	4.0×10^{-8}	2.0×10^{-8}	2.0×10^{-8}	5.2×10^{-10}
Dose to population within 50 miles of INTEC (person-rem per year)[e]	0.032	0.094	5.6×10^{-3}	0.095	3.1×10^{-3}	0.097	0.095	0.048	0.048	1.3×10^{-3}[f]
Integrated collective dose to population (person-rem)[c]	1.2	1.1	0.12	0.33	0.06	1.1	1.1	1.7	1.2	2.3×10^{-3}

Table 5.2-19. Estimated public and occupational radiological impacts from atmospheric emissions (continued).

Receptor	No Action Alternative	Continued Current Operations Alternative	Separations Alternative: Full Separations Option	Separations Alternative: Planning Basis Option	Separations Alternative: Transuranic Separations Option	Non-Separations Alternative: Hot Isostatic Pressed Waste Option	Non-Separations Alternative: Direct Cement Waste Option	Non-Separations Alternative: Early Vitrification Option	Minimum INEEL Processing Alternative: At INEEL	Minimum INEEL Processing Alternative: At Hanford[a]
Estimated number of latent cancer fatalities to population	6.0×10^{-4}	5.5×10^{-4}	6.0×10^{-5}	1.7×10^{-4}	3.2×10^{-5}	5.5×10^{-4}	5.5×10^{-4}	8.5×10^{-4}	6.0×10^{-4}	1.1×10^{-6}

a. Data based on analysis of the Interim Storage Shipping Scenario which has higher impacts than the Just-in-Time Shipping Scenario. See Appendix C.8.
b. Doses are maximum values over any single year during which waste processing occurs; annual doses from waste stored on an interim basis after waste processing is completed would be much less.
c. The annual average project doses were multiplied by the project duration and summed for all projects within a given option to determine the integrated dose and resultant health effects for each option.
d. Location of highest onsite dose is Central Facilities Area.
e. Population dose assumes growth rate of 6 percent per decade between 1990 and 2035.
f. Dose to population within 50 miles of Hanford Site (person-rem per year).

Operations Alternative, Direct Cement Waste Option, and Minimum INEEL Processing Alternative. The highest integrated offsite maximally exposed individual dose of 0.03 millirem occurs under the Early Vitrification Option. The noninvolved worker doses from facility emissions would also be a small fraction of the allowable limit. The Federal occupational dose limit is 5,000 millirem per year, as established in 10 CFR 835.202. The highest predicted onsite worker annual dose of 1.0×10^{-4} millirem and integrated dose of 1.4×10^{-3} millirem would occur from the Minimum INEEL Processing Alternative. No applicable standards exist for collective population doses; however, DOE policy requires that doses resulting from radioactivity in effluents be reduced to levels as low as reasonably achievable. The highest annual collective dose to the population within 50 miles of INTEC of 0.097 person-rem would occur for the Hot Isostatic Pressed Waste Option. The highest total collective population dose of 1.7 person-rem would occur from the Early Vitrification Option and corresponds to less than 8.5×10^{-4} LCF for the entire operations period. The total integrated collective population doses associated with the other options are lower and range from 0.002 to 1.2 person-rem.

Involved Worker Impacts - Table 5.2-20 provides a summary of radiological impacts to involved workers from facility operations. This table provides the number of involved workers, annual average collective dose, total campaign collective worker dose and estimated increased lifetime number of LCFs for each alternative. The highest annual collective worker dose would occur from the Planning Basis Option. The highest collective worker dose, integrated over the entire campaign would occur from the Direct Cement Waste Option. The total collective worker dose is projected to be 1,600 person-rem, which corresponds to 0.64 LCF.

Table 5.2-21 presents annual radiological impacts for interim storage after the year 2035. Impacts are presented in terms of annual average worker dose for radiological workers and the resultant increase in LCFs. There are no toxic air pollutants or criteria pollutant emissions expected with interim storage activities after the year 2035. The Transuranic Separations Option is not listed in this table because there would be no interim storage of final waste forms produced under this option.

Nonradiological Air Emissions - Table 5.2-22 presents hazard quotients for concentrations of noncarcinogenic toxic air pollutants at the INEEL site boundary for the option with the maximum value. The locations of these modeled concentrations are dependent on different points and times of release, so 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 noncarcinogens, the maximum concentrations for each of the pollutants occur most frequently from the Planning Basis Option. However, all hazard quotients are much less than 1, indicating no expected adverse health effects.

Table 5.2-23 presents hazard quotients for concentrations of carcinogenic toxic air pollutants at the INEEL site boundary by option. As with noncarcinogens, the locations of these modeled maximum concentrations are dependent on different points and times of release so the risks are not summed. The results of this evaluation indicate that the hazard quotients for each chemical range from 7.6×10^{-7} for hydrazine to 0.14 for nickel. As stated in Section 5.2.6, the highest carcinogenic air pollutant impacts are projected for those options that involve the greatest amount of fossil fuel combustion, most notably the Planning Basis Option. For the Planning Basis Option, nickel concentrations could be as high as 14 percent of the State of Idaho standard at the INEEL boundary. Projected carcinogenic concentrations are based on the conservative assumption that all toxic pollutant sources are operating concurrently, and no credit is taken for reductions by air pollution control equipment. All other carcinogens are expected to be at very low ambient levels with negligible health impacts. As stated in Section 5.2.6, concentrations of all carcinogenic and noncarcinogenic substances at INEEL facility areas are less than 1 percent of occupational exposure limits in all cases. Ambient concentrations of carcinogenic and noncarcinogenic toxic pollutants at other public access locations, such as public roads and Craters of the Moon Wilderness Area are presented in Appendix C.2.5.2.

Table 5.2-20. Estimated radiological impacts to involved workers by alternative during facility operations.

Receptor	No Action Alternative	Continued Current Operations Alternative	Separations Alternative: Full Separations Option[a]	Separations Alternative: Planning Basis Option	Separations Alternative: Transuranic Separations Option[b]	Non-Separations Alternative: Hot Isostatic Pressed Waste Option	Non-Separations Alternative: Direct Cement Waste Option	Non-Separations Alternative: Early Vitrification Option	Minimum INEEL Processing Alternative: At INEEL	Minimum INEEL Processing Alternative: At Hanford[c]
Annual average number of involved workers	120	260	220	410	190	330	400	180	240	94
Annual average collective dose (person-rem)[d]	23	49	41	80	35	62	76	34	46	NA[e]
Total campaign collective worker dose (person-rem)[f]	490	760	1.1×10^3	1.5×10^3	980	1.3×10^3	1.6×10^3	870	1.1×10^3	350
Total number of latent cancer fatalities	0.19	0.30	0.44	0.61	0.39	0.51	0.64	0.35	0.42	0.14

a. Assumes LLW Class A type grout disposal in INEEL disposal facility (P35D and P27).
b. Assumes LLW Class C type grout disposal in INEEL disposal facility (P49D and P27).
c. Data based on analysis of the Interim Storage Shipping scenario which has higher impacts than the Just-in-Time Shipping Scenario. See Appendix C.10.4.11. Annual average number of workers based on table C.10-9 employment levels.
d. Doses are average values over any single year during which waste processing occurs.
e. NA = Not assessed.
f. Total campaign dose is based on the average annual dose for each project that comprises each alternative multiplied by the duration for each project and then summed for each alternative.

Table 5.2-21. Estimated radiological impacts to involved workers from interim storage operations post-2035.

Alternatives[a]	Radiological workers/year	Annual average worker dose (rem)	Annual average collective dose (person-rem)	Estimated annual latent cancer fatalities
No Action Alternative (P1D)	15	0.19	2.85	1.1×10^{-3}
Continued Current Operations Alternative (P4)	0	NA[b]	NA	NA
Full Separations Option (P24)	5	0.19	0.95	3.8×10^{-4}
Planning Basis Option (P24)	5	0.19	0.95	3.8×10^{-4}
Hot Isostatic Pressed Waste Option (P72)	2.5	0.19	0.48	1.9×10^{-4}
Direct Cement Waste Option (P81)	4.5	0.19	0.86	3.4×10^{-4}
Early Vitrification Option (P61)	4.5	0.19	0.86	3.4×10^{-4}
Minimum INEEL Processing Alternative (P24)	5	0.19	0.95	3.8×10^{-4}

a. Project Titles: P1D - No Action; P4- Long-Term Storage of Calcine in Bin Sets; P24 - Vitrified Product Interim Storage; P72 - Interim Storage of Hot Isostatic Pressed Waste; P81 - Unseparated Cementitious HLW Interim Storage; P61 - Vitrified Product Interim Storage; P24 - Interim Storage of Vitrified Waste at INEEL.
b. NA = not applicable.

Table 5.2-22. Projected noncarcinogenic toxic pollutant maximum concentrations at the site boundary for the proposed waste processing alternatives.[a,b]

Pollutant[c]	Maximum concentration option	Concentration ($\mu g/m^3$)[d]	Idaho standard ($\mu g/m^3$)	Hazard quotient
Antimony	Planning Basis Option	6.9×10^{-4}	25	2.8×10^{-5}
Chloride	Planning Basis Option	0.05	150	3.3×10^{-4}
Cobalt	Planning Basis Option	7.9×10^{-4}	2.5	3.2×10^{-4}
Copper	Planning Basis Option	2.3×10^{-4}	10	2.3×10^{-5}
Fluorides (as F)	Early Vitrification Option	7.7×10^{-3}	125	6.2×10^{-5}
Lead	Planning Basis Option	2.0×10^{-4}	1.5	1.3×10^{-4}
Manganese (as Mn)	Planning Basis Option	3.9×10^{-4}	50	7.8×10^{-6}
Mercury	Full Separations/Planning Basis Option	1.6×10^{-5}	5	3.2×10^{-6}
Phosphorus	Planning Basis Option	1.2×10^{-3}	5	2.4×10^{-4}
Vanadium	Planning Basis Option	4.0×10^{-3}	2.5	1.6×10^{-3}

a. Emissions include chemical processing and fossil fuel combustion.
b. Only site boundary conditions are listed, conditions at public access on site roads can be found in Appendix C.2.
c. Pollutants listed are those that account for more than 95 percent of health risk. See Appendix C.2 for details.
d. $\mu g/m^3$ = micrograms per cubic meter.

Table 5.2-23. Projected carcinogenic toxic pollutant maximum concentrations at the site boundary for the proposed waste processing alternatives.[a,b]

Pollutant[c]	Maximum concentration option	Concentration ($\mu g/m^3$)[d]	Idaho standard ($\mu g/m^3$)	Hazard quotient
Arsenic	Planning Basis Option	9.3×10^{-6}	2.3×10^{-4}	0.04
Beryllium	Planning Basis Option	2.0×10^{-7}	4.2×10^{-3}	4.8×10^{-5}
Cadmium compounds	Planning Basis Option	2.8×10^{-6}	5.6×10^{-4}	5.0×10^{-3}
Chromium (hexavalent forms)	Planning Basis Option	1.7×10^{-6}	8.3×10^{-5}	0.02
Dioxins and furans[d]	Hot Isostatic Pressed Waste Option	1.8×10^{-13}	2.2×10^{-8}	8.2×10^{-6}
Formaldehyde	Planning Basis Option	2.3×10^{-4}	0.08	2.9×10^{-3}
Hydrazine	Planning Basis Option/Hot Isostatic Pressed Waste Option	2.6×10^{-10}	3.4×10^{-4}	7.6×10^{-7}
Nickel	Planning Basis Option	5.9×10^{-4}	4.2×10^{-3}	0.14

a. Emissions include chemical processing and fossil fuel combustion.
b. Only site boundary conditions are listed. Conditions at public access on site roads can be found in Appendix C.2.
c. Pollutants listed are those that account for more than 95 percent of health risk. See Appendix C.2 for details.
d. $\mu g/m^3$ = micrograms per cubic meter.

For each alternative, maximum incremental impacts of carcinogenic air pollutants are projected to occur at or just beyond the southern site boundary, while maximum non-carcinogenic air pollutant levels would occur along U.S. Highway 20.

5.2.10.4 Occupational Safety Impacts

Estimated occupational injury rates for waste processing alternatives are presented in Tables 5.2-24 and 5.2-25. The projected rates for injury are based on observed historic rates at INEEL. Table 5.2-25 provides estimates of the number of lost work days and total recordable cases that would occur during a peak employment year and for the entire period during construction for each of the alternatives. The projected injury rates are based on INEEL historic injury rates for construction workers over a 5-year period from 1993 through 1997 multiplied by the employment levels for each alternative. Table 5.2-25 provides similar data for the operations phase for each of the alternatives. The projected injury rates are based on the INEEL historic injury rates for operations from a 15-year period from 1983 through 1997 (Millet 1998). The data for lost work days represents the number of workdays, beyond the day of injury or onset of illness, the employee was away from work or limited to restricted work activity because of an occupational injury or illness. The total recordable cases value includes work-related death, illness, or injury which resulted in loss of consciousness, restriction from work or motion, transfer to another job, or required medical treatment beyond first aid.

As shown in Table 5.2-24, the highest occurrences of lost work days and total recordable cases during a peak construction year are projected to occur for the Full Separations Option and the Planning Basis Option. This is due to the larger number of employees and work hours associated with these options during a peak year. The highest total number of cases of lost work days and total recordable cases would be likely to occur for the Planning Basis Option followed by the Full Separations Option due to the larger number of total worker hours associated with these options.

Table 5.2-24. Estimated worker injury impacts during construction at INEEL by alternative (peak year and total cases).

Receptor	No Action Alternative	Continued Current Operations Alternative	Separations Alternative: Full Separations Option	Separations Alternative: Planning Basis Option	Separations Alternative: Transuranic Separations Option	Non-Separations Alternative: Hot Isostatic Pressed Waste Option	Non-Separations Alternative: Direct Cement Waste Option	Non-Separations Alternative: Early Vitrification Option	Minimum INEEL Processing Alternative: At INEEL	Minimum INEEL Processing Alternative: At Hanford[a]
Number of workers during peak year	21	89	1,200	1,300	920	570	510	540	600	NR[b]
Peak year lost workdays[c]	6.6	28	370	420	290	180	160	70	190	NR
Peak year total recordable cases[d]	0.8	3.4	44	51	35	22	20	20	23	NR
Total lost workdays	34	120	1,700	2,000	1,400	720	680	740	840	NR
Total recordable cases	4	14	200	240	170	86	81	88	100	227

a. Data based on analysis of the Interim Storage Scenario. See Appendix C.8.4.11, Table C.8-17.
b. NR = Not reported.
c. The number of workdays, beyond the day of injury or onset of illness, the employee was away from work or limited to restricted work activity because of an occupational injury or illness.
d. A recordable case includes work-related death, illness, or injury which resulted in loss of consciousness, restriction of work or motion, transfer to another job, or required medical treatment beyond first aid.

Table 5.2-25. Estimated worker injury impacts at INEEL by alternative during operations (peak year and total cases).

			Separations Alternative			Non-Separations Alternative			Minimum INEEL Processing Alternative	
Receptor	No Action Alternative	Continued Current Operations Alternative	Full Separations Option	Planning Basis Option	Transuranic Separations Option	Hot Isostatic Pressed Waste Option	Direct Cement Waste Option	Early Vitrification Option	At INEEL	At Hanford[a]
Number of workers during peak year	80	350	450	730	320	530	590	330	320	NR[b]
Peak year lost workdays[c]	18	80	100	170	72	120	130	75	71	NR
Peak year total recordable cases[d]	2.6	11	15	23	10	17	19	71	10	NR
Total lost workdays	310	860	2,500	3,100	1,900	2,000	2,300	1,800	1,700	NR
Total recordable cases	44	120	350	430	270	290	330	260	240	27

a. Data based on analysis of the Interim Storage Scenario. See Appendix C.8.4.11, Table C.8-17.
b. NR = Not reported.
c. The number of workdays, beyond the day of injury or onset of illness, the employee was away from work or limited to restricted work activity because of an occupational injury or illness.
d. A recordable case includes work-related death, illness, or injury which resulted in loss of consciousness, restriction of work or motion, transfer to another job, or required medical treatment beyond first aid.

As shown in Table 5.2-25, the highest occurrences of lost work days and total recordable cases during a peak operations year are projected to occur for the Planning Basis Option followed by the Direct Cement Waste Option. This is due to the larger number of employees and work hours associated with these options during a peak year. The highest total number of cases of lost work days and total recordable cases would also be likely to occur for the Planning Basis Option followed by the Full Separations Option due to the larger number of total worker hours associated with these options.

Table 5.2-26 presents the occurrences of lost work days and total recordable cases for interim storage activities after the year 2035. Impacts are highest for the Direct Cement Option due to the larger number of employees during interim storage operations.

5.2.11 ENVIRONMENTAL JUSTICE

Executive Order 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations, directs each Federal agency to "make…achieving environmental justice part of its mission" and to identify and address "…disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority and low-income populations." The Presidential Memorandum that accompanied Executive Order 12898 emphasized the importance of using existing laws, including the National Environmental Policy Act, to identify and address environmental justice concerns, "including human health, economic, and social effects, of Federal actions."

The Council on Environmental Quality, which oversees the Federal government's compliance with Executive Order 12898 and the National Environmental Policy Act, subsequently developed guidelines to assist Federal agencies in incorporating the goals of Executive Order 12898 in the NEPA process. This guidance, published in 1997, was intended to "…assist Federal agencies with their NEPA procedures so that environmental justice concerns are effectively identified and addressed."

As part of this process, DOE identified (in Section 4.12) minority and low-income populations within a 50-mile radius of INTEC, which was defined as the region of influence for the environmental justice analysis. The section that follows discusses whether implementing the proposed waste processing alternatives described in Chapter 3 would result in disproportionately high or adverse impacts to minority and low-income populations. Section C.8.4.19 discusses the environmental justice analysis at the Hanford Site under the Minimum INEEL Processing Alternative.

5.2.11.1 Methodology

The Council on Environmental Quality guidance (CEQ 1997) does not provide a standard approach or formula for identifying and addressing environmental justice issues. Instead, it offers Federal agencies general principles for conducting an environmental justice analysis under NEPA:

- Federal agencies should consider the population structure in the region of influence to determine whether minority populations, low-income populations, or Indian tribes are present, and if so, whether there may be disproportionately high and adverse human health or environmental effects on any of these groups.

- Federal agencies should consider relevant public health and industry data concerning the potential for multiple or cumulative exposure to human health or environmental hazards in the affected population and historical patterns of exposure to environmental hazards, to the extent such information is available.

- Federal agencies should recognize the interrelated cultural, social, occupational, historical, or economic factors that may amplify the effects of the proposed agency action. These would include the physical sensitivity of the community or population to particular impacts.

Table 5.2-26. Estimated annual worker injury impacts to involved workers from interim storage operations post-2035.

Alternative	Workers per year	Lost workdays per year	Total recordable cases per year
No Action Alternative	0	NA[a]	NA
Continued Current Operations Alternative	3	0.7	0.1
Full Separations Option	6.5	1.5	0.2
Planning Basis Option	6.5	1.5	0.2
Hot Isostatic Pressed Waste Option	13	3.0	0.3
Direct Cement Waste Option	17.5	4.0	0.6
Early Vitrification Option	6.5	1.5	0.2
Minimum INEEL Processing Alternative	6.5	1.5	0.2

a. NA = Not applicable.

- Federal agencies should develop effective public participation strategies that seek to overcome linguistic, cultural, institutional, and geographic barriers to meaningful participation, and should incorporate active outreach to affected groups.

- Federal agencies should assure meaningful community representation in the process, recognizing that diverse constituencies may be present.

- Federal agencies should seek tribal representation in the process in a manner that is consistent with the government-to-government relationship between the United States and tribal governments, the Federal government's trust responsibility to Federally-recognized tribes, and any treaty rights.

The environmental justice analysis was based on the assessment of potential impacts associated with the various waste processing alternatives to determine if there were high and adverse human health or environmental impacts. In this assessment, DOE reviewed potential impacts arising under the major disciplines and resource areas including socioeconomics, cultural resources, air resources, water resources, ecological resources, health and safety, and waste and materials during both the construction and operations work phases. Regarding health effects, both normal facility operations and postulated accident conditions were analyzed, with accident scenarios evaluated in terms of risk to the public. Likewise, the analysis of transportation impacts included both normal and potential accident conditions for the transportation of materials.

Although no high and adverse impacts were predicted for the activities analyzed in this EIS, DOE nevertheless considered whether there were any means for minority or low-income populations to be disproportionately affected. The basis for making this determination would be a comparison of areas predicted to experience human health or environmental impacts with areas in the region of influence known to contain high percentages of minority or low-income populations as reported by the U.S. Bureau of the Census.

Environmental justice guidance developed by the Council on Environmental Quality defines members of a "minority" as individuals who are members of the following population groups: American Indian or Alaskan Native; Asian or Pacific Islander; Black, not of Hispanic origin; or Hispanic (CEQ 1997). The Council defines these groups as minority populations when either the minority population of the affected area exceeds 50 percent or the percentage of minority population in the affected area is meaningfully greater than the minority population percentage in the general population or other appropriate unit of geographical analysis.

Low-income populations are identified using statistical poverty thresholds from the Bureau of Census Current Population Reports, Series P-60 on Income and Poverty. In identifying low-income populations, a community may be considered either as a group of individuals living in geographic proximity to one another, or a set of individuals (such as migrant workers or Native Americans), where either type of group experiences common conditions of environmental exposure or effect.

Any disproportionately high and adverse human health or environmental effects on minority or low-income populations that could result from the waste processing alternatives are assessed for a 50-mile area surrounding INTEC, as discussed in Section 4.12.

5.2.11.2 Construction Impacts

For environmental justice concerns to be implicated, high and adverse human health or environmental impacts must disproportionately affect minority populations or low-income populations. As shown in Section 5.2.2, Socioeconomics, construction under all the waste processing alternatives would generate temporary increases in employment and earnings in the region of interest.

None of the alternatives is expected to significantly affect land use (see Section 5.2.1), cultural resources (see Section 5.2.3), or ecological resources (see Section 5.2.8) because no previously-undisturbed onsite land would be required and no offsite lands are affected. Sections 5.2.6, Air Resources, and 5.2.10, Health and Safety, discuss potential impacts of construction on human health (both workers and the offsite population) and the environment.

Because construction impacts would not significantly impact the surrounding population, and no means were identified for minority or low-income populations to be disproportionately affected, no disproportionately high and adverse impacts would be expected for minority or low-income populations.

5.2.11.3 Operational Impacts

For environmental justice concerns to be implicated, high and adverse human health or environmental impacts must disproportionately affect minority populations or low-income populations. As shown in Section 5.2.2, Socioeconomics, waste processing operations under all alternatives would either maintain (No Action) or increase employment and earnings in the region of influence. None of the alternatives would result in significantly adverse land use or cultural resources impacts.

Sections 5.2.6, Air Resources, 5.2.8, Ecological Resources, and 5.2.10, Health and Safety, discuss potential impacts of operational releases on human health (both workers and the offsite population) and the environment. As shown in these environmental consequences sections, none of the alternatives would result in significantly adverse impacts.

Impacts from high-consequence, low-probability accident scenarios (Section 5.2.14) would be significant should they occur; however, the impacts to specific population locations would be subject to meteorological conditions at the time of the accident. Whether or not such impacts would have disproportionately high and adverse effects with respect to any particular segment of the population would be subject to natural forces, including random meteorological factors. However, the probability of one of these accidents occurring is extremely low (see Section 5.2.14).

Because the impacts from routine facility operations (see Sections 5.2.6 and 5.2.7) and reasonably-foreseeable accidents (see Section 5.2.14) would be low for the surrounding population and no means were identified for minority or low-income populations to be disproportionately affected, no disproportionately high and adverse impacts would be expected for minority or low-income populations.

Unlike fixed-facility accidents, it is impossible to predict where a transportation accident may occur and, accordingly, who might be affected.

In addition to the variability of meteorological conditions, the random nature of accidents with respect to location and timing make it impossible to predict who could be affected by a severe accident. Although adverse impacts could occur in the unlikely event of a high-consequence transportation accident, any potential disproportionate impacts to these populations would be subject to the randomness of these factors. Routine transportation would be carried out over existing roads and highways. The impacts would be expected to be low on the population as a whole. Because the impacts of routine transportation would be expected to be the same on minority or low-income populations as on populations as a whole, no disproportionately high and adverse impacts on minority or low-income populations would be expected from transportation activities.

As noted in Section 5.2.10, public health impacts from waste processing activities are based on projected airborne releases of radioactive and nonradioactive contaminants. Because prevailing winds are out of the southwest and northeast (see Section 4.7.1), contaminants released to the atmosphere from INTEC tend to be carried to the northeast (into the interior of INEEL) or southwest (into the sparsely-populated area south and west of INEEL). Minority populations tend to be concentrated south and east of INTEC, in urban areas like Pocatello and Idaho Falls and along the Interstate 15 corridor (see Figure 4-22). The Fort Hall Indian Reservation is also some 40 miles southeast of INTEC (see Figure 4-23). This suggests that minority and low-income populations would not experience higher exposure rates than the general population and that disproportionately high and adverse human health effects would not be expected to occur as a result of HLW processing activities. Releases to surface water would be small by comparison, and would not be expected to result in adverse health impacts.

5.2.11.4 Subsistence Consumption of Fish, Wildlife, and Game

Section 4-4 of Executive Order 12898 directs Federal agencies "whenever practical and appropriate, to collect and analyze information on the consumption patterns of populations who principally rely on fish and/or wildlife for subsistence and that Federal governments communicate to the public the risks of these consumption patterns." There is no evidence to suggest that minority or low-income populations in the region of influence are dependent on subsistence fishing, hunting, or gathering on the INEEL. DOE nevertheless considered whether there were any means for minority or low-income populations to be disproportionately affected by examining levels of contaminants in crops, livestock, and game animals on the INEEL and from adjacent lands.

Controlled hunting is permitted on INEEL land but is restricted to a very small portion of the northern half of the INEEL. The hunts are intended to assist the Idaho Department of Fish and Game in reducing crop damage on private agricultural lands adjacent to the INEEL. In addition to the limited hunting on the INEEL, several game species and birds live on and migrate through the INEEL. DOE routinely samples game species residing on the INEEL, sheep that have grazed on the INEEL, locally grown foodstuffs and milk around the INEEL for radionuclides (ESRF 1996). Concentrations of radionuclides in the samples have been small and are seldom higher than concentrations observed at control locations distant from the INEEL. The principal source of non-natural radionuclides at these control locations is very small amounts of residual atmospheric fallout from past nuclear weapons tests. Data from programs monitoring these sources of food are reported annually in the *INEEL Site Environmental Report* (ESRF 1996).

Based on DOE monitoring results (ESRF 1996), concentrations of contaminants in crops, livestock, and game animals in areas surrounding the INEEL are low, seldom above background levels. Moreover, the impact analyses conducted for this EIS (see Section 5.2.8) indicate that native plants and wildlife in the region of influence would not be harmed by any of the actions being proposed. Consequently, no disproportionately high and adverse human health impacts would be expected in minority or low-income populations in the region as a result of subsistence consumption of fish, wildlife, native plants, or crops.

INEEL utility worker.

5.2.12 UTILITIES AND ENERGY

This section presents the potential impacts on the projected demand for electricity, process and potable water, fossil fuels, and wastewater treatment from implementing the proposed waste processing alternatives. The analysis includes potential impacts associated with increased demand and usage during construction and operation. The data represent the bounding (or highest potential impact) case for each alternative or option; the data have been totaled for all projects supporting the option and do not take into account the fact that all facilities may not be operating simultaneously. Because one of the alternatives (Minimum INEEL Processing) involves shipment of mixed HLW to the Hanford Site for treatment, possible changes in utility and energy use at Hanford were also evaluated (see Appendix C.8).

5.2.12.1 Construction Impacts

There would be a small amount of construction under the No Action Alternative. It would be necessary to build a Calcine Retrieval and Transport System to retrieve calcine from bin set 1 and transport it to another existing bin set. Implementation of the Continued Current Operations, Separations, Non-Separations, and Minimum INEEL Processing Alternatives would require DOE to construct new waste management and support facilities as described in Chapter 3. New facilities (additional Canister Storage Buildings and a Calcine Dissolution Facility) would be built within the 200-East Area at the Hanford Site under the Minimum INEEL Processing Alternative (Interim Storage Scenario). Appendix C.8 examines the impacts to utility and energy usage for the Hanford Site.

Construction activities would result in increased power and water consumption and wastewater generation. Water usage would include potable water for workers and process water for dust control and other construction-related activities. Domestic and process water would be supplied from existing wells. The use of heavy equipment (e.g., bulldozers, earth movers, dump trucks, compactors) and portable generators during construction would result in the consumption of fossil (diesel) fuel. Table 5.2-27 presents projected utility and energy usage for each alternative. The existing INTEC capacity would adequately support any of the alternatives.

As discussed in Section 3.1.5 under the Minimum INEEL Processing Alternative, DOE would retrieve and transport calcine to a packaging facility, where it would be placed into shipping containers. The containers would then be

Table 5.2-27. Utility and energy requirements for construction by waste processing alternative.[a]

Waste Processing Alternative	Annual electricity usage (megawatt-hours per year)	Annual fossil fuel use (million gallons per year)	Annual potable water use (million gallons per year)	Annual non-potable water use (million gallons per year)	Annual sanitary wastewater discharges (million gallons per year)
INTEC Baseline (1996 usage)	8.8×10^4	0.98	55	400	55
No Action Alternative	180	6.6×10^{-3}	0.12	0.041	0.12
Continued Current Operations Alternative	3.4×10^3	0.036	0.77	0.11	0.77
Separations Alternative					
Full Separations Option	3.3×10^3	0.43	6.6	0.38	6.6
Planning Basis Option	6.5×10^3	0.41	6.8	0.41	6.8
Transuranic Separations Option	2.9×10^3	0.45	4.7	0.27	4.7
Non-Separations Alternative					
Hot Isostatic Pressed Waste Option	4.0×10^3	0.35	3.0	0.28	3.0
Direct Cement Waste Option	4.0×10^3	0.39	3.2	0.46	3.2
Early Vitrification Option	900	0.30	2.5	0.30	2.5
Minimum INEEL Processing Alternative					
At INEEL	1.1×10^3	0.23	2.9	0.29	2.9
At Hanford Site[b]	2.9×10^3	0.092	1.8	0.040	1.8

a. INTEC baseline data from LMITCO (1998); remainder of data from the project data sheets identified in Appendix C.6. Values represent incremental increases from the baseline quantities.
b. Data from Project Data Sheets contained in Appendix C.8.

shipped to DOE's Hanford Site where the HLW would be separated into mixed high- and low-level waste fractions. Each fraction would be vitrified. The vitrified high- and low-level waste fractions would be returned to INEEL. There are two scenarios for shipping INEEL's calcine to the Hanford Site, the Interim Storage Shipping Scenario and the Just-in-Time Shipping Scenario. The data in Table 5.2-27 for the Minimum INEEL Processing Alternative (at INEEL) includes the construction impacts to resources from the Interim Storage Shipping Scenario which is considered the base case in this EIS.

5.2.12.2 Operational Impacts

DOE analyzed the utility and energy requirements for operation of the facilities, projects, and components associated with each of the nine options under the five alternatives discussed in the EIS for the period 2000 through 2035. DOE evaluated the impacts associated with each option relative to existing or historic INEEL capacity and usage.

Operation of INEEL waste processing facilities under any alternative would result in water usage and wastewater generation. Water usage would include potable water for workers and process water for operation of facilities. Domestic and process water would be supplied from existing INTEC wells. Wastewater would be treated at new or existing INEEL facilities. The existing percolation ponds (or their replacements) are capable of handling the service wastewater for all waste processing alternatives.

The existing percolation ponds will be replaced on a like-for-like basis and will be placed approximately 10,200 feet from the southwest corner of INTEC. The environmental impacts for the replacement percolation ponds are discussed in the Waste Area Group 3 CERCLA Record of Decision (DOE/ID-10660). Following the selection of the preferred alternative for HLW waste processing, the requirements for the service wastewater system would be determined. Depending on system requirements, service wastewater system alternatives would be analyzed and a determination to provide supplemental NEPA documentation would be made.

The use of steam generators and backup electrical power generators during operations would consume diesel fuel. Table 5.2-28 presents the operational utility and energy requirements for each alternative or option. The existing INTEC infrastructure would be adequate to support these demands. Utility and energy requirements for operation of facilities at the Hanford Site under the Minimum INEEL Processing Alternative are discussed in Appendix C.8.

There are three methods for disposal of the grouted low-level waste fraction under the Separations Alternative. These methods include (1) disposal in an onsite INEEL disposal facility; (2) disposal in an offsite disposal facility; and (3) disposal in two INEEL facilities, the Tank Farm and the bin sets, after they are closed. The data presented in Table 5.2-28 for the Full Separations and Transuranic Separations Options are for disposal of grout in an onsite INEEL disposal facility, which is considered the base case for this EIS. Resource consumption under other disposal methods is similar (for most resources) to the onsite disposal method.

The waste processing alternatives include projects that would provide interim HLW storage, packaging, and loading. The No Action and Continued Current Operations Alternatives would be similar due to continuing waste generation as a result of long-term storage and monitoring of the calcine in the bin sets. Depending on the alternative, the duration of these activities is shown extending beyond the year 2035. Annual utility and energy requirements during this interim storage period is shown in Table 5.2-29.

Table 5.2-28. Utility and energy requirements for operations by waste processing alternative.[a]

Waste Processing Alternative	Annual electricity usage (megawatt-hours per year)	Annual fossil fuel use (million gallons per year)	Annual potable water use (million gallons per year)	Annual non-potable water use (million gallons per year)	Annual sanitary wastewater discharges (million gallons per year)
INTEC Baseline (1996 usage)	8.8×10^4	0.10	55	400	55
No Action Alternative	1.2×10^4	0.64	1.4	14	1.4
Continued Current Operations Alternative	1.8×10^4	1.9	2.7	62	2.7
Separations Alternative					
Full Separations Option	4.0×10^4	4.5	4.0	5.0	4.0
Planning Basis Option	5.0×10^4	6.3	5.8	69	5.8
Transuranic Separations Option	2.9×10^4	2.2	2.8	53	2.8
Non-Separations Alternative					
Hot Isostatic Pressed Waste Option	3.3×10^4	2.8	3.8	89	3.8
Direct Cement Waste Option	2.8×10^4	2.5	4.8	62	4.8
Early Vitrification Option	3.9×10^4	1.1	2.9	6.3	2.9
Minimum INEEL Processing Alternative					
At INEEL	2.5×10^4	0.49	2.8	6.3	2.8
At Hanford Site[b]	6.6×10^5	1.3	4.8	500	4.8

a. INTEC baseline data from LMITCO (1998); remainder of data from the project data sheets identified in Appendix C.6 (Project Summaries). Values represent incremental increases from the baseline quantities.

b. Data from Project Data Sheets contained in Appendix C.8.

Table 5.2-29. Annual utility and energy requirements from interim storage operations after the year 2035.

Waste Processing Alternative	Annual electricity usage (megawatt-hours per year)	Annual fossil fuel use (million gallons per year)	Annual potable water usage (million gallons per year)	Annual non-potable water usage (million gallons per year)	Annual sanitary wastewater discharges (million gallons per year)
No Action Alternative	4.3×10^3	0.48	0.70	14	0.70
Continued Current Operations Alternative	10	None	0.027	None	0.027
Separations Alternative					
Full Separations Option	290	None	0.059	None	0.059
Planning Basis Option	290	None	0.059	None	0.059
Transuranic Separations Option	None	None	None	None	None
Non-Separations Alternative					
Hot Isostatic Pressed Waste Option	4.4×10^3	None	0.059	None	0.059
Direct Cement Waste Option	4.6×10^3	None	0.059	None	0.059
Early Vitrification Option	4.4×10^3	None	0.059	None	0.059
Minimum INEEL Processing Alternative	290	None	0.059	None	0.059

5.2.13 WASTE AND MATERIALS

This section presents the potential impacts from implementing the proposed waste processing alternatives described in Chapter 3 on the generation and management of wastes that would result from modifications or expansions to facilities, and from new facilities being constructed at the INEEL as part of the proposed action. This information is presented for each of the alternatives, including the No Action Alternative, to support comparisons where appropriate. The information is presented first for the construction phase, then for operations. The operations phase discussion also presents a summary of the key ingredient materials that would be dedicated to treatment processes involved in each of the waste processing alternatives in order to obtain disposable waste products. Finally, this section provides an overview of the potential impacts to treatment, storage, or disposal facilities that would receive waste from the proposed action.

5.2.13.1 Methodology

Each of the alternatives (and, where appropriate, options within the alternatives) being considered has been broken down into a series of projects or activities that would have to be completed if the alternative were to be implemented. These project descriptions were then used as the basis for the waste processing alternatives. Project descriptions and data sheets developed for each project include projections of waste generation (by quantity and type) and represent the source of the waste and material data summarized in this section. For example, waste generation was tabulated for each project making up an alternative and the totals, by waste type, are presented in this section. Additionally, the data sheets provide waste projections by project phase, which normally consist of construction, operations, and decontamination and decommissioning. Although waste volumes as provided in the project descriptions and data sheets have generally been conservatively estimated, they are based on current regulations and laws which determine waste types and to some extent waste volumes. Future regulations and laws could change predicted waste volumes and in the worst case, could require some reanalysis to show that predicted impacts are bounding. Such analyses would generally be provided as an addendum to this EIS at some future date.

In general, the types of waste discussed in this section are industrial waste, hazardous waste, mixed low-level waste, low-level waste, transuranic waste, and HLW. Industrial waste, in this case, is used to designate all the non-hazardous and non-radiological waste that might be generated during a project. The waste summaries presented in this section also use another category: "product waste." This term is being used for waste that is derived directly from the waste materials being addressed by the proposed action; that is the mixed HLW and the mixed transuranic waste (SBW and newly generated liquid waste). Product wastes are the direct result of the management or processing of these materials and would be generated only during the operations phase of a project. Product wastes are further categorized as HLW, transuranic waste, and low-level waste fraction. The "process" waste (that is, all other waste) is produced indirectly as a result of the waste processing activities and would include, for example, waste from offgas treatment, as well as waste generated from normal facility operation and maintenance, and construction wastes. Although more likely to be encountered during the facility disposition phase, any waste identified in the project descriptions as being CERCLA or environmental restoration program waste is not included in these discussions.

"Product" and "process" wastes are categories used in this EIS to distinguish the differing types of analyses for these wastes. The analyses for product wastes evaluate impacts up to (and sometimes including) disposal. Process wastes are evaluated only against the capacity of DOE infrastructure to receive the waste. This EIS further describes product and process wastes in terms of their classification (e.g., radioactive waste classification in accordance with DOE Manual 435.1-1) and associated management requirements.

Planned disposition of the product waste is defined under the various alternatives, while plans for the ultimate disposition of the process wastes generated from the proposed action are conceptual in nature. In general, the ultimate treatment or disposal strategies for the various waste types would be as follows:

- Industrial waste would be managed onsite, with material not recycled or retrieved ultimately being disposed of at the INEEL disposal facility.
- Hazardous waste would be shipped offsite to commercial facilities.
- Mixed low-level waste would be treated onsite or shipped offsite to commercial facilities or another DOE site.
- Low-level waste would be disposed of onsite or shipped offsite to commercial facilities or another DOE site. Per Section 4.14.4, DOE expects that the Radioactive Waste Management Complex will stop taking contact-handled low-level waste in 2006 and remote-handled low-level waste in 2008.
- Transuranic waste would be sent to the Waste Isolation Pilot Plant.
- HLW would be sent to a geologic repository.
- The low-level waste fraction would be disposed of onsite in a facility prepared as part of the applicable alternative (i.e., either in a new near-surface disposal facility or in emptied Tank Farm and bin sets) or would be shipped offsite.

Because there is limited information on the ultimate disposition of much of the waste identified in this section, the discussion on impacts to facilities that would receive waste from the various waste processing alternatives (5.2.13.4) is also limited.

5.2.13.2 Construction Impacts

Waste would be produced as a result of modifying or constructing new HLW management facilities. Table 5.2-30 summarizes the annual average and total volumes of waste that would be generated during construction. The annual average values represent the average over the duration of all projects generating the specific waste type.

The Full Separations Option includes three separate disposal options for the low-level waste Class A type grout that would be produced: (1) construction of a near-surface disposal facility at the INEEL, (2) use of existing INTEC facilities such as the Tank Farm and bin sets, and (3) transportation to an offsite disposal location. The larger amount of industrial waste associated with disposal in the near-surface disposal facility is attributed directly to the construction of that facility. The disposal option involving use of the Tank Farm and bin sets would require that these facilities be closed prior to receiving the low-level Class A type grout. This action would involve the production of waste that is not included in Table 5.2-30 because it is addressed as part of the overall facility disposition process in Section 5.3.10.

The Transuranic Separations Option includes two disposal options for the low-level Class C type grout that would be produced: (1) construction of a new near-surface disposal facility at the INEEL and (2) use of existing INTEC facilities such as the Tank Farm and bin sets. Again, the larger amount of industrial waste associated with disposal in the new near-surface disposal facility is from the construction of that facility.

Table 5.2-31 is based on the same project information used to generate Table 5.2-30 but presents estimated waste generation in terms of peak annual volumes. It also shows the year or years in which the peaks would occur.

5.2.13.3 Operational Impacts

This section describes the waste generation that would be expected as a result of the operation of waste processing facilities. Discussions of wastes that would be generated indirectly as a result of the waste processing activities are presented separately from the product waste itself. Also discussed in this section are the key input materials that would be dedicated to treatment processes involved in each of the waste processing alternatives. The input or process feed mate-

Table 5.2-30. Annual average and total process waste volumes (cubic meters) generated during construction.[a]

Alternatives	Schedule[b]	Industrial waste		Hazardous waste		Mixed low-level waste		Low-level waste	
		Average	Total	Average	Total	Average	Total	Average	Total
No Action Alternative	2005-2011	220	1,400	0	0	35	220	0	0
Continued Current Operations Alternative	2005-2014	680	6,800	3	30	38	240	3	20
Separations Alternative									
Full Separations Option									
New INEEL disposal option	2005-2034	3,600	55,000	52	790	180	1,100	30	330
Tank Farm, bin set disposal option	2005-2015	4,400	47,900	71	780	180	1,100	30	320
Offsite facility disposal option	2005-2015	4,400	48,600	71	790	180	1,100	30	330
Planning Basis Option									
Offsite facility disposal option	2006-2020	3,700	59,700	55	880	99	1,100	13	210
Transuranic Separations Option									
New INEEL disposal option	2005-2034	2,600	39,100	19	280	180	1,100	21	210
Tank Farm, bin set disposal option	2005-2014	3,200	32,100	27	270	180	1,100	20	200
Offsite facility disposal option	2005-2014	3,300	32,600	28	280	180	1,100	21	210
Non-Separations Alternative									
Hot Isostatic Pressed Waste Option	2005-2014	2,600	25,800	79	790	99	1,100	26	260
Direct Cement Waste Option	2005-2014	3,000	29,900	56	560	99	1,100	34	340
Early Vitrification Option	2005-2014	2,300	23,100	64	640	180	1,100	31	310
Minimum INEEL Processing Alternative									
At INEEL	2005-2020	1,700	26,100	22	340	270	1,100	10	110
At Hanford[c]	2010-2027	NA[d]	19,200	NA	20	0	0	0	0

a. Source: Project Data Sheets in Appendix C.6.
b. Schedules shown include construction and systems operations testing performed prior to releasing the facility for operations.
c. Source: Project Data Sheets in Appendix C.8.
NA = not applicable because annual generation varies greatly due to intermittent construction activity.

Table 5.2-31. Peak annual process waste volumes (cubic meters) generated during construction and the year(s) they would occur.[a]

Alternatives	Industrial waste		Hazardous waste		Mixed low-level waste		Low-level waste	
	Peak	Year(s)	Peak	Year(s)	Peak	Year(s)	Peak	Year(s)
No Action Alternative	220	2005-2010	0	NA[b]	35	2005-2010	0	NA[b]
Continued Current Operations Alternative	1,200	2008-2010	5	2008-2010	39	2006-2010	3	2008-2014
Separations Alternative								
Full Separations Option								
New INEEL disposal option	8,500	2011-2014	140	2011-2014	180	2010-2015	48	2011-2014
Tank Farm, bin set disposal option	7,700	2011-2014	140	2011-2014	180	2010-2015	47	2011-2014
Offsite facility disposal option	7,900	2011-2014	140	2011-2014	180	2010-2015	48	2011-2014
Planning Basis Option								
Offsite facility disposal option	8,500	2016-2019	140	2016-2019	180	2014-2019	24	2016-2019
Transuranic Separations Option								
New INEEL disposal option	6,100	2011-2014	63	2011-2014	180	2009-2014	29	2011-2014
Tank Farm, bin set disposal option	5,300	2011-2014	62	2011-2014	180	2009-2014	28	2011-2014
Offsite facility disposal option	5,500	2011-2014	63	2011-2014	180	2009-2014	29	2011-2014
Non-Separations Alternative								
Hot Isostatic Pressed Waste Option	3,900	2011-2014	140	2011-2014	180	2009-2014	40	2011-2014
Direct Cement Waste Option	4,500	2011-2014	98	2011-2014	180	2009-2014	53	2011-2014
Early Vitrification Option	3,800	2011-2014	110	2011-2014	180	2009-2014	46	2011-2014
Minimum INEEL Processing Alternative								
At INEEL	2,800	2007-2008	59	2011-2014	270	2007-2010	20	2007-2008
At Hanford[c]	3,400	2024-2027	3	2009-2010[d]	0	NA	0	NA

a. Source: Project Data Sheets in Appendix C.6.
b. NA = Not applicable.
c. Source: Project Data Sheets in Appendix C.8.
d. Peak hazardous waste generation also occurs during 2014-2015 and 2019-2020 construction periods.

rials are either consumed or become part of the product wastes during treatment.

Process Waste - Table 5.2-32 summarizes the annual average and total process waste volumes generated indirectly during the operations phase of the waste processing alternatives. The annual average values represent the average over the duration of the projects generating the specific waste type. For example, if a single project within the alternative or option is the only one that would generate hazardous waste, the average is over the duration of that project even if its duration is shorter than that of the overall alternative. The average and total values shown in the table are, however, restricted by the period of analysis, which ends in the year 2035. In some cases, project descriptions include work that extends beyond the year 2035. These projects are primarily those involving interim storage of HLW and its eventual transportation to the national geologic repository. Those projects show an extended duration to address the possibility that the repository may be unable to receive the waste as it is produced. The amounts of waste that would be produced from these post-2035 activities are discussed on an annual, rather than total basis later in this section.

Table 5.2-33 is based on the same project information as Table 5.2-32 but presents estimated waste generation in terms of peak annual volumes. It also shows the year or years in which the peaks would occur.

Several of the projects that make up the alternatives and their options show durations that extend beyond the 2035 period of analysis. Each of the options under the Separations, Non-Separations, and Minimum INEEL Processing alternatives include a laboratory project that would continue its operations into 2040. This activity is projected to continue production of industrial waste, mixed low-level waste, and low-level waste during these post-2035 years in the amounts of 580, 56, and 1 cubic meters per year, respectively. Alternatives and options that would produce disposable HLW forms at the INEEL [i.e., the Full Separations Option, the Planning Basis Option, and each of the options under the Non-Separations Alternative] include projects that would provide interim storage, packaging and loading for that HLW. The No Action and Continued Current Operations Alternatives would each have a similar situation due to continuing industrial waste production (approximately 17 cubic meters per year) as a result of long-term storage and monitoring of the calcine in the bin sets. Depending on the alternative, the duration of these activities is shown extending to some point beyond the year 2050. Annual production of waste during this interim storage period is shown in Table 5.2-34. Packaging and shipping activities that would ultimately remove waste from interim storage under the Separations, Non-Separations, and Minimum INEEL Processing Alternatives would produce waste types and quantities very similar to those shown in Table 5.2-34.

Product Wastes - Table 5.2-35 summarizes the estimated volumes of product wastes that would be generated for each of the alternatives that would produce disposable waste forms. No product waste generation is shown for the No Action Alternative because it is not configured to treat the waste materials of primary concern into disposable waste forms. The Continued Current Operations Alternative would include processing of tank-heel waste from the Tank Farm, which would result in the generation of 7,000 cubic meters of low-level waste (included in the process waste summaries in Tables 5.2-32 and 5.2-33, and 110 cubic meters of remote-handled transuranic waste (included in Table 5.2-35). The other waste processing alternatives would result in varying amounts of product waste that would be classified as low-level waste, transuranic waste, or high-level waste as shown in Table 5.2.35.

Process Feed Materials - The waste processing approaches described in the different options would require the addition of various materials to support the processes and enable the production of a stable, disposable form for the product waste. Table 5.2-36 provides a summary of the key feed materials that would be committed to each of the alternatives.

Table 5.2-32. Annual average and total process waste volumes (cubic meters) generated during operations through the year 2035.[a]

Alternatives	Industrial waste Average	Industrial waste Total	Hazardous waste Average	Hazardous waste Total	Mixed low-level waste Average	Mixed low-level waste Total	Low-level waste Average	Low-level waste Total
No Action Alternative	390	13,900	0	0	37	1,300	5	190
Continued Current Operations Alternative	660	19,200	0	0	110	3,200	330	9,500
Separations Alternative								
Full Separations Option								
New INEEL disposal option	2,000	52,700	58	1,600	210	5,800	45	1,200
Tank Farm, bin set disposal option	1,900	50,200	58	1,600	220	5,900	45	1,200
Offsite facility disposal option	1,900	50,600	58	1,600	210	5,800	45	1,200
Planning Basis Option								
Offsite facility disposal option	2,000	51,500	57	1,200	300	7,900	400	10,200
Transuranic Separations Option								
New INEEL disposal option	1,600	43,200	36	960	190	5,200	36	960
Tank Farm, bin set disposal option	1,500	40,900	35	940	200	5,300	36	960
Offsite facility disposal option	1,500	41,500	36	960	190	5,200	36	960
Non-Separations Alternative								
Hot Isostatic Pressed Waste Option	1,600	43,200	<1	4	230	6,400	370	10,000
Direct Cement Waste Option	1,900	50,400	<1	4	320	8,600	370	10,000
Early Vitrification Option	1,200	41,700	<1	4	170	6,000	21	750
Minimum INEEL Processing Alternative								
At INEEL	960	34,700	1	40	160	5,700	20	700
At Hanford Site[b]	NA[c]	6,700	NA	23	0	0	NA	1,500

a. Source: Project Data Sheets in Appendix C.6.
b. Source: Project Data Sheets in Appendix C.8.
c. NA = not applicable. Except for Canister Storage Buildings, the operating period for the Hanford Site facilities is short (about 2 years), making average annual values not applicable.

Table 5.2-33. Peak annual waste volumes (cubic meters) generated during operations and the year(s) they would occur.[a]

Alternatives	Industrial waste		Hazardous waste		Mixed low-level waste		Low-level waste	
	Peak	Year(s)	Peak	Year(s)	Peak	Year(s)	Peak	Year(s)
No Action Alternative	630	2012	0	–	100	2012	17	2012
Continued Current Operations Alternative	1,430	2015-2016	0	–	250	2015-2016	1,300	2015-2016
Separations Alternative								
Full Separations Option								
New INEEL disposal option	2,500	2016-2035	76	2016-2035	260	2016-2035	57	2016-2035
Tank Farm, bin set disposal option	2,400	2027-2035	76	2016-2035	270	2016-2035	57	2016-2035
Offsite facility disposal option	2,400	2016-2035	76	2016-2035	260	2016-2035	57	2016-2035
Planning Basis Option								
Offsite facility disposal option	2,800	2021-2035	80	2021-2035	390	2021-2035	1,000	2020
Transuranic Separations Option								
New INEEL disposal option	2,000	2015-2035	46	2015-2035	230	2015-2035	45	2015-2035
Tank Farm, bin set disposal option	1,900	2015-2035	45	2015-2035	240	2015-2035	45	2015-2035
Offsite facility disposal option	1,900	2015-2035	46	2015-2035	230	2015-2035	45	2015-2035
Non-Separations Alternative								
Hot Isostatic Pressed Waste Option	2,600	2015-2016	<1	2009-2035	390	2015-2016	1,400	2015-2016
Direct Cement Waste Option	2,900	2015-2016	<1	2009-2035	500	2015-2016	1,400	2015-2016
Early Vitrification Option	1,800	2015-2035	<1	2009-2035	240	2015-2035	37	2015-2035
Minimum INEEL Processing Alternative								
At INEEL	1,800	2015-2025	2	2016-2035	300	2015-2025	42	2015-2025
At Hanford[b]	4,100	2029	2	2029	0	–	1,020	2029

a. Source: Project Data Sheets in Appendix C.6.
b. Source: Project Data Sheets in Appendix C.8.

Table 5.2-34. Annual production of process waste (cubic meters) from storage operations after the year 2035.[a]

Alternatives	Industrial waste	Hazardous waste	Mixed low-level waste	Low-level waste
No Action Alternative	17	0	0	0
Continued Current Operations Alternative	17	0	0	0
Separations Alternative				
Full Separations Option	36	2	0	0
Planning Basis Option	36	2	0	0
Transuranic Separations Option	NA[b]	NA	NA	NA
Non-Separations Alternative				
Hot Isostatic Pressed Waste Option	36	0	0	0
Direct Cement Waste Option	36	0	0	0
Early Vitrification Option	36	0	0	0
Minimum INEEL Processing Alternative				
At INEEL	36	2	0	0
At Hanford	NA	NA	NA	NA

a. Source: Project Data Sheets in Appendix C.6.
b. NA = not applicable. There is no storage of HLW associated with this alternative.

Table 5.2-35. Total volumes (cubic meters) of product waste that would result from the alternatives.[a]

Alternatives	Low-level waste	Transuranic Waste: Contact-handled	Transuranic Waste: Remote-handled	High-level waste
No Action Alternative	NA[b]	NA	NA	NA
Continued Current Operations Alternative	0	0	110	0
Separations Alternative				
Full Separations Option	27,000	0	0	470
Planning Basis Option	30,000	0	110	470
Transuranic Separations Option	22,700	0	220	0
Non-Separations Alternative				
Hot Isostatic Pressed Waste Option	0	0	110	3,400
Direct Cement Waste Option	0	0	110	13,000
Early Vitrification Option	0	0	360	8,500
Minimum INEEL Processing Alternative				
At INEEL	0	7,500	0	0
At Hanford[c]	14,400	0	0	730

a. Source: Project Data Sheets in Appendix C.6.
b. NA = not applicable.
c. Source: Facilities and projects associated with the Hanford option of this alternative are described in Appendix C.8.

Table 5.2-36. Summary of key material quantities (cubic meters) that would be committed to each of the alternative processes.

	Total material quantities (cubic meters)[a]								
Alternatives	Argon gas	Boiler or blast furnace slag	Cement	Clay	Fly ash	Glass frit	Silica	Sodium hydroxide	Titanium or aluminum powder
No Action Alternative	–	–	–	–	–	–	–	–	–
Continued Current Operations Alternative	–	–	–	–	–	–	–	–	–
Separations Alternative									
Full Separations Option	–	5,600	5,100	–	5,400	420	–	–	–
Planning Basis Option[b]	–	5,600	5,100	–	5,400	420	–	–	–
Transuranic Separations Option	–	6,400	5,800	–	6,100	–	–	–	–
Non-Separations Alternative									
Hot Isostatic Pressed Waste Option	1,200	–	–	–	–	–	2,300	–	240
Direct Cement Waste Option	–	1,300	–	8,500	–	–	–	500	–
Early Vitrification Option	–	–	–	–	–	7,800	–	–	–
Minimum INEEL Processing Alternative[c]	–	–	–	–	–	9,200	–	7,600	–

a. Source: Helm (1998).
b. Materials quantities committed under the Planning Basis Option are assumed to be identical to those committed under the Full Separations Option.
c. Materials quantities committed under this alternative at the Hanford Site based on Project Data Sheets in Appendix C.8.

5.2.13.4 Impacts to Facilities that Would Receive Waste from the Waste Processing Alternatives

This section addresses possible impacts resulting from the disposition of wastes at facilities that are not part of the Idaho HLW & FD EIS waste processing alternatives. This includes waste that would go to other INEEL facilities such as the industrial waste disposal facility, as well as waste that would go offsite for final disposition at commercial facilities or other DOE-operated sites such as the Waste Isolation Pilot Plant. DOE assumes that facilities receiving these wastes would be operated in full compliance with all existing agreements and regulations. Therefore, the impacts of primary concern are whether appropriate facilities exist and have adequate capacity to support disposition of the waste. With the exception of the offsite disposal options for the low-level waste Class A and C type grout under the Separations Alternative and the vitrified low-level waste fraction under the Minimum INEEL Processing Alternative, final disposal facilities or sites are identified for each of the product waste types that are put into a disposable form (i.e., product wastes generated from alternatives that include waste processing). For the non-product wastes, a specific disposition site is currently identified only for the industrial waste category. The following paragraphs discuss each of the product (low-level waste, transuranic waste, and HLW) and process (industrial, hazardous, low-level, and mixed low-level waste) waste types that would be produced from the proposed action.

Product Low-Level Waste Fraction – The product low-level waste consists of the Class A and Class C type grout that would be produced under the Full Separations and Planning Basis Options and Transuranic Separations Option, respectively. Both the Full and Transuranic Separations Options include disposal options where the grout would be disposed of either in a newly constructed disposal facility (the base case), or in the emptied Tank Farm and bin sets. If either of these alternatives/option combinations were to be implemented, the waste would not adversely affect the disposal facility because the facility would have been planned specifically for the proposed usage. Under all three Separations Alternative options, a disposal option for the low-level waste Class A or Class C type grout would call for its disposal at an offsite facility. Currently, DOE has not identified a specific receiving facility for the grout under this disposal option. DOE has evaluated transportation-related impacts based on the Envirocare of Utah, Inc. disposal site, 80 miles west of Salt Lake City for the low-level waste Class A type grout and the Chem-Nuclear Systems disposal site in Barnwell, South Carolina for the low-level waste Class C type grout. DOE assumes that the grout could be managed as low-level waste. Therefore, its potential impact could be estimated by comparing it to the amount of other low-level waste that would be managed within the DOE complex. According to DOE estimates, future waste management activities require the management of approximately 1.5 million cubic meters of low-level waste generated over the next 20 years (DOE 1997a). The 27,000 and 30,000 cubic meters of low-level waste Class A type grout that would be produced under the Full Separations and Planning Basis Options and the 23,000 cubic meters of low-level waste Class C type grout that would be produced under the Transuranic Separations Option, although a sizable quantity, is still a minor portion of the DOE low-level waste that would require disposal independently of the alternatives.

A product low-level waste fraction would also be produced under the Minimum INEEL Processing Alternative. Under this alternative, about 14,400 cubic meters of vitrified low-level waste would be transported from the Hanford Site to INEEL for disposal in a newly constructed disposal facility at INTEC or at an offsite disposal facility. DOE has evaluated transportation-related impacts based on the Envirocare of Utah, Inc. disposal site. This vitrified low-level waste would represent a minor portion of the DOE low-level waste that would require disposal independently of the waste processing alternatives.

Product Transuranic Waste - Other product waste types identified in this section would be transported offsite for disposal (Waste Isolation Pilot Plant for transuranic waste and a geologic repository for HLW). A primary objective of the processes that would produce these wastes would be to generate a waste form that would meet acceptance criteria for the appropriate repository. These facilities would, therefore, be expected to accept these types of waste unless content or concentration type concerns might exist. The remaining concern would be whether waste from the waste processing alternative would pose capacity issues.

According to the *Waste Isolation Pilot Plant Disposal Phase Final Supplemental EIS*, current limits and agreements place the capacity of the Waste Isolation Pilot Plant repository at 175,600 cubic meters, of which 7,080 cubic meters can be remote handled. DOE (1997b) presents an estimate for the projected amount of transuranic waste that would be sent to the Waste Isolation Pilot Plant which puts the total quantity of remote-handled transuranic waste at slightly less than 5,000 cubic meters and slightly more than 140,000 cubic meters for the contact-handled transuranic waste. Based on these figures, the Waste Isolation Pilot Plant would have adequate capacity for both the contact-handled and remote-handled transuranic waste that, depending on the alternative and option selected, could result in as much as 7,500 cubic meters (Minimum INEEL Processing Alternative) and 360 cubic meters (Early Vitrification Option), respectively.

Additional restrictions on remote-handled transuranic waste under the Waste Isolation Pilot Plant Land Withdrawal Act (Public Law 102-579) could present problems for transuranic waste generated under the waste processing alternatives. These additional restrictions are as follows:

- Remote-handled transuranic waste containers shall not exceed 23 curies of radioactivity per liter maximum activity level averaged over the volume of the container.

- The total curies of remote-handled transuranic waste shall not exceed 5,100,000 curies of radioactivity.

Under the Transuranic Separations Option, the remote-handled transuranic waste that would be produced would average less than 2 curies per liter. The total radioactivity of this transuranic waste would be about 330,000 curies. Based on this information, the waste would be expected to meet the current Waste Isolation Pilot Plant requirements and limits for remote-handled transuranic waste.

Under the Early Vitrification Option, the remote-handled transuranic waste produced would average less than 2 curies per liter and total about 510,000 curies of activity. The radioactivity would be well below existing limits and the total would consume about one tenth of the 5,100,000 curie limit. The current identified DOE inventory for remote handled transuranic waste does not consume the curie limit for WIPP. An estimated 1.3 million curies remains, some of which may be used under this option.

Product High-Level Waste - The final disposition point for INEEL's HLW is expected to be a geologic repository, and the only site currently being considered for this repository is at Yucca Mountain in Nevada. Planning for this facility includes a base case inventory of spent nuclear fuel and HLW equivalent to 70,000 metric tons of heavy metal (MTHM). The base case allocates a portion of the total 4,667 MTHM, for HLW; however, current HLW inventory projections exceed this value. At this time there has been no determination of which waste would be shipped to the repository, or the order of shipments.

The planning for a repository at Yucca Mountain also includes analyses (modules) for "reasonably foreseeable future actions" that include accepting additional quantities of spent nuclear fuel and HLW. One of the modules being considered includes accepting all of the current inventory of HLW. As shown in Table 5.2-35, the volume of HLW that would be generated by INEEL from the various options ranges from 0 to 13,000 cubic meters.

Current planning for the repository is based on the premise that HLW will be in a vitrified form. This could represent another issue with regard to the repository's receipt of INEEL HLW because options being considered include the generation of HLW in non-vitrified forms. This issue is addressed further in Section 6.3.

Industrial Waste - Each of the alternatives would involve generation of industrial (non-hazardous and non-radiological) waste, and in each case this waste would be disposed of at INEEL. The INEEL's industrial/commercial disposal facility complex annually receives between 46,000 and 85,000 cubic meters of solid waste for disposal or recycling (LMITCO 1998). Under the waste processing alternatives, production of industrial waste could be as high as about 8,500 cubic meters per year during construction (Table 5.2-31) and about 3,000 cubic meters per year during operations (Table 5.2-33). The large quantities generated during construction would be for a relatively short period, and some of these waste materials may be disposed of as clean construction rubble rather than take up room in the disposal facility. The operations phase represents by far the longer duration activity. The peak annual production of industrial waste during this phase is small in comparison to the volumes currently disposed of at the INEEL disposal facility. DOE expects that the quantities of solid industrial waste that would be produced under any of the alternatives would not cause problems for the existing INEEL disposal facility operations (EG&G 1993).

Hazardous Waste - Hazardous waste has been generated, or is projected to be generated, at most DOE sites. Much of this waste, particularly hazardous wastewater, is stored and treated onsite. However, based on fiscal year 1992 data, about 3,440 cubic meters of hazardous waste were sent to commercial facilities from DOE sites (DOE 1997a). In the Waste Management Programmatic EIS (DOE 1997a), DOE assumes that this quantity of hazardous waste (3,440 cubic meters or an equivalent 3,440 metric tons per the EIS's one-to-one conversion factor) is representative of DOE's current hazardous waste treatment requirements. This document identifies another 6,600 cubic meters of Toxic Substances Control Act, State-regulated hazardous waste, and environmental restoration generated hazardous waste that was shipped to commercial treatment in fiscal year 1992. As shown in Table 5.2-33, the peak annual quantities of hazardous waste that would be produced at the INEEL from the waste processing alternatives vary from 0 to 80 cubic meters depending on the alternative and option. These quantities are minor in comparison to those produced throughout the DOE complex and sent to commercial facilities for treatment and disposal. It is unlikely these additional wastes would adversely impact the ability of commercial facilities to manage hazardous waste. The Waste Management Programmatic EIS also makes the assumption that if additional capacity is needed, new DOE facilities or offsite commercial facilities will be available (DOE 1997a).

Mixed Low-Level Waste - Mixed low-level waste is either generated, projected to be generated, or stored at 37 DOE sites. DOE estimates that approximately 137,000 cubic meters of mixed low-level waste will be generated over the next 20 years (DOE 1997a). Analysis in the Waste Management Programmatic EIS assumes use of existing and planned facilities in the management of this waste until their capacities are met. Then if additional capacity is needed, DOE assumes new facilities would be constructed. Total quantities of mixed low-level waste produced during construction and operations under the proposed action would be about 10,000 cubic meters or less. These estimated quantities are small enough in comparison to DOE's 20-year projection of mixed low-level waste generation that they should not adversely impact DOE's plans for the management of this type waste. This is more evident when it is realized that personal protective equipment would make up most of the mixed low-level waste in Tables 5.2-31 and 5.2-32. This material could easily be subjected to significant reductions in volume through compaction and is normally amenable to treatment through incineration for even greater reduction in volume.

Low-Level Waste - Low-level waste is routinely generated at the INEEL and will continue to be generated in the future. As identified in Section 4.14 (Table 4-27), annual production of low-level waste at the INEEL is currently about 6,400 cubic meters. Although the peak annual quantity of low-level waste generated under the proposed action could be as high as 1,400 cubic meters, the highest annual average would be only about 400 cubic meters. These quantities should not overload the site's capacity and capability to accumulate, manage, and transport this type waste.

On a DOE complex-wide basis, low-level waste is generated, projected to be generated, or stored at 27 DOE sites. According to DOE estimates, approximately 1.5 million cubic meters of low-level waste will be generated over the next 20 years (DOE 1997a). Estimates of low-level waste generation from the proposed action vary from about 1,200 to 10,200 cubic meters over the active life of the project, depending on the alternative (see Table 5.2-32). These quantities are minor in comparison to the amount that would be produced from other DOE activities and should have no more than a minor impact on the ability of the DOE complex facilities to manage low-level waste. The Waste Management Programmatic EIS (DOE 1997a) assumes that new facilities will be constructed if additional capacity is needed.

5.2.14 FACILITY ACCIDENTS

Facility accidents are unplanned, unexpected, and undesirable events that have the potential to harm workers, the public, and the environment. Accidents in an EIS are defined as undesired events, or combinations of events, that can occur during or as a result of implementing an alternative and that have the potential to result in human health impacts or environmental impacts. Accidents may occur as a result of natural phenomena, such as earthquakes, from operational errors, or failures of process equipment. Accidents can result in exposure to direct health impacts (exposure to fires or explosions), exposure to ionizing radiation, exposure to hazardous chemicals, or combinations of these hazards. This section presents a summary of the accident analysis for the waste processing alternatives described in Chapter 3. Section C.4.1 in Appendix C.4, Facility Operational Accidents for Waste Processing Alternatives, contains further discussion of this accident analysis. Figure C.4-5 in Appendix C.4 provides the visual relationship of the *Idaho High-Level Waste and Facilities Disposition EIS Facility Accidents Technical Resource Document (TRD;* DOE 1999) components to the facility accident summary contained in this section of the EIS.

Each alternative and option being considered in this Idaho HLW & FD EIS requires an analysis of facility accidents as one of the environmental impacts, particularly to human health and safety, associated with its implementation. An accident analysis is performed to identify indirect environmental impacts associated with accidents that would not necessarily occur but which are reasonably foreseeable and could result in significant impacts from air releases. Although most safety assurance evaluations of facility accidents indicate that industrial accidents are the largest single contributor to the overall health and safety risk associated with the implementation of an alternative, industrial accident risks are evaluated separately in this EIS (see Section 5.2.10, Health and Safety).

Since the potential for accident impacts varies substantively for different facilities and operations associated with waste processing alternatives, facility accidents may provide a key discriminator among waste processing alternatives.

Accident analysis requires a technical information base that includes descriptions of potentially bounding accidents (scenarios), as well as the likelihood of occurrence, source term, and predicted consequences of each accident. The scope of the accident analysis involves identification of bounding accidents for HLW management activities and determination of source terms for each bounding event. Primary activities performed in the analysis includes the following:

- Identification of the processes associated with each alternative
- Definition of a set of process element evaluations for each alternative that comprehensively assesses accidents and can be jointly used to establish bounding accidents for each alternative
- Identification and description of the bounding abnormal, design basis, and beyond design basis accident for each process element
- Development of source terms and description of the basis for estimating source terms and consequences for the bounding accidents
- Calculation of potential impacts to human receptors from each accident

The scope of this facility accident analysis does not include:

- Evaluation of facility accidents occurring at sites other than INEEL
- Evaluation of accidents associated with transportation of radioactive or hazardous material, other than transportation within a site as part of facility operations; the impacts of transportation are presented in Section 5.2.9
- Evaluation of the bounding accident potential associated with facility closure

activities; the impacts of facility closure and disposition activities are included in Section 5.3.11.

5.2.14.1 Historical Perspective

Most of the historical INEEL accidents, such as the release of chlorine gas at Argonne National Laboratory-West on April 15, 1994, are less severe than the postulated accidents analyzed in this study. The primary historical cause of fatalities to INEEL workers has been industrial accidents, and risks to the public from INEEL facility industrial accidents have been analyzed in detail and have been determined to be low (DOE 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 this EIS included concerns about potential accidents, the historical record shows the industrial accident rate for DOE facilities at the INEEL is somewhat lower (Millet 1998) compared to the rate in the DOE complex overall. The historic accident rate compares favorably to national average rates compiled for various industry groups by the National Safety Council (NSC 1993) and Idaho averages compiled from State statistics (DOE 1993a).

One measure of the expected effectiveness of site management in controlling facility accident risks at future facilities is the effectiveness of current management in controlling risk to workers. The Computerized Accident Incident Reporting System database that chronicles injuries, accidents, and fatalities to workers at INEEL can be used as a measure of management effectiveness in controlling the risk of fatal industrial accidents to involved and co-located workers. This assumption is based on the fact that control over all accidents in the workplace is a requirement for controlling fatal accidents.

Historically at INEEL, fatal accidents represent approximately 0.1 percent of all accidents. Accident data are typically collected in terms of different types of activities. Based on the different types of activities in standard accident databases, "construction" is considered the most applicable to the activities that will be occurring at the INEEL during HLW processing. From the SNF & INEL EIS (DOE 1995), the rate of injury/illness for construction activities in the DOE complex was 6.2 per 100 worker-years and the rate of injury/illness for construction activities in private industry was 13 per 100 worker-years from 1988-1992. From 1993-1997, the rate of injury/illness for construction activities at INEEL was 5.4 per 100 worker-years (Fong 1999). These data support the conclusion that the injury/illness rate at INEEL is slightly lower than DOE as a whole and significantly lower than private industry. The fatality rate from 1993-1997 was approximately 0.05 per 100 worker-years higher than the previously reported fatality rate to 1992 and is due to the occurrence of a fatality at the INEEL in 1996. An additional INEEL fatality occurred in 1998. Incorporating this 1998 fatality into the industrial accident rate using a Baysean update results in a fatality rate of 0.14 per 100 worker-years, which is clearly greater than the fatality rate for the DOE complex as a whole. Additional detail in the derivation of industrial accident rates is provided in Appendix C.4.

During implementation, each of the waste processing alternatives temporarily adds risk to humans and the environment during the life of the project. Implementation risk results from the activities associated with implementing a waste processing alternative. This implementation risk, which can be thought of as the "risk from doing something," is illustrated qualitatively in Figure 5.2-6 as the potentially negative impact of a waste processing alternative. Implementation risk to humans is the sum of risk from facility accidents (i.e., accidents involving release of or exposure to radioactive or chemical materials), transportation accidents, industrial accidents, and accrued occupational exposures during operations. Facility accidents involve risk to the public and are a potential discriminator for waste processing alternatives. Environmental risk is represented on Figure 5.2-6 as both the initial

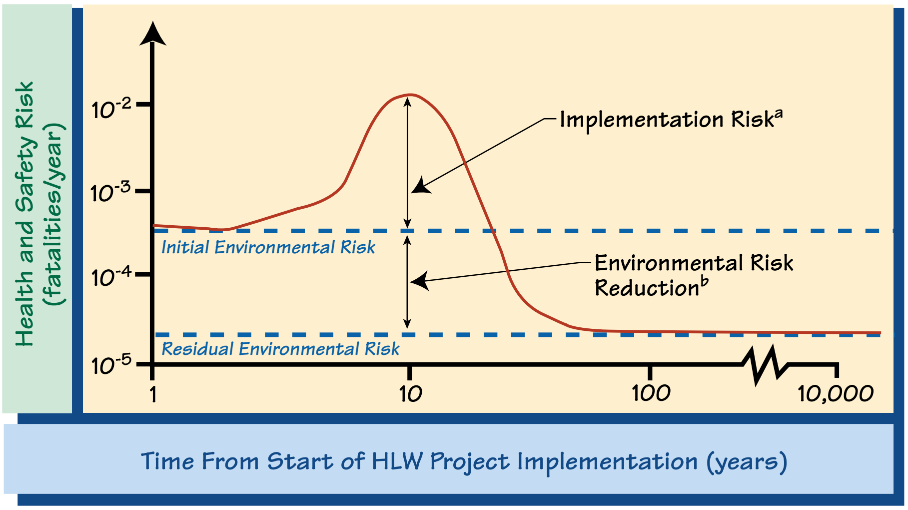


FIGURE 5.2-6.
Conceptual relationship of implementation risk to environmental risk.

a Implementation Risk is that which results from the activities associated with implementing the waste processing alternative. Implementation Risk includes risk to involved workers, co-located workers, the public, and the environment. Implementation Risk is the sum of risk from facility accidents (i.e., release of radioactive and chemical materials), industrial accidents, and accrued occupational exposures during normal operations. Significant disparities in the expected Implementation Risk can be a discriminator among waste processing alternatives.

b Environmental Risk is associated with existing environmental contamination or with materials that could constitute a hazard to humans or the environment, if released. The purpose of the waste processing alternatives is the reduction of environmental risk associated with past processes at INTEC that resulted in accumulation of HLW and related wastes. Environmental Risk Reduction involves removal of contamination or the hazards associated with materials at a facility by removing them, by rendering them immobile, or by otherwise rendering them inaccessible to human or environmental contact. The effectiveness of Environmental Risk Reduction is a potential discriminator among waste processing alternatives.

environmental risk (upper dashed line) and the long term residual environmental risk (lower dashed line). Environmental impacts were not evaluated separately, human impacts were the primary focus rather than flora and fauna impacts. Observational data is not available to predict future performance of planned waste processing facilities. Safety assurance documents such as facility safety analysis reports and safety analysis reports for packaging provide some sense of public risk concerns at DOE facilities and operations. A perspective on the implementation risk for waste processing alternatives is obtained through an analysis of radiological and toxicological accidents supported by the TRD.

Relative contribution to worker risk from facility accidents, industrial accidents, and occupational exposures is shown qualitatively in Figure 5.2-7. Figure 5.2-7 shows that, for some waste processing alternatives, implementation risk is more likely to be dominated by industrial accidents and unavoidable occupational exposures. What is important is that facility accident risks to workers typically bound those risks to the public. Facility risk to workers will be dependent on the effectiveness of environmental safety and health management at future facilities associated with waste processing. An effective environmental, safety, and health program that manages risk to workers and the public is assumed in this accident analysis. The accident analysis presented in this section appraises the implementation risk of facility accidents for future facility operations associated with each of the major waste processing alternatives.

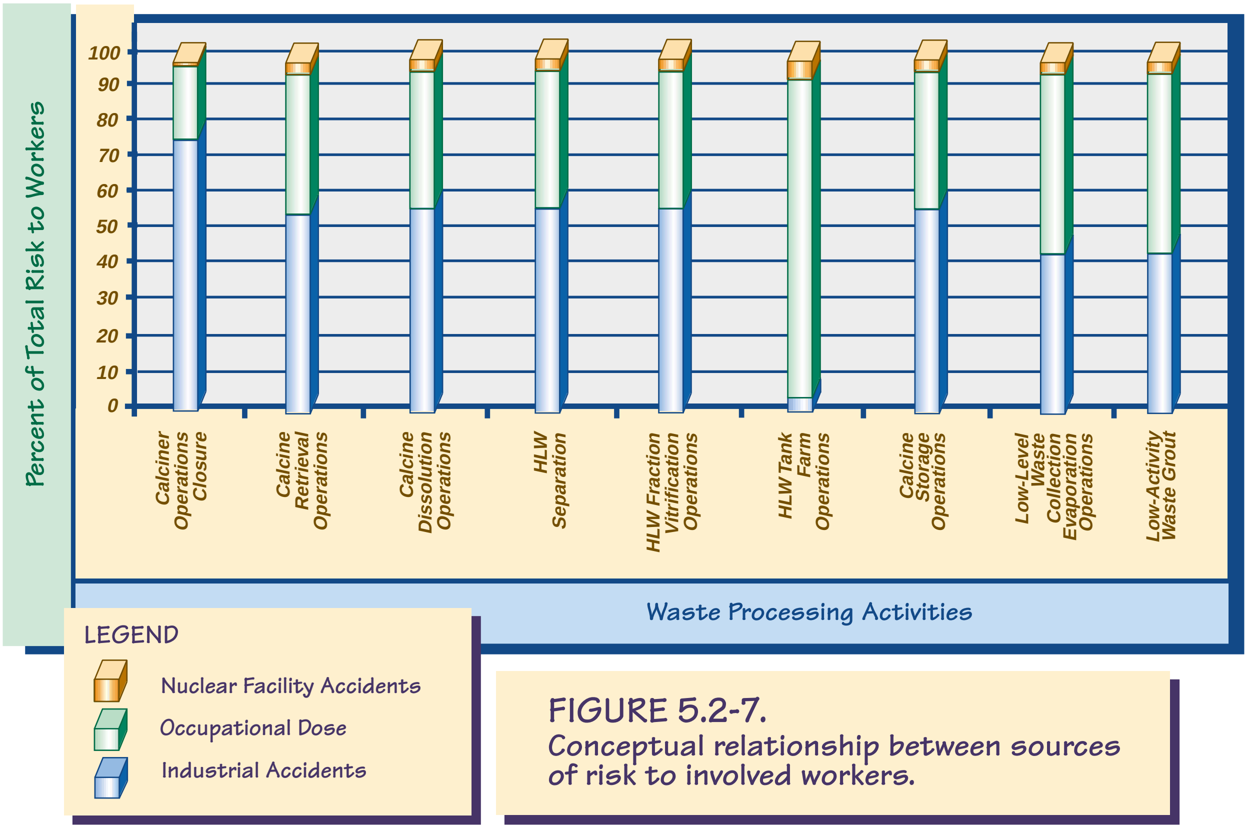


FIGURE 5.2-7.
Conceptual relationship between sources of risk to involved workers.

5.2.14.2 Methodology for Analysis of Accident Risk to Noninvolved Workers and the Public

The technical approach and methods used in this accident analysis are intended to be fully compliant with DOE technical guidelines for accident analysis (DOE 1993b). These same guidelines allow the incorporation by reference of information that was previously addressed in other EIS documents. For activities occurring at Hanford under the Minimum INEEL Processing Alternative, facility accidents due to the processing of INEEL waste are effectively analyzed in Jacobs (1998). Accidents that could occur at Hanford during the processing of INEEL waste are bounded by accidents that are defined for the TWRS waste treatment alternatives. In addition, accidents at WIPP are examined in site-specific NEPA documents prepared for WIPP. This approach is not only permissible in DOE National Environmental Policy Act guidelines, they constitute a reasonable method of assuring that there is not a "double counting" of impacts associated with DOE activities. The DOE technical guidelines require the identification of three broad frequency ranges of potential accidents: abnormal, design basis, and beyond design basis accidents that are reasonably foreseeable and bounding for each alternative. As used in this EIS, abnormal events have frequencies equal to or greater than once in a thousand years of facility operation; design basis accidents have frequencies equal to or greater than once in a million years but less than once in a thousand years; and beyond design basis events have frequencies equal to or greater than once in ten million years but less than once in a million years. 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. 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.

This EIS defines a bounding accident as the reasonably foreseeable event (i.e., not requiring extraordinary initiating events or unrealistic progressions of events to occur during facility operation) that has the highest environmental impacts, particularly human health and safety impacts, among all reasonably foreseeable accidents identified for an alternative. This analysis discusses possible causes, assumptions, likelihoods of occurrence, and consequences for the bounding accident within each frequency category. Some accidents in the abnormal and design basis frequency ranges are based on existing analyses, such as facility safety analysis reports.

DOE performed accident analyses of waste processing facilities that are currently operating using data from facility safety analysis reports, facility operating experience, and probabilistic data from similar facilities and operations. Accident analysis of facilities that have not yet been designed (including most facilities proposed in this HLW & FD EIS to implement waste processing alternatives) uses information primarily from technical feasibility studies performed to ascertain process feasibility and identify process implementation costs (Fluor Daniel 1997). Information from the TRD used in the accident analysis includes preliminary inventories of material at risk, process design data, and some overall design features. Methods used to assess the potential for facility accidents are based primarily on DOE guidance, experience with similar systems, and understanding of the INTEC site layout. Documents such as facility safety analysis reports, safety reviews, and unresolved safety question determinations evaluate the potential for harm as part of the process of assuring high levels of safe facility operation. While these documents are available for existing facilities, they have not been available to DOE given the early state of development in most waste processing alternatives.

The EIS accident analysis of HLW treatment facilities incorporates the following three levels of screening analyses (definition of special terms follows the three levels):

1. DOE performed a screening evaluation of major facilities and identified various operations needed to implement waste processing alternatives (referred to herein as process elements) to assess the potential for significant facility accidents. Process element attributes that infer the existence of significant process hazards include inventories of hazardous or radioactive materials, dispersible physical forms, and the potential for energetic releases during operation.

2. DOE performed detailed accident analyses beginning with the description of activities, inventories, and conditions pertinent to the accident analysis. DOE compared a standardized set of "accident initiating events" against the described set of activities, inventories, and operating conditions to identify and describe accident scenarios.

3. Finally, DOE grouped accident scenarios into the three major frequency categories and the accident scenario in each frequency range with the highest potential risk of health and safety impacts to offsite persons or noninvolved onsite workers (the potentially bounding accident scenario) was selected for consequence evaluation.

An "accident scenario" consists of a set of causal events starting with the "initiating event" that can lead to release of radioactive or hazardous materials with the potential to cause injury or death. Therefore, along with the initiator, accident scenarios include events such as the failure of facility safety functions or failure of facility defense in depth features.

An accident "initiating event" of varying frequency and severity can challenge and sometimes degrade the safety functions of the facility. For purposes of the accident analysis, DOE considered six classes of initiating events/accidents types in detailed accident reviews:

- Fires during facility operations
- Explosions during facility operations
- Spills (radiological or hazardous material)

- Criticality (nuclear chain reaction)
- Natural phenomena (for example: flood, lightning, seismic event, high wind)
- External events (human-caused events external to a facility that may impact the safe operation and integrity of the facility)

A team of qualified analysts performed a system review to evaluate potential accidents that could arise from operation of the identified facilities and activities under each waste processing alternative. The systems accident analysis team included personnel knowledgeable in HLW management, facility operation, radiological hazards, chemical hazards, hazards identification, source term development, and consequence evaluation. The accident analysis team employed a systems review process to determine the bounding accident scenarios for each activity. Also, the accident analysis team sought to capture and retain the intermediate work steps that comprised the scenario selection process. This secondary goal served the dual purpose of ensuring traceability of the selection process, as well as providing a link to the source term estimation and evaluation.

The screening process identified a subset of process elements requiring detailed accident analysis to assess the potential for bounding accidents to occur. In some cases, the bounding accident potential for vulnerable process elements of several alternatives could be evaluated using a single accident evaluation. The resulting set of required accident analysis used to identify potentially bounding accident scenarios for the waste processing alternatives is shown in Table 5.2-37. From Table 5.2-37, there are 22 separate accident analyses used to identify potentially bounding accident scenarios. The 22 accident analyses are identified on Table 5.2-37 as the shaded blocks. Each accident analysis identifies potentially bounding accident scenarios in the three frequency classes, abnormal events, design basis events, and beyond design basis events.

Appendix C.4 provides a discussion of the forms used to document the bounding accident identification process. In these forms, the hazards identification block contains the six initiators or accident types with the accident frequency categories previously described. Sabotage and terrorist activities were not addressed separately, since sabotage and terrorism are not random or accidental events. The consequences from these acts are likely bounded by events already defined as accidents.

Source Term Identification

Radiological Releases – For non-criticality radiological releases, the source term is defined as the amount of respirable material that is released to the atmosphere from a specific location. The radiological source term for non-criticality events is dependent upon several factors including the material at risk, material form, initiator, operating conditions, and material composition. The technical approach described in DOE-STD-3010 (DOE 1994) is modified in the Safety Analysis and Risk Assessment Handbook (Peterson 1997) and was used to estimate source terms for radioactive releases. This approach applies a set of release factors to the material at risk constituents to produce an estimated release inventory. The release inventory was combined with the conditions under which the release occurs and other environmental factors to produce the total material released for consequence estimation. Factors applied in the DOE-STD-3010 (DOE 1994) source term method and additional details with respect to source term estimation are contained in Appendix C.4 and in the TRD.

For criticality events, the source term also includes a prompt dose, which is a function of the number of fissions. Criticality was assessed in each accident analysis evaluation. Only one bounding criticality accident scenario was identified in the accident analysis evaluations. DBE 21, Transuranic Waste Stabilization and Preparation for Transport to the Waste Isolation Pilot Plant, identified an inadvertent criticality during transuranic waste shipping container loading operations as a result of vulnerability to loss of control over storage geometry. This scenario is identified in Table 5.2-38 under the Minimum INEEL Processing Alternative. The

Table 5.2-37. Accident evaluations required.

Vulnerability to accidents by process element[a]	Project Element Designator	No Action Alternative	Continued Current Operations Alternative	Separations Alternative: Full Separations Option	Separations Alternative: Planning Basis Option	Separations Alternative: Transuranic Separations Option	Non-Separations Alternative: Hot Isostatic Pressed Waste Option	Non-Separations Alternative: Direct Cement Waste Option	Non-Separations Alternative: Early Vitrification Option	Minimum INEEL Processing Alternative
New Waste Calcining Facility Continued Operations			AA1[b]		AA1		AA1	AA1		
New Waste Calcining Facility High Temperature & Maximally Achievable Control Technology Mods	E2		AA2		AA2		AA2	AA2		
Long-Term Onsite Storage of MTRU waste/SBW	E3	AA22								
Calcine Retrieval and Onsite Transport	E4	AA3	AA3	AA3	AA3	AA3	AA3	AA3	AA3	AA3
MTRU waste/SBW Retrieval & Onsite Transport	E5		AA24	AA24	AA24	AA24	AA24	AA24	AA24	AA24
Separation	E6		AA6	AA4	AA4	AA5				AA6
Class C Grout	E7					AA7				AA7
Borosilicate Vitrification	E8			AA8	AA8				AA9	
HLW/MTRU waste/SBW Immobilization for Transport (e.g., Cement, HIP, Polymer)	E9						AA11	AA12		AA10
Liquid Waste Stream Evaporation	E10		AA14	AA14	AA14	AA14	AA14	AA14		
Additional Off-gas Treatment	E11			AA15	AA15	AA15	AA15	AA15	AA15	AA15
LLW Class C Type Grout Disposal	E12					AA16				
LLW, MLLW Disposal	E13									
HLW Onsite Storage for Transport	E14									AA17
Long-Term Onsite Storage of Calcine in Bin Sets	E15	AA20	AA20							
HLW/HLW fraction/MTRU waste/SBW Stabilization & Preparation for Transport	E16								AA23	AA18
Transuranic Waste Stabilization & Preparation for Transport	E17		AA21		AA21	AA21	AA21	AA21		AA21
Transuranic Waste Onsite Storage	E18									

a. Two accident evaluations (13 and 19) are no longer used.
b. In this table and throughout this document the AA# refers to the accident analysis that was performed in Appendix A of the TRD.
LLW = low-level waste; MLLW = mixed low-level waste; MTRU = mixed transuranic.

Table 5.2-38. Summary of bounding radiological events for the various waste processing alternatives.

Bounding accident analysis	Process title	Event Description	Maximally exposed individual dose (millirem)	Maximally exposed individual latent cancer fatality probability	Noninvolved worker dose (millirem)	Noninvolved worker latent cancer fatality probability	Offsite population (person-rem)	Latent cancer fatalities to offsite population
No Action Alternative								
ABN20	Long-Term Onsite Storage of Calcine in bin sets	Bin set system degradation over time results in failure of the outer containment and a portion of the internal containment in a bin set and the possibility of opening a bin set to the environment. Likelihood of this event increases after 2095 when monitoring and maintenance requirements would no longer be met.	170	8.5×10^{-5}	1.2×10^{4}	4.8×10^{-3}	1.3×10^{3}	0.65
DBE20	Long-Term Onsite Storage of Calcine in bin sets	Seismic failure of a bin set structure and equipment such that a release occurs with a direct pathway to the environment (no interdiction for 30 days).	9.7×10^{3}	4.9×10^{-3}	6.6×10^{5}	0.26	6.6×10^{4}	33
BDB20	Long-Term Onsite Storage of Calcine in bin sets	An aircraft crash into a bin set causes failure of the structure and the release of materials from a portion of the internal containment.	420	2.1×10^{-4}	2.9×10^{4}	0.012	3.5×10^{3}	1.8
Continued Current Operations Alternative								
ABN20	Long-Term Onsite Storage of Calcine in bin sets	Bin set system degradation over time results in failure of the outer containment and a portion of the internal containment in a bin set and the possibility of opening a bin set to the environment. Likelihood of this event increases after 2095 when monitoring and maintenance requirements would no longer be met.	170	8.5×10^{-5}	1.2×10^{4}	4.8×10^{-3}	1.3×10^{3}	0.65
DBE20	Long-Term Onsite Storage of Calcine in bin sets	Seismic failure of a bin set structure and equipment such that a release occurs with a direct pathway to the environment (no interdiction for 30 days).	9.7×10^{3}	4.9×10^{-3}	6.6×10^{5}	0.26	6.6×10^{4}	33
BDB20	Long Term Onsite Storage of Calcine in bin sets	An aircraft crash into a bin set causes failure of the structure and the release of materials from a portion of the internal containment.	420	2.1×10^{-4}	2.9×10^{4}	0.012	3.5×10^{3}	1.8

Table 5.2-38. Summary of bounding radiological events for the various waste processing alternatives (continued).

Bounding accident analysis	Process title	Event Description	Maximally exposed individual dose (millirem)	Maximally exposed individual latent cancer fatality probability	Noninvolved worker dose (millirem)	Noninvolved worker latent cancer fatality probability	Offsite population (person-rem)	Latent cancer fatalities to offsite population
Full Separations Option								
ABN24	Mixed Transuranic Waste/SBW Retrieval and Onsite Transport	Operational error or equipment failure results in structural failure of one of the two mixed transuranic waste/SBW receiving tanks in a constructed receiving facility.	5.3×10^{-3}	2.7×10^{-9}	0.36	1.4×10^{-7}	0.056	2.8×10^{-5}
DBE04	Full Separation	An organic-oxidant (red-oil) explosion during solvent treatment in the transuranic separation or strontium extraction separations processes, results in release of a significant quantity of radioactive and chemically hazardous material and simultaneous failure of operational confinement.	460	2.3×10^{-4}	3.2×10^{4}	0.013	3.5×10^{3}	1.8
BDB08	Borosilicate Vitrification	An aircraft crash into the facility results in structural failure, process equipment damage, and subsequent fire.	6.8×10^{4}	0.034	4.6×10^{6}	1.8	6.0×10^{5}	300
Planning Basis Option								
ABN24	Mixed Transuranic Waste/SBW Retrieval and Onsite Transport	Operational error or equipment failure results in structural failure of one of the two mixed transuranic waste/SBW receiving tanks in a constructed receiving facility.	5.3×10^{-3}	2.7×10^{-9}	0.36	1.4×10^{-7}	0.056	2.8×10^{-5}
DBE01	New Waste Calcining Facility Continued Operations	A calciner vessel explosion due to loss of operational control results in subsequent failure of HEPA filtration and a direct pathway to the environment.	350	1.8×10^{-4}	2.4×10^{4}	9.6×10^{-3}	5.9×10^{3}	2.9
BDB08	Borosilicate Vitrification	An aircraft crash into the facility results in structural failure, process equipment damage, and subsequent fire.	6.8×10^{4}	0.034	4.6×10^{6}	1.8	6.0×10^{5}	300

Table 5.2-38. Summary of bounding radiological events for the various waste processing alternatives (continued).

Bounding accident analysis	Process title	Event Description	Maximally exposed individual dose (millirem)	Maximally exposed individual latent cancer fatality probability	Noninvolved worker dose (millirem)	Noninvolved worker latent cancer fatality probability	Offsite population (person-rem)	Latent cancer fatalities to offsite population
		Transuranic Separations Option						
ABN16	Low-Level Waste Class C Type Grout Disposal	Failure of the above ground grout transport line to the Container Filling, Storage, and Shipping Area.	5.8	2.9×10^{-6}	390	1.6×10^{-4}	71	0.035
DBE05	Transuranic Separation	An organic-oxidant (red-oil) explosion, during solvent treatment results in release of a significant quantity of radioactive and chemically hazardous material and simultaneous failure of operational confinement.	1.3×10^{3}	6.5×10^{-4}	8.6×10^{4}	0.034	7.9×10^{3}	4.0
BDB05	Transuranic Separation	An earthquake with subsequent fire causes failure of three transuranic waste fraction surge tanks such that a release occurs with a direct pathway to the environment.	1.3×10^{3}	6.5×10^{-4}	8.6×10^{4}	0.034	7.9×10^{3}	4.0
		Hot Isostatic Pressed Waste Option						
ABN24	Mixed Transuranic Waste/SBW Retrieval and Onsite Transport	Operational error or equipment failure results in structural failure of one of the two mixed transuranic waste/SBW receiving tanks in a constructed receiving facility.	5.3×10^{-3}	2.7×10^{-9}	0.36	1.4×10^{-7}	0.056	2.8×10^{-5}
DBE01	New Waste Calcining Facility Continued Operations	A calciner vessel explosion due to loss of operational control results in subsequent failure of HEPA filtration and a direct pathway to the environment.	350	1.8×10^{-4}	2.4×10^{4}	9.6×10^{-3}	5.9×10^{3}	2.9
BDB14	Liquid Waste Stream Evaporation	An aircraft crash impacts the evaporator process building and release material in the high-activity waste surge tanks. The fire and crash are assumed to breach the building and provide a direct release path to the environment.	460	2.3×10^{-4}	3.2×10^{4}	0.013	3.5×10^{3}	1.8

Table 5.2-38. Summary of bounding radiological events for the various waste processing alternatives (continued).

Bounding accident analysis	Process title	Event Description	Maximally exposed individual dose (millirem)	Maximally exposed individual latent cancer fatality probability	Noninvolved worker dose (millirem)	Noninvolved worker latent cancer fatality probability	Offsite population (person-rem)	Latent cancer fatalities to offsite population
Direct Cement Waste Option								
ABN24	Mixed Transuranic Waste/SBW Retrieval and Onsite Transport	Operational error or equipment failure results in structural failure of one of the two mixed transuranic waste/SBW receiving tanks in a constructed receiving facility.	5.3×10^{-3}	2.7×10^{-9}	0.36	1.4×10^{-7}	0.056	2.8×10^{-5}
DBE01	New Waste Calcining Facility Continued Operations	A calciner vessel explosion due to loss of operational control results in subsequent failure of HEPA filtration and a direct pathway to the environment.	350	1.8×10^{-4}	2.4×10^{4}	9.6×10^{-3}	5.9×10^{3}	2.9
BDB12	Direct Cement Waste Immobilization	An aircraft crash into the Direct Cement Waste Facility causes failure of the static gravity mixer.	1.0×10^{3}	5.0×10^{-4}	7.1×10^{4}	0.028	1.1×10^{4}	5.6
Early Vitrification Option								
ABN24	Mixed Transuranic Waste/SBW Retrieval and Onsite Transport	Operational error or equipment failure results in structural failure of one of the two mixed transuranic waste/SBW receiving tanks in a constructed receiving facility.	5.3×10^{-3}	2.7×10^{-9}	0.36	1.4×10^{-7}	0.056	2.8×10^{-5}
DBE09	Borosilicate Vitrification	A steam explosion occurs in the melter due to intrusion of water into the melt cell, which causes catastrophic failure of the melter and release of vitrified waste material.	1.6	8.0×10^{-7}	110	4.4×10^{-5}	14	7.0×10^{-3}
BDB09	Borosilicate Vitrification	An aircraft crash into the facility results in structured failure of the operating melter, seal pot, and the glass canister, and a subsequent fire.	730	3.7×10^{-4}	5.0×10^{4}	0.02	6.6×10^{3}	3.3

Table 5.2-38. Summary of bounding radiological events for the various waste processing alternatives (continued).

Bounding accident analysis	Process title	Event Description	Maximally exposed individual dose (millirem)	Maximally exposed individual latent cancer fatality probability	Noninvolved worker dose (millirem)	Noninvolved worker latent cancer fatality probability	Offsite population (person-rem)	Latent cancer fatalities to offsite population
Minimum INEEL Processing Alternative								
ABN17	High-Level Waste Interim Storage for Transport	A spill of material during canister filling operations with some of the spilled material would be entrained in the ventilation system and be exhausted into the environment.	0.25	1.310^{-7}	17	6.8×10^{-6}	2.6	1.3×10^{-3}
DBE21	Transuranic Waste Stabilization and Preparation for Transport to Waste Isolation Pilot Plant	Inadvertent criticality during transuranic waste shipping container loading operations as a result of vulnerability to loss of control over storage geometry.	3.0	1.5×10^{-6}	210	8.4×10^{-5}	120	0.06
BDB17	High-Level Waste Interim Storage for Transport	An aircraft crash breaches the facility housing and impacts a rail car containing four casks. A subsequent fire could result in the release of the inventory.	4.9×10^{3}	2.5×10^{-3}	3.4×10^{5}	0.14	5.3×10^{4}	26
Cross-Cutting Accidents								
ABN03	Calcine Retrieval and Onsite Transport	Failure of a transfer line or cyclone housing due to operation error or equipment failure causing direct impact of heavy object such as construction crane.	0.014	7.0×10^{-9}	0.94	3.8×10^{-7}	150	0.073
DBE03/20	Calcine Retrieval and Onsite Transport	A flood causes failure of bin set #1 structure and equipment such that a release occurs after 2000 with a direct pathway to the environment.	3.8	1.9×10^{-6}	260	1.0×10^{-4}	4.5×10^{4}	22

annual likelihood for this bounding accident is estimated to be between one chance in a thousand and one chance in a million per year of facility operation. This event could result in a large dose to a nearby, unshielded maximally exposed worker that is estimated to be 218 rem, representing a 1 in 5 chance of a latent cancer fatality. However, this same bounding analysis estimates a dose to the maximally exposed offsite individual at the site boundary (15,900 meters down wind at the nearest public access) to be only 3 millirem from this accident, representing a 2 per million increase in cancer risk to that person. Most waste processing alternatives do not contribute enough fissile materials in an aqueous environment to allow criticalities to develop. There have been three criticalities at INTEC (October 16, 1959; January 25, 1961; and October 17, 1978). All three events were a result of high uranium concentration aqueous solutions finding its way to geometrically unsafe storage areas.

Chemical Releases – Chemicals used in waste processing can pose risks to workers and the public. Many chemicals are in use at INTEC at present and the quantity and types of the chemicals change overtime. The accident analysis team evaluated those chemicals that could pose the most hazard. Chemicals that pose the greatest hazard to workers and the public are gases at ambient temperatures and pressures. An example of this type of gas is ammonia, which is stored under pressure as a liquid but quickly flashes to a vapor as it is released. Chemicals such as nitric acid that are liquids at ambient conditions also could pose a toxic hazard to immediate workers. However, the potential for these types of chemicals to become airborne and travel to nearby or offsite facilities is low. Therefore, this analysis focuses on those chemicals that are gases at ambient conditions.

Technically, the release mechanism of pressurized gases involves a fraction that flashes to vapor as the gas depressurizes and a fraction that drops to the ground and forms a boiling pool. The pool-boiling rate is a function of several factors: pool area, substrate material (e.g., soil, concrete, etc.), and substrate temperature. Another factor that influences the release is the degree to which liquid droplets become entrained into the flash fraction. See Appendix C.4 of this EIS and the TRD for additional information on chemical releases.

Receptor Identification

Radiological Releases – For radiological releases, DOE evaluated the health impact or consequence of the bounding accidents by estimating the radiation dose to human receptors and the number of latent cancer fatalities for the offsite population. Most radiation dose was due to inhalation. For criticality events, the dose also included exposure to prompt critical radiation. Human receptors are people who might be exposed to or affected by source terms resulting from accidents associated with the waste processing alternatives. Three categories of human receptors used in this evaluation are:

- **Maximally-Exposed Individual:** A hypothetical individual located at 5,900 meters from INTEC at the nearest public access point from the facility location where the release occurs.
- **Noninvolved Worker:** Onsite employees not directly involved in the site's waste processing operations and that are located 640 meters from INTEC.
- **Offsite Population:** The collective sum of offsite persons within a 50-mile radius of the INTEC facilities and within the path of the source term plume with the wind blowing in the most populous direction.

Chemical Releases – To determine the potential health effects to workers and the public that could result from accidents involving releases of chemicals and hazardous materials, the airborne concentrations of such materials released during an accident at varying distances from the point of release were compared to Emergency Response Planning Guideline (ERPG) values. The American Industrial Hygiene Association established ERPG values, which are specific to hazardous chemical substances, to ensure that necessary emergency actions are taken in the event of a release. ERPG severity levels are as follows:

- **ERPG-3.** Exposure to airborne concentrations greater than ERPG-3 values for a period greater than 1 hour results in an unacceptable likelihood that a person would experience or develop life-threatening health effects.

- **ERPG-2.** Exposures to airborne concentrations greater than ERPG-2 but less than ERPG-3 values for a period greater than 1 hour results in an unacceptable likelihood that a person would experience or develop irreversible or other serious health effects or symptoms that could impact a person's ability to take protective action.

- **ERPG-1.** Exposure to airborne concentrations greater than ERPG-1 but less than ERPG-2 values for a period of greater than 1 hour results in an unacceptable likelihood that a person would experience mild transient adverse health effects or perception of a clearly defined objectionable odor.

Consequences Assessment

Radiological source terms were used as input into the computer program "Radiological Safety Analysis Computer Program (RSAC-5)" to estimate dose consequences for radioactive releases. DOE used this program to determine the radiation doses at receptor locations from the airborne release and transport of radionuclides from each accident sequence. Meteorological data used in the program were selected to be consistent with previous INEEL EIS analyses (i.e., SNF & INEL EIS) and are for 95 percent meteorological conditions (DOE 1995). The 95 percent meteorological condition represents the meteorological conditions that could produce the highest calculated exposures. This is defined as that condition that is not exceeded more than 5 percent of the time or is the worst combination of weather stability class and wind speed.

The population radiation doses from the computer output were then converted into expected latent cancer fatalities using dose-to-risk conversion factors recommended by the National Council on Radiation Protection and Measurements. To be conservative, the National Council on Radiation Protection and Measurements assumes that any amount of radiation carries some risk of inducing cancer. DOE has adopted the National Council on Radiation Protection and Measurements factor of 5×10^{-4} latent cancer fatality for each person-rem of radiation dose to the general public for doses less than 20 rem. For larger doses, when the rate of exposure would be greater than 10 rad (radiation absorbed dose) per hour, the increased likelihood of latent cancer fatality is doubled, assuming the body's diminished capability to repair radiation damage. DOE calculated the expected increase in the number of latent cancer fatalities above those expected for the population.

The consequences from accidental chemical releases were calculated using the computer program "Areal Locations of Hazardous Atmospheres (ALOHA)." Because chemical consequences are based on concentration rather than dose, the computer program calculated air concentrations at receptor locations. Meteorological assumptions used for chemical releases were the same as used for radiological releases.

For each accident evaluation, conservative assumptions were applied to obtain bounding results. For the most part, the assumptions in the Idaho HLW & FD EIS were consistent with those applied in other EIS documents prepared at INEEL, such as the SNF & INEL EIS (DOE 1995). However, there were some assumptions that differed.

DOE only performed a comprehensive evaluation of accidents that could result in an air release of radioactive or chemically hazardous materials to the environment. The reason for this simplification was that the short time between the occurrence of an air release and the time it would impact human health through respiration would not allow for mitigation measures other than execution of the site emergency plan. Accidents that resulted in a release only to groundwater were not generally evaluated since the time between their occurrence and their impact on the public was assumed to be long enough to take comprehensive mitigation measures. The one exception, DOE did identify bounding groundwater release accidents for which effective mitigation might not be feasible.

Also, DOE only focused on the human health and safety impacts associated with air release accidents. Other environmental impacts would also result from such events, such as loss of farm production, land usage, and ecological harm. However, these consequences were not evaluated directly since the discrimination between waste processing alternatives could be made without them.

DOE further decided not to evaluate impacts from some initiators (i.e., volcanoes) because they determined that these initiators would not provide new opportunities to identify bounding accidents. Based on evaluations in the TRD, volcanic activity impacting the INTEC was considered a beyond design basis event. This would place the event with initiators such as aircraft crashes and beyond design basis earthquakes. However, based on the phenomena associated with these initiators, volcanic activity initiated events are considered bounded by other initiators. This is because the lava flow from the eruption (basaltic volcanism) would likely cover the affected structures. Therefore, the amount that is released from process vessels and piping due to lava flow would be limited and would be bounded by events such as aircraft crashes, where the entire inventory would be impacted and available for release. See Appendix C.4 (Section C.4.1.2.4) for more detail on volcanism.

5.2.14.3 Methodology for Integrated Analysis of Risk to Involved Workers

Health and safety risk to involved workers (workers associated with the construction, operation, or decontamination and decommissioning of facilities that implement a waste processing alternative) is a potentially significant "cost" of implementing waste processing alternatives, a source that has been systematically characterized and reported in this EIS. Together with health and safety risk to the public, evaluation of involved worker risk provides a comprehensive basis for comparing waste processing alternatives on the basis of contribution to the implementation risk due to accidents. Unlike health and safety risk to noninvolved workers and the public that results mainly from facility accidents and accidents occurring during transportation, health and safety risk to involved workers results from three sources, industrial accidents, exposure to radioactive materials during normal operations, and facility accidents.

- Industrial accident risk to involved workers can result from industrial activities needed to complete major projects that implement an alternative.

- Occupational risk to involved workers results from routine exposure to radioactive materials during industrial activities that implement an alternative.

- Facility accident risk to involved workers results from accidents that release radioactive or chemically hazardous materials, accidents (e.g., criticality) that could result in direct exposure to radiation, or energetic accidents (e.g,. explosions) that can directly harm workers.

Risk to involved workers from facility accidents is evaluated in a manner analogous to noninvolved workers and the public. Consequences for involved workers are estimated using information on bounding accidents in three frequency categories with the highest potential consequences to noninvolved workers and the public. Due to limitations on the accuracy of consequence prediction codes at locations near the origin of a release, doses to involved workers are estimated proportionally based on doses to noninvolved workers at 640 meters. The method used is intended to provide consistency with the definition of facility worker utilized in the SNF & INEL EIS (DOE 1995).

Risk to involved workers from occupational exposures and industrial accidents is appraised in the Health and Safety section of the EIS (5.2.10). In the accident analysis methodology, information used to generate worker risk due to industrial accidents and occupational exposures is integrated with results of the facility accidents evaluation to produce a comprehensive perspective on involved worker risk. Due to the relatively large uncertainties involved in estimating involved worker risk, the accident analysis methodology includes the use of Monte Carlo simulation as means of gaining perspective on the importance of sensitivities and uncertainties in the information base.

5.2.14.4 Radiological Impacts to Noninvolved Workers and the Public of Implementing the Alternatives

This section analyzes the impacts or consequences of implementing the waste processing alternatives and their options. It describes (1) the major processes of each alternative, (2) the bounding accident scenarios applicable to the major processes, and (3) the resulting impact to INEEL workers and the general public. The systematic accident analysis process employed by DOE identified potentially bounding accidents for each alternative/option. The results for radiological releases are expressed in terms of the estimated impacts for the maximally-exposed individual, noninvolved worker, offsite population, and the latent cancer fatalities for the offsite population. After evaluating the human health consequences associated with these potentially bounding accidents, DOE selected three bounding accidents (one abnormal, one design basis, and one beyond design basis) for each of the processes with the particular alternative/option. Consequences for each of the potentially bounding accident scenarios are given in the tabular summaries associated with each alternative and each frequency category in the TRD.

In general, the process used in selecting the bounding accident scenario was to select the scenario with the highest consequence within each frequency bin. In some cases, one scenario had the highest consequence for the maximally-exposed individual and noninvolved worker but another scenario had higher consequences for the offsite population and latent cancer fatalities. In these cases, the scenario with the higher consequences for the offsite population/latent cancer fatalities was selected. Although this is the rule of thumb, there were several exceptions to this.

1. Abnormal and Design Basis Events for the "Active" Alternatives – Operational failures associated with the removal of calcine from bin set 1 and flood-induced failure of bin set 1 are bounding abnormal and design basis events respectively that affect all waste processing alternatives/options. In order to compare waste processing alternatives, these two accidents have been shown separately in Table 5.2-38 as accidents that cross cut treatment alternatives. In order to provide additional resolution in determining the highest risk alternatives, the scenario with the second highest consequence is also highlighted as a "bounding" scenario.

2. Highest Risk vs. Highest Consequence Scenario – Risk is defined as the product of frequency and consequence. In some cases, the scenario with the perceived higher risk was selected even though another scenario had higher consequences. The frequency bands considered in the analysis were fairly wide. For instance, the design basis frequency band is from 1.0×10^{-3} per year to 1.0×10^{-6} per year. From a risk standpoint, a scenario that is a 1,000 times more likely (e.g., 1.0×10^{-3} per year vs. 1.0×10^{-6}, per year), has a higher risk than another scenario that has a consequence that is 100 times greater. Therefore, the approach taken was to select the higher frequency/lower consequence scenario as the bounding scenario. These are identified on a case-by-case basis and identified in the relevant sections following.

3. Reconsideration of Conservatism in Model – In some scenarios, assumptions used in the development of source terms for the accident scenarios were determined to be highly conservative under different operating conditions. For instance, the beyond design basis accident for AA14 was assumed to be the same as for AA4. This is true for most alternatives except for the Continued Current Operations Alternative due to the differences in process requirements. These are noted on a case-by-case basis and identified in the relevant sections following.

Summary tables in the TRD describe potentially bounding accidents and their forecasted consequences. The TRD also provides additional information with respect to the process used to identify potentially bounding accidents, their source terms, and consequences.

No Action Alternative

Alternative/Process Data – Three major processes or functions apply to and form the basis of this accident analysis for the No Action Alternative. These are Calcine Retrieval and Onsite Transport (bin set 1 only) (AA03), Long-Term On-Site Storage of calcine in bin sets (AA20), and Long-Term Storage of Mixed Transuranic Waste/SBW (AA22). A detailed description of each of these three major processes or functions can be found in Appendix I of the TRD.

Accident Consequence – The systematic accident analysis process employed by DOE identified potentially bounding accidents for the No Action Alternative associated with the three functional activities. After evaluating the human health consequences associated with these potentially bounding accidents, DOE selected three bounding accidents (one abnormal, one design basis, and one beyond design basis) for each of the three processes. Summary tables in the TRD describe the potentially bounding accidents and their forecasted consequences. The TRD also provides additional information with respect to the process used to identify potentially bounding accidents, their source terms, and consequences. Table 5.2-38 provides a summary of the bounding radiological events for the No Action Alternative. This summary table (5.2-38) shows that degradation of the bin sets over time (after 2095, ABN20), seismic failure of a bin set (after 2095, DBE20), and an aircraft crash into a bin set (BDB20) result in the bounding abnormal, design basis, and beyond design basis accidents, respectively, for this alternative.

Continued Current Operations Alternative

Alternative/Process Data – Eight major processes or functions apply to and form the basis of this accident analysis for the Continued Current Operations Alternative. These are New Waste Calcining Facility Continued Operation (AA01), New Waste Calcining Facility High Temperature and Maximum Achievable Control Technology Modifications (Off-Gas Treatment Facility Only) (AA02), Calcine Retrieval and On-Site Transport (Bin Set 1 Only) (AA03), Cesium Separation (Cesium Ion Exchange Only) (AA06), Liquid Waste Stream Evaporation (AA14), Long Term Onsite Storage of Calcine in Bin Sets (AA20), Transuranic Waste Stabilization and Preparation for Transport to Waste Isolation Pilot Plant (Transuranic or Transuranic and Strontium Feedstocks) (AA21), and Mixed Transuranic Waste/SBW Retrieval and Onsite Transport (AA24). A detailed description of each of these eight major processes of functions can be found in Appendix I of the TRD.

Accident Consequence – The systematic accident analysis process employed by DOE identified potentially bounding accidents for the Continued Current Operations Alternative associated with the eight functional activities. After evaluating the human health consequences associated with these potentially bounding accidents, DOE selected three bounding accidents (one abnormal, one design basis, and one beyond design basis) for each of the eight processes. Summary tables in the TRD. describe the potentially bounding accidents and their forecasted consequences. The TRD also provides additional information with respect to the process used to identify potentially bounding accidents, their source terms, and consequences. Table 5.2-38 provides a summary of the bounding radiological events for the Continued Current Operations Alternative. This summary table (5.2-38) shows that degradation of the bin sets over time (after 2095, ABN20), seismic failure of a bin set (after 2095, DBE20), and an aircraft crash into a bin set (BDB20) result in the bounding abnormal, design basis, and beyond design basis accidents, respectively, for this alternative.

Separations Alternative – Full Separations Option

Alternative/Process Data – Six major processes or functions apply to and form the basis of the accident analysis for the Full Separations Option. These are Calcine Retrieval and Onsite Transport (AA03), Full Separation (Cesium Ion Exchange, Transuranic Extraction, and Strontium Extraction) (AA04), Borosilicate Vitrification (Cesium, Transuranic, and Strontium Feedstocks) (AA08), Liquid Waste Stream Evaporation (AA14), Additional Off-Gas Treatment (AA15), and Mixed Transuranic Waste/SBW Retrieval and Onsite Transport (AA24). A detailed description of each of these six major processes or functions can be found in Appendix I of the TRD.

Accident Consequence – The systematic accident analysis process employed by DOE identified potentially bounding accidents for the Full Separations Option associated with the six functional activities. After evaluating the human health consequences associated with these potentially bounding accidents, DOE selected three bounding accidents (one abnormal, one design basis, and one beyond design basis) for each of the six processes. Summary tables in the TRD describe the potentially bounding accidents and their forecasted consequences. The TRD also provides additional information with respect to the process used to identify potentially bounding accidents, their source terms, and consequences. Table 5.2-38 provides a summary of the bounding radiological events for the Full Separations Option. This summary table (5.2-38) shows that a failure during mixed transuranic waste/SBW retrieval (ABN24), an operational failure during the full separations processes (DBE04), and an aircraft crash into the Borosilicate Vitrification Facility (BDB08) result in the bounding abnormal, design basis, and beyond design basis events, respectively, for this alternative.

Separations Alternative – Planning Basis Option

Alternative/Process Data – Nine major processes or functions apply to and form the basis of the accident analysis for the Planning Basis Option. These are New Waste Calcining Facility Continued Operation (AA01), New Waste Calcining Facility High Temperature and Maximum Achievable Control Technology Modifications (Off-Gas Treatment Facility Only) (AA02), Calcine Retrieval and Onsite Transport (AA03), Full Separation (Cesium Ion Exchange, Transuranic Extraction, and Strontium Extraction) (AA04), Borosilicate Vitrification (Cesium, Transuranic, and Strontium Feedstocks) (AA08), Liquid Waste Stream Evaporation (AA14), Additional Off-Gas Treatment (AA15), Transuranic Waste Stabilization and Preparation for Transport to the Waste Isolation Pilot Plant (Transuranic or Transuranic and Strontium Feedstocks) (AA21), and Mixed Transuranic Waste/SBW Retrieval and Onsite Transport (AA24). A detailed description of each of these nine major processes or functions can be found in Appendix I of the TRD.

Accident Consequence – The systematic accident analysis process employed by DOE identified potentially bounding accidents for the Planning Basis Option associated with the nine functional activities. After evaluating the human health consequences associated with these potentially bounding accidents, DOE selected three bounding accidents (one abnormal, one design basis, and one beyond design basis) for each of the nine processes. Summary tables in the TRD describe the potentially bounding accidents and their forecasted consequences. The TRD also provides additional information with respect to the process used to identify potentially bounding accidents, their source terms, and consequences. Table 5.2-38 provides a summary of the bounding radiological events for the Planning Basis Option. This summary table (5.2-38) shows that an operational failure during mixed transuranic waste/SBW retrieval (ABN24), a failure during continued operation of the calcining facility (DBE01), and an aircraft crash into the Borosilicate Vitrification Facility (BDB08) result in the bounding abnormal, design basis, and beyond design basis accidents respectively, for this alternative.

Separations Alternative – Transuranic Separations Option

Alternative/Process Data – Eight major processes or functions apply to and form the basis of this accident analysis for the Transuranic Separations Option. These are Calcine Retrieval and Onsite Transport (AA03), Transuranic Separation (Transuranic Extraction Only) (AA05), Low-Level Waste Class C Type Grout (AA07), Liquid Waste Stream Evaporation (AA14), Additional Off-Gas Treatment (AA15), Low-Level Waste Class C Type Grout Disposal (AA16), Transuranic Waste Stabilization and Preparation for Transport to the Waste Isolation Pilot Plant (Transuranic or Transuranic and Strontium Feedstocks) (AA21), and Mixed Transuranic Waste/SBW Retrieval and Onsite Transport (AA24). A detailed description of each of these eight major processes or functions can be found in Appendix I of the TRD.

Accident Consequence – The systematic accident analysis process employed by DOE identified potentially bounding accidents for the Transuranic Separations Option associated with the eight functional activities. After evaluating the human health consequences associated with these potentially bounding accidents, DOE selected three bounding accidents (one abnormal, one design basis, and one beyond design basis) for each of the eight processes. Summary tables in the TRD describe the potentially bounding accidents and their forecasted consequences. The TRD also provides additional information with respect to the process used to identify potentially bounding accidents, their source terms, and consequences. Table 5.2-38 provides a summary of the bounding radiological events for the Transuranic Separations Option. This summary table (5.2-38) shows that an operational failure during Low-Level Waste Class C Type Grout Disposal (ABN11), an operational failure during the transuranic separations process (DBE05), and an aircraft crash into the transuranic separations facility (BDB05) result in the bounding abnormal, design basis, and beyond design basis accidents, respectively, for this alternative.

Non-Separations Alternative – Hot Isostatic Pressed Waste Option

Alternative/Process Data – Eight major processes or functions apply to and form the basis of this accident analysis for the Hot Isostatic Pressed Waste Option. These are New Waste Calcining Facility Continued Operations (AA01), New Waste Calcining Facility High-Temperature and Maximum Achievable Control Technology Modifications (Off-Gas Treatment Facility Only) (AA02), Calcine Retrieval and Onsite Transport (AA03), High-Level Waste/Mixed Transuranic Waste/SBW Immobilization for Transport (Hot Isostatic Press) (AA11), Liquid Waste Stream Evaporation (AA14), Additional Off-Gas Treatment (AA15), Transuranic Waste Stabilization and Preparation for Transport to the Waste Isolation Pilot Plant (Transuranic or Transuranic and Strontium Feed stocks) (AA21), and Mixed Transuranic Waste/SBW Retrieval and Onsite Transport (AA24). A detailed description of each of these eight major processes or functions can be found in Appendix I of the TRD.

Accident Consequence – The systematic accident analysis process employed by DOE identified potentially bounding accidents for the Hot Isostatic Pressed Waste Option associated with the eight functional activities. After evaluating the human health consequences associated with these potentially bounding accidents, DOE selected three bounding accidents (one abnormal, one design basis, and one beyond design basis) for each of the eight processes. Summary tables in the TRD describe the potentially bounding accidents and their forecasted consequences. The TRD also describes additional information with respect to the process used to identify potentially bounding accidents, their source terms, and consequences. Table 5.2-38 provides a summary of the bounding radiological events for the Hot Isostatic Pressed Waste Option. This summary table (5.2-38) shows that an operational failure during mixed transuranic waste/SBW retrieval (ABN24), a failure during continued operation of the calcining facility (DBE01), and an aircraft crash into the liquid waste evaporation process (BDB14) result in the bounding abnormal, design basis, and beyond design basis accidents, respectively, for this alternative.

Non-Separations Alternative – Direct Cement Waste Option

Alternative/Process Data – The Direct Cement Waste Option has eight major processes or functions that have applicability to this accident analysis. These eight major processes, described in the following paragraphs, are the basis for this alternative accident analysis. These are New Waste Calcining Facility Continued Operation (AA01), New Waste Calcining Facility with High-Temperature and Maximum Achievable Control Technology Modifications (Off-Gas Treatment Facility Only) (AA02), Calcine Retrieval and Onsite Transport (AA03), Direct Cement Waste Immobilization for Transport (AA12), Liquid Waste Stream Evaporation (AA14), Additional Off-Gas Treatment (AA15), Transuranic Waste Stabilization and Preparation for Transport to the Waste Isolation Pilot Plant (Transuranic or Transuranic and Strontium Feedstocks) (AA21), and Mixed Transuranic Waste/SBW Retrieval and Onsite Transport (AA24). A detailed description of each of these eight major processes or function can be found in Appendix I of the TRD.

Accident Consequence – The systematic accident analysis process employed by DOE identified potentially bounding accidents for the Direct Cement Waste Option associated with the eight functional activities. After evaluating the human health consequences associated with these potentially bounding accidents, DOE selected three bounding accidents (one abnormal, one design basis, and one beyond design basis) for each of the eight processes. Summary tables in the TRD (DOE 1998) describe the potentially bounding accidents and their forecasted consequences. The TRD also provides additional information with respect to the process used to identify potentially bounding accidents, their source term, and consequences. Table 5.2-38 provides a summary of the bounding radiological events for the Direct Cement Waste Option. This summary table (5.2-38) shows that an operational failure during mixed transuranic waste/SBW retrieval (ABN24), a failure during continued operation of the calcining facility (DBE01), and an aircraft crash into the direct cement process facility (BDB12) result in the bounding abnormal, design basis, and beyond design basis accidents, respectively, for this alternative.

Non-Separations Alternative – Early Vitrification Option

Alternative/Process Data – Five major processes or functions apply to this accident analysis for the Early Vitrification Option and form the basis for the accident analysis. These are Calcine Retrieval and Onsite Transport (AA03), Borosilicate Vitrification (Calcine and SBW Feedstocks) (AA09), Additional Off-Gas Treatment (AA15), Mixed Transuranic Waste/SBW Stabilization and Preparation for Transport to Waste Isolation Pilot Plant (AA23), and Mixed Transuranic Waste/SBW Retrieval and Onsite Transport (AA24). A detailed description of each of these five major processes or function can be found in Appendix I of the TRD.

Accident Consequence – The systematic accident analysis process employed by DOE identified potentially bounding accidents for the Early Vitrification Option associated with the five functional activities. After evaluating the human health consequences associated with these potentially bounding accidents, DOE selected three bounding accidents (one abnormal, one design basis, and one beyond design basis) for each of the five processes. Summary tables in the TRD describe the potentially bounding accidents and their forecasted consequences. The TRD also provides additional information with respect to the process used to identify potentially bounding accidents, and their source terms, and consequences. Table 5.2-38 provides a summary of the bounding radiological events for the Early Vitrification Option. This summary table (5.2-38) shows that an operational failure during mixed transuranic waste/SBW retrieval (ABN24), an operational failure during operation of the Borosilicate Vitrification Facility (DBE09), and an aircraft crash into the Borosilicate Vitrification Facility (BDB09), result in the bounding abnormal, design basis, and beyond design basis accidents, respectively, for this alternative.

Minimum INEEL Processing Alternative

Alternative/Process Data – Nine major processes or functions apply to and form the basis of this accident analysis for the Minimum INEEL Processing Alternative. There are Calcine Retrieval and On-Site Transport (AA03), Cesium Separation (Cesium Ion Exchange Only) (AA06), Low-Level Waste Class C Type Grout Process (AA07), HLW/Mixed Transuranic Waste/SBW Immobilization for Transport (Calcine and Cesium Ion Exchange Resin Feedstocks) (AA10), Additional Off-Gas Treatment (AA15), High-Level Waste Interim Storage for Transport (AA17), High-Level Waste/High-Level Waste Fraction Stabilization and Preparation for Transport (Calcine and Cesium Resin Feedstocks) (AA18), Contact-Handled Transuranic Waste Stabilization and Preparation for Transport to Waste Isolation Pilot Plant (Transuranic or Transuranic and Strontium Feedstocks) (AA21), and Mixed Transuranic Waste/SBW Retrieval and Onsite Transport (AA24). A detailed description of each of these nine major processes or functions can be found in Appendix I of the TRD.

Accident Consequence – The systematic accident analysis process employed by DOE identified potentially bounding accidents for the Minimum INEEL Processing Alternative associated with the nine functional activities. After evaluating the human health consequences associated with these potentially bounding accidents, DOE selected three bounding accidents (one abnormal, one design basis, and one beyond design basis) for each of the nine processes. Summary tables in the TRD describe the potentially bounding accidents and their forecasted consequences. The TRD also provides additional information with respect to the process used to identify potentially bounding accidents, their source terms, and consequences. Table 5.2-38 provides a summary of the bounding radiological events for the Minimum INEEL Processing Alternative. This summary table (5.2-38) shows that an operational failure during high level waste interim storage (ABN17), an inadvertent criticality during transuranic waste stabilization and packaging (DBE21), and an aircraft crash into casks awaiting transport to the Hanford Site (BDB17) result in the bounding abnormal, design basis, and beyond design basis accidents, respectively, for this alternative.

5.2.14.5 Impacts of Chemical Release Accidents on Noninvolved Workers and the Public to Implement the Alternatives

This section discusses the impacts or consequences of chemical releases from accidents that occur as a result of a implementing the waste processing alternatives and their options. It describes (1) the major processes that contribute chemicals to the atmosphere during an accident and (2) the impacts to INEEL workers and the general public in terms of Emergency Response Planning Guideline values. Potentially bounding chemical release accidents from the TRD include mercury (AA02) and ammonia (AA15). Mercury could be released from the carbon bed filter during an exothermic reaction that results from inadequate nitrous oxide reduction. Ammonia could be released during failure of the ammonia storage tanks. Current feasibility studies for several waste processing alternatives identify a need for additional offgas treatment to meet EPA environmental requirements during separation, vitrification, and other functions associated with alternative implementation. These same feasibility studies have identified an ammonia-based treatment process as being most likely to meet the technical requirements of the waste processing alternatives. Thus ammonia has been identified as a chemical substance posing a potential significant hazard to workers and the public during waste processing alternative implementation. Current design studies are identifying alternative processes for meeting environmental compliance requirements that do not require the use of ammonia. However, at this time the ammonia-based process is still considered a potential source of bounding accidents.

Alternative/Process Data – Two major processes or functions can produce chemical releases from accidents resulting during implementation of waste processing alternatives. These are New Waste Calcining Facility High Temperature and Maximum Achievable Control Technology Modifications (AA02), and Additional Off-Gas Treatment (AA15).

Accident Consequence – Summary tables in the TRD present the chemical accidents and the impacts of these accidents. The TRD also provides additional information with respect to the process used to identify bounding accidents, their source terms, and consequences. Table 5.2-39 provides a summary of the bounding chemical events for all waste processing alternatives/options. This summary table (5.2-39) shows that failures involving ammonia handling and storage equipment (AA15) represents the bounding abnormal, design basis, and beyond design basis chemical release accidents for all alternatives requiring additional offgas treatment. BDB15 which involves an aircraft crash and subsequent fire is a threat since it results in an "external initiator" that could in turn result in a release from another waste processing facility due to operator incapacitation or evacuation.

5.2.14.6 Groundwater Impacts to the Public of Implementing the Alternatives

The bounding accident scenarios described in the preceding sections produce human health consequences mainly as a result of inhalation of air releases. In EIS accident analysis, it is generally assumed that the inhalation pathway is the predominant source of human health consequences since an air release does not provide an opportunity for intervention and mitigation.

Several potentially bounding accident scenarios from the detailed accident evaluation process produced mainly groundwater releases. In theory, groundwater releases can be mitigated, with little ultimate impact on the public. However, since significant groundwater releases would produce a substantive risk to the environment and the opportunity to mitigate may be limited by time and resource constraints, the impact of accident scenarios resulting in groundwater releases is considered in the facility accidents evaluation.

Environmental risk is usually presented in the Remedial Investigation/Feasibility Study process in terms of expected contamination at the site boundary as a function of time. Therefore, the metrics of environmental risk such as maximum contaminant levels can be used to estimate the potential for future adverse human health impacts. Specifically, expected contamination due to a postulated release can be compared with maximum contaminant levels to assess the environmental risk associated with a release.

Table 5.2-39. Summary of bounding chemical events for the various waste processing alternatives.

Events	Bounding accident analysis	Process title	Event description	Contaminant	Peak atmospheric concentration (ERPG)
Abnormal	AA15	Additional Off-Gas Treatment	Failure of ammonia tank connections results in a spill of 150 pounds per minute of liquid ammonia. A fraction of the ammonia would flash to vapor as it escapes the tank. The remainder would settle and form a boiling pool.	Ammonia	Less than ERPG-2 at 3,600 meters
Design Basis	AA15	Additional Off-Gas Treatment	Failure of ammonia tank connections results in a spill of 1,500 pounds per minute of liquid ammonia. A fraction of the ammonia would flash to vapor as it escapes the tank. The remainder would settle and form a boiling pool.	Ammonia	Greater than ERPG-2 at 3,600 meters
Beyond Design Basis	AA15	Additional Off-Gas Treatment	Failure of ammonia tank connections results in a spill of 15,000 pounds per minute of liquid ammonia. A fraction of the ammonia would flash to vapor as it escapes the tank. The remainder would settle and form a boiling pool.	Ammonia	Greater than ERPG-2 at 3,600 meters

ERPG = Emergency Response Planning Guidelines.

Following this approach, accident scenarios resulting in a release to groundwater can be appraised for their potential contribution to environmental risk and the overall economic impact of the accident.

Alternative/Process Data – Appendix C.4 presents analyses of two major processes or functions that can produce groundwater releases from accidents. These are New Waste Calcining Facility High Temperature and Maximum Achievable Control Technology Modifications (AA02) and Long-Term Onsite Storage of Mixed Transuranic Waste/SBW (AA22).

Accident Consequence – The predicted impacts to groundwater from accident scenarios resulting in major groundwater releases are summarized in Table C.4-21 through C.4-23 in Appendix C.4. From the summary tables in Appendix C.4, it can be concluded that groundwater releases involving organic constituents such as benzene from kerosene (ABN02 and BDB02) could add substantially to the organic contamination remediation requirements for INTEC.

Accident ABN02 would release to groundwater the entire inventory of kerosene from storage facilities associated with the New Waste Calcining Facility. This is considered to be an abnormal event with an occurrence equal to or greater than once in 1,000 years. A similar but less probable occurrence (BDB02) would be an aircraft crash into both kerosene storage tanks. The estimated chance of occurrence for this event is less than one in one million.

In both cases, the kerosene is assumed to spill and form a pool about 3 inches deep. After pooling, the kerosene could seep into the available soil pore space to a depth of about 16 inches and could cover an area about 100 feet in diameter. The soil concentration could approach 100 milligrams of kerosene per kilogram of soil. If the kerosene spill were not remediated, it could move through the soil toward the aquifer in about 200 years (for the benzene component). ABN02 is estimated to cause peak groundwater concentrations of 24 times the Maximum Contaminant Level or 120 micrograms per liter. Such a release would also be the maximum reasonably foreseeable hazardous material accident for public consequences, but no fatalities would be expected. Accident BDB02 is estimated to cause a peak groundwater contamination of 180 micrograms per liter. However, since INTEC would be operational during a kerosene spill, emergency crews would take immediate action to stop the spill, halt the spread of kerosene, and dispose of contaminated soil. It is estimated that remediation could involve removal of 5 to 10 cubic yards of soil.

An intrusion scenario (ABN22) that results in a release of 10 percent of a mixed transuranic waste/SBW tank contents, would not add substantially to the site mitigation requirements. An earthquake release accident (DBE22) would also not add substantially to groundwater remediation requirements for radionuclides. Even though the release to surface soil from a seismic event would be difficult to remediate, the predicted impact to groundwater would result in a small increase in groundwater activities. Detailed explanation of modeling input parameters, source inventories, and results are contained in Appendix C.4.

Although accident DBE22 involved the seismic failure of a single Tank Farm tank containing mixed transuranic waste/SBW, one could bound the potential impact of tank failures by postulation failure of all five remaining tanks simultaneously. Using the estimated peak groundwater concentration of iodine-129 from DBE22 (0.9 picocuries per liter), DOE conservatively estimated a concentration of 4.5 picocuries per liter for failure of five tanks. Using the concentration-to-dose conversion factor from DOE (1988), and 72 years of water ingestion at 2 liters per day, DOE estimated a lifetime effective dose equivalent of 66 millirem or 33 in a million increase in probability of cancer.

In addition, either long term degradation of the bin sets, a flood, or an airplane crash (see accident analyses AA03 and AA20 in Appendix C.4) would disperse mixed HLW calcine to the environment by air dispersion. If a flood or heavy rainfall were to occur before an emergency response by the Government, the flow of water could further disperse the calcine (a scenario not analyzed in accident analyses AA03 and AA20). Although the primary short-term impact to human receptors of theses accidents would be from airborne contamination, the released calcine could deposit onto soils surrounding the bins, move with the surface water runoff to low-lying areas, and partially re-suspend in the air directly or as a result of water evaporation. Direct ground contamination would be expected within a few miles of INEEL. Calcine could subsequently slowly dissolve and release some contaminants to the groundwater; however, most of the available contaminants would be bound up in the first few feet of the soil column. Iodine-129 and plutonium could migrate to the groundwater over a very long period of time. Any groundwater impacts would be much lower than those analyzed for other accidents such as the failure of storage tank full of mixed transuranic waste/SBW (as described earlier in this subsection).

5.2.14.7 Consideration of Other Accident Initiators

Each of the process elements associated with the different waste processing alternatives and options was evaluated by the accident analysis team using a consistent set of accident initiators. During the review of the accident analysis, additional initiators were identified that could potentially result in releases of radioactive or hazardous materials. However, the bounding accidents that describe the potential risk associated with the waste processing alternatives and the accident analyses were not modified as a result of identifying these additional initiators for the following reasons:

Initiator Frequency is Less Than Beyond Design Basis – Very low likelihood events (e.g., meteor strikes) have the potential to cause significant releases. However, accidents that have a frequency of occurrence much less than 1.0×10^{-7} pose a limited risk of occurrence and do not impact the choice of bounding accidents.

Initiator is Encompassed by Another Initiator – The consequences and initiating frequencies of some newly identified initiators are bounded by accidents already identified in the accident analysis. For instance, a release could originate from an aircraft crash (included in analysis) or volcanic activity (identified in review process). The magnitude of the release and the initiating event frequencies for both initiators are similar and for all intents and purposes, the risk is the same. In this case, the volcanic activity initiator is not added into the accident analysis.

Initiator is in Planning/Hypothetical Stage – Some newly identified initiators are associated with potential future activities in and around the INEEL site. For instance, the Venture Star project is currently in the planning stage and could potentially impact the INEEL site. However, for activities such as these, their impact on waste processing alternatives would be evaluated as plans for initiation of the project are defined.

5.2.14.8 Sensitivity Analysis

The Idaho HLW & FD EIS accident analysis consequence modeling was performed for three receptors as defined above.

For each of these analyses, conservative assumptions were applied to obtain bounding results. For the most part, the assumptions in the Idaho HLW & FD EIS were consistent with those applied in other EIS documents prepared at the INEEL, such as the SNF & INEL EIS (DOE 1995). However, there were some assumptions that differed. Of the assumptions incorporated in the Idaho HLW & FD EIS consequence modeling, exposure pathways, exposure time, breathing rate, meteorology, and location (for the population dose) were some that had significant impact on the results. Table C.4-24 in Appendix C.4 summarizes the potential effects that may be observed if these assumptions are changed.

The approach that was taken in the Idaho HLW & FD EIS consequence modeling was done to ensure that a "consequence envelope" was provided. As discussed above, this approach differs in part from the approach taken in other EISs, such as the SNF & INEL EIS. Due to this, the results presented in the Idaho HLW & FD EIS are larger than the results that would have been obtained by applying the SNF & INEL EIS assumptions. However, the key issue at hand is that the Idaho HLW & FD EIS is providing a likely upper bound to the potential consequences for the accidents associated with the candidate alternatives. In addition, these conservative assumptions were incorporated in a consistent manner. Although adjustments to these assumptions will modify the absolute magnitudes of the predicted consequences, they will not modify the relative ranking of the modeled scenarios. So the set of bounding scenarios are anticipated to remain the same. More detail can be found in King (1999).

5.2.14.9 Risk to Involved Worker

Appendix C.4 provides comprehensive and integrated evaluation of involved worker risk (in fatalities per year) as a result of industrial accidents, occupational exposures, and facility accidents. Appendix C.4 develops baseline estimates of involved worker risk using point estimates of risk contributors. Appendix C.4 also provides simulated estimates of involved worker risk developed through Monte Carlo simulations. Results of the baseline estimates of involved worker risk are given in Figure 5.2-8, while results of the Monte Carlo simulations are summarized in Figure 5.2-9.

From Figures 5.2-8 and 5.2-9 several conclusions can be drawn:

- Mean values of involved worker risk from the simulations are higher than those obtained from point estimates. Involved worker risk for all alternatives are sensitive to parameters such as the number of worker years of exposure, the rate of industrial accident fatalities, and the frequency of radiological release accidents. The simulated means tend to bound the potential for involved worker risks by encompassing in the distributions of these variables, particularly upper bounds that represent relatively unlikely but possible conditions. Consistent with the state of knowledge regarding projects and activities associated with implementation of alternatives, the simulations provide a more bounding and hence more reliable basis for comparing alternatives at this time.

- Estimates of involved worker risk due to industrial accidents do not favor alternatives that require the largest amount of manpower during implementation. Thus options such as Planning Basis that encompass the largest requirements for facility construction as well as the longest facility operation campaigns, could pose risk to involved workers

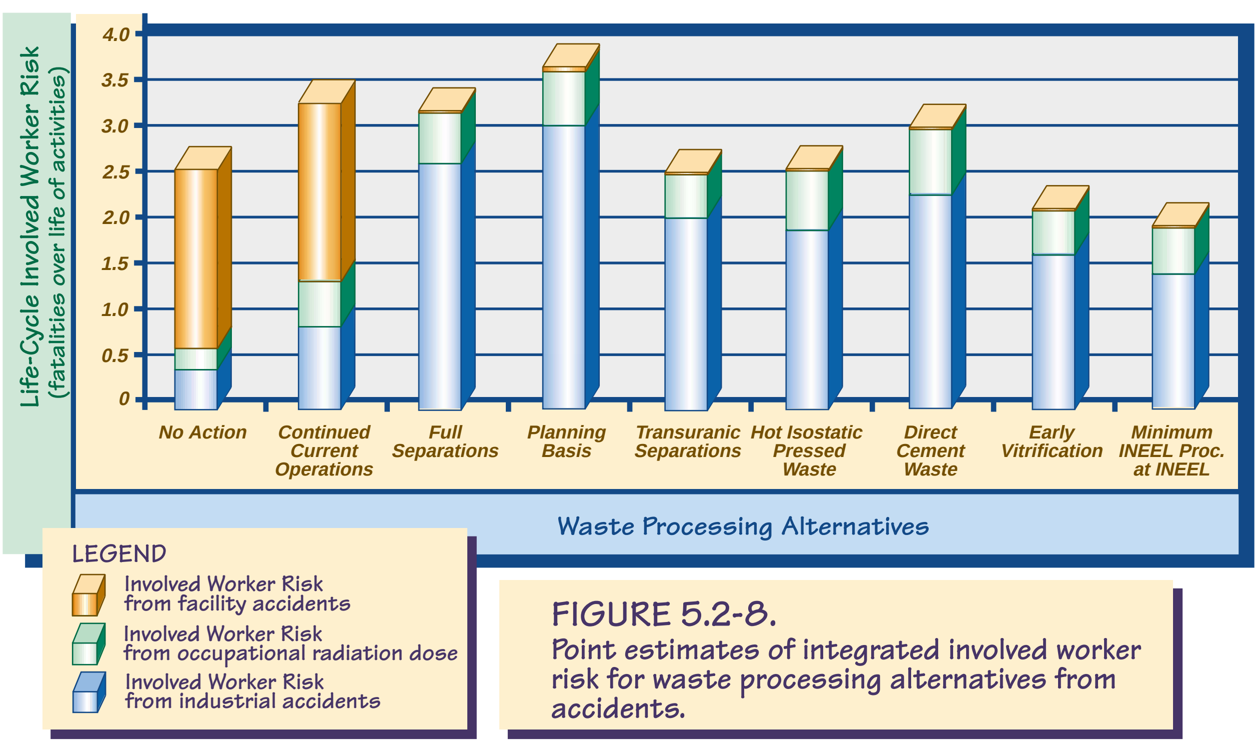


FIGURE 5.2-8.
Point estimates of integrated involved worker risk for waste processing alternatives from accidents.

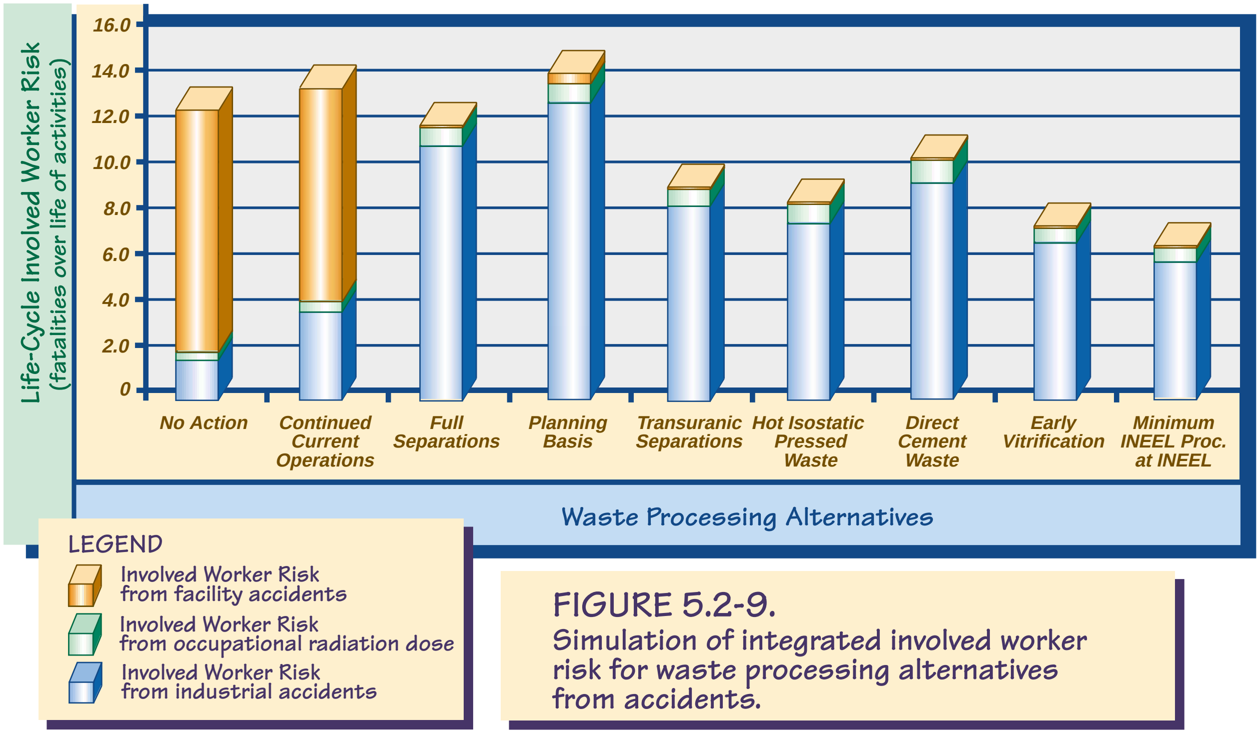


FIGURE 5.2-9.
Simulation of integrated involved worker risk for waste processing alternatives from accidents.

from industrial accidents that is a full order of magnitude higher than that posed by less ambitious alternatives.

- Estimates of involved worker risk due to facility accidents do not favor alternatives that are vulnerable to bounding accident scenarios with high probabilities of occurrence or large radioactive or chemical releases. Alternatives such as No Action and Continued Current Operations that do not address the basis issue of reducing releasable material inventories have the highest predicted combinations of likelihood and consequences for bounding accidents. As such, the contribution of facility accidents to involved worker risk for these alternatives are as much as an order of magnitude higher than the contribution for the other alternatives that actively seek to reduce risk over time.

- Industrial accidents are, for most of the alternatives, the largest contributors to involved worker risk. Therefore, estimates of integrated involved worker risk (including all sources) favor the alternatives such as No Action, Continued Operations, and Minimum INEEL Processing that involve less site activity over time. It should be remembered, however, that risks posed by transportation and activities at the Hanford site are not included in the estimates of involved worker risk for the Minimum INEEL Processing Alternative.

5.2.14.10 Comparison of Waste Processing Alternatives Based on Facility Accidents

Table 5.2-40 provides an integrated perspective on risk to noninvolved workers and the public as a result of bounding facility accidents for all the waste processing alternatives. In Table 5.2-40, accrued risk to the public from bounding accident scenarios in each frequency category are given as a fractional increase in cancer fatalities for the population at risk. Table 5.2-40 also provides comparisons of risk to the public from bounding accident scenarios with current DOE facility safety criteria. Finally, Table 5.2-40 provides an estimate of total risk to the public from facility accidents that could occur during the implementation of waste processing alternatives.

Table 5.2-40. Risks from bounding facility accidents for waste processing alternatives.

Frequency category	Bounding accident scenario	Related accident frequency [1/year]	Bounding accident frequency [1/year]	Related window of exposure [years]	Bounding window of exposure [years]	Probability of occurrence [events]	Offsite individual public dose [rem]	Offsite public LCFs [fatalities/ event]	Additional risk to offsite public [fatalites]	Fractional increase in cancer fatatlities to offsite population
	No Action									
ABN	Degradation and failure of bin set structure and equipment		1.0×10^{-3}[n]		1.0×10^{2}[h,i]	1.0×10^{-1}	1.3×10^{3}	6.5×10^{-1}	6.5×10^{-2}	3.9×10^{-6}[s]
DBE	Seismic failure of bin set structure and equipment	5.0×10^{-5}	5.0×10^{-4}[k]	1.0×10^{2}	1.0×10^{1}[h,I]	4.0×10^{-2}[r]	6.6×10^{4}	3.3×10^{1}	1.3	7.9×10^{-5}[s]
BDB	Aircraft crash failure of bin set structure and equipment		2.1×10^{-8}[g]		1.0×10^{2}[h,I]	2.1×10^{-6}	3.5×10^{3}	1.75	3.6×10^{-6}	2.1×10^{-10}
	Continued Current Operations									
ABN	Degradation and failure of bin set structure and equipment		1.0×10^{-3}[n]		1.0×10^{2}[h,I]	1.0×10^{-1}	1.3×10^{3}	6.5×10^{-1}	6.5×10^{-2}	3.9×10^{-6}[s]
DBE	Seismic failure of bin set structure and equipment	5.0×10^{-5}	5.0×10^{-4}[k]	1.0×10^{2}	1.0×10^{1}[h,I]	4.0×10^{-2}[r]	6.6×10^{4}	3.3×10^{1}	1.3	7.9×10^{-5}[s]
BDB	Aircraft crash failure of bin set structure and equipment		2.05×10^{-8}[g]		1.0×10^{2}[h,I]	2.05×10^{-6}	3.5×10^{3}	1.75	3.6×10^{-6}	2.1×10^{-10}
	Full Separations Option									
ABN	Operational failure of mixed transuranic waste/SBW retrieval and transport system		3.0×10^{-3}[m]		2.0×10^{1}[h]	6.0×10^{-2}	5.6×10^{-2}	2.8×10^{-5}	1.7×10^{-6}	1.0×10^{-10}
DBE	Organic oxidant explosion failure of Separations Facility structure and equipment		3.0×10^{-4}[j]		2.0×10^{1}[h]	6.0×10^{-3}	3.5×10^{3}	1.8	1.1×10^{-2}	6.3×10^{-7}
BDB	Aircraft crash failure of Borosilicate Facility structure and equipment		2.1×10^{-8}[g]		2.0×10^{1}[h]	4.1×10^{-7}	6.0×10^{5}	3.0×10^{2}	1.2×10^{-4}	7.3×10^{-9}
	Planning Basis Option									
ABN	Operational failure of mixed transuranic waste/SBW retrieval and transport system		3.0×10^{-3}[m]		2.0×10^{1}[h]	6.0×10^{-2}	5.6×10^{-2}	2.8×10^{-5}	1.7×10^{-6}	1.0×10^{-10}
DBE	Calciner explosion failure of New Waste Calcining Facility structure and equipment		1.0×10^{-4}[o]		2.0×10^{1}[h]	2.0×10^{-3}	5.9×10^{3}	3.0	5.9×10^{-3}	3.5×10^{-7}

Table 5.2-40. Risks from bounding facility accidents for waste processing alternatives (continued).

Frequency category	Bounding accident scenario	Related accident frequency [1/year]	Bounding accident frequency [1/year]	Related window of exposure [years]	Bounding window of exposure [years]	Probability of occurrence [events]	Offsite individual public dose [rem]	Offsite public LCFs [fatalities/ event]	Additional risk to offsite public [fatalites]	Fractional increase in cancer fatatlities to offsite population
BDB	Aircraft crash fails Vitrification Facility structure and equipment		2.1×10^{-8}[g]		2.0×10^{1}[h]	4.1×10^{-7}	6.0×10^{5}	3.0×10^{2}	1.2×10^{-4}	7.3×10^{-9}
	Transuranic Separations Option									
ABN	Operational failure of low-level waste Class C type grout transport system		3.0×10^{-3}[m]		2.0×10^{1}[h]	6.0×10^{-2}	7.1×10^{1}	3.6×10^{-2}	2.1×10^{-3}	1.3×10^{-7}
DBE	Organic oxidant explosion failure of Separations Facility structure and equipment		3.0×10^{-4}[j]		2.0×10^{1}[h]	6.0×10^{-3}	7.9×10^{3}	4.0	2.4×10^{-2}	1.4×10^{-6}[s]
BDB	Seismic failure of HLW fraction surge equipment		5.0×10^{-5}[l]		2.0×10^{1}[h]	1.0×10^{-3}	7.9×10^{3}	4.0	4.0×10^{-3}	2.4×10^{-7}
	Hot Isostatic Pressed Waste Option									
ABN	Operational failure of mixed transuranic waste/SBW retrieval and transport system		3.0×10^{-3}[m]		2.0×10^{1}[h]	6.0×10^{-2}	5.6×10^{-2}	2.8×10^{-5}	1.7×10^{-6}	1.0×10^{-10}
DBE	Calciner explosion failure of New Waste Calcining Facility structure and equipment		1.0×10^{-4}[o]		2.0×10^{1}[h]	2.0×10^{-3}	5.9×10^{3}	3.0	5.9×10^{-3}	3.5×10^{-7}
BDB	Aircraft crash fails evaporator structure and equipment		2.1×10^{-8}[g]		2.0×10^{1}[h]	4.1×10^{-7}	3.5×10^{3}	1.8	7.2×10^{-7}	4.3×10^{-11}
	Direct Cement Waste Option									
ABN	Operational failure of mixed transuranic waste/SBW retrieval and transport system		3.0×10^{-3}[m]		2.0×10^{1}[h]	6.0×10^{-2}	5.6×10^{-2}	2.8×10^{-5}	1.7×10^{-6}	1.0×10^{-10}
DBE	Calciner explosion failure of New Waste Calcining Facility structure and equipment		1.0×10^{-4}[o]		2.0×10^{1}[h]	2.0×10^{-3}	5.9×10^{3}	3.0	5.9×10^{-3}	3.5×10^{-7}
BDB	Aircraft crash fails Cement Waste Facility structure and equipment		2.1×10^{-8}[g]		2.0×10^{1}[h]	4.1×10-7	1.1×10^{4}	5.5	2.3×10^{-6}	1.3×10^{-10}

Table 5.2-40. Risks from bounding facility accidents for waste processing alternatives (continued).

Frequency category	Bounding accident scenario	Related accident frequency [1/year]	Bounding accident frequency [1/year]	Related window of exposure [years]	Bounding window of exposure [years]	Probability of occurrence [events]	Offsite individual public dose [rem]	Offsite public LCFs [fatalities/ event]	Additional risk to offsite public [fatalites]	Fractional increase in cancer fatatlities to offsite population
	Early Vitrification Option									
ABN	Operational failure of mixed transuranic waste/SBW retrieval and transport system		3.0×10^{-3}		2.0×10^{1}[h]	6.0×10^{-2}	5.6×10^{-2}	2.8×10^{-5}	1.7×10^{-6}	1.0×10^{-10}
DBE	Steam explosion fails Vitrification Facility structure and equipment		1.0×10^{-4}[p]		2.0×10^{1}[h]	2.0×10^{-3}	1.4×10^{1}	7.0×10^{-3}	1.4×10^{-5}	8.3×10^{-10}
BDB	Aircraft crash fails Vitrification Facility structure and equipment		2.1×10^{-8}[g]		2.0×10^{1}[h]	4.1×10^{-7}	6.6×10^{3}	3.3	1.4×10^{-6}	8.1×10^{-11}
	Minimum INEEL Processing									
ABN	Operations failure in canister filling facility		3.0×10^{-3}[m]		2.0×10^{1}[h]	6.0×10^{-2}	2.6	1.3×10^{-3}	7.8×10^{-5}	4.7×10^{-9}
DBE	Criticality fails transuranic waste shipping facility structure and equipment		1.0×10^{-5}[q]		2.0×10^{1}[h]	2.0×10^{-4}	1.2×10^{2}	6.0×10^{-2}	1.2×10^{-5}	7.1×10^{-10}
BDB	Aircraft crash fails railcar storage facility		2.1×10^{-8}[g]		2.0×10^{1}[h]	4.1×10^{-7}	5.3×10^{4}	2.7×10^{1}	1.1×10^{-5}	6.5×10^{-10}
	Cross-Cut, All Alternatives									
ABN	Impact failure of transfer line, bin set 1 transfer equipment		3.0×10^{-3}[a]		6.0[b]	1.8×10^{-2}	1.5×10^{2}	7.5×10^{-2}	1.4×10^{-3}	8.0×10^{-8}
DBE	Flood induced failure of bin set during calcine storage	1.0×10^{-6}	1.0×10^{-4}[c,d]	3.8×10^{2}	6.0[e,f]	4.6×10^{-3}[r]	4.5×10^{4}	2.3×10^{1}	1.0×10^{-1}	6.1×10^{-6}[s]

a. During transfer of calcine from bin set, impact of transfer lines, equipment, temporary storage would produce a release calcine waste, calcine fines, etc. directly to the environment. Scenarios resulting in dropping of a heavy load on transfer equipment or temporary storage are assumed to be dominated by human failures. Catastrophic human failure during transfer operations is assessed as 0.001/activity with 30 activities per year.

b. Transfer of calcine from a single bin set is predicated on estimates of 30 years to remove all calcine waste (7 bin sets), 2 addition years required for the first transfer.

c. Several INEEL specific evaluations of flood frequency support an estimate of 10,000 years as a recurrence frequency for a flood that reaches elevation 4912, the bottom of the berm surrounding bin set 1. Bin set 1 is known to be statically unstable. To assess the likelihood of bin set failure, it is assumed that a flood reaching the bottom of bin set 1 would liquify the earth surrounding bin set 1 and result in structural failure of the vault. Failure of the vault would result in the bin set lid falling on top of and failing the internal stainless steel bins. Calcine material would then be transported to the environment in flood waters.

d. Conditional failure of bin sets given the occurrence of a flood that reaches 4,912 feet is assumed to be 0.01 or less.

e. DOE intends to remove waste from bin set 1 at the earliest possible date. Therefore the period of vulnerability for bin set 1 flooding is assumed to be 10 years or less.

f. DOE does not intend to remove waste from bin sets 2 through 7 under no action and continued operations scenarios. Period of vulnerability for flooding failure of bin sets 2 through 7 is estimated based on 475 years of remaining useful design life minus 95 years (to 2095) after which mitigation efforts in a flood cannot be assured.

Table 5.2-40. Risks from bounding facility accidents for waste processing alternatives (continued).

g. Data from NUREG 800 and military sources agree that the frequency of aircraft impacts decreases with distance from an existing runway, from 1.7×10^{-7}/movement-sq.mi. within a mile of the runway to 1.2×10^{-9}/movement-sq.mi. at 10 miles. After 5 miles the rate of decrease is dramatically less, and it is assumed that the rate beyond 10 miles is asymptotic to 1.0×10^{-9}/movement-sq.-mi. It is assumed that aircraft with sufficient mass to penetrate a bin set land and take off from Idaho Falls airport at a rate of 6 per day or 2,190 movements/year. It is also assumed that INTEC bin sets and other facilities with potentially hazardous inventories occupy approximately 6 acres of exposed land area. Therefore the area over which aircraft induced fires and releases can occur is less than 0.01 sq.-mi.

h. Period of vulnerability for operational or external events threatening INTEC facilities is estimated based on the estimated time the facility is in use, or the time at which the contents of the facility no longer pose a significant offsite hazard.

i. Half lives of strontium-90 and cesium-137 are 27.7 and 30.2 years respectively. Risk from air releases of stored calcine is assumed to be dominated by cesium and strontium release components. Significant risk exists up to the period of time in which Cs decays to < 10% of its existing inventory, a period of 100 years.

j. An oxidant explosion is modeled as a complex set of human errors and equipment failures. Without a systems model, it is difficult to predict a systems based event frequency. Several similar failures have occurred over approximately 1,000 years of reprocessing operations around the world. If the conditional likelihood of a catastrophic explosion is 0.01 the frequency of the event is estimated to be 3×10^{-5}/year.

k. Bin sets 2 through 7, designed to meet STD 1024 criteria, should withstand a 10,000 year earthquake. The frequency of seismic induced failure for bin sets 2 through 7 is estimated using a fragility factor of 2. Division of STD 1024 criteria by 2 provides a measure of the frequency of an earthquake that threatens the integrity of bin sets 2 through 7. Therefore, the frequency of seismic failure for bin sets 2 through 7 is 5×10^{-5}/year. Bin set 1 does not meet STD 1024. An estimate of 5×10^{-4}/year is used for frequency of earthquake induced failure.

l. Same assumptions used to evaluate bin set is used to estimate frequency of seismically induced failure for HLW storage.

m. Frequency of failure is based on likelihood of human or equipment based failure being > 0.01/year and < 0.01/year. A geometric mean of 0.03/year is used.

n. Frequency estimated to be 1×10^{-6}/year for first year of performance period, varying upward to 1 in last year of performance period. Performance period estimated to be 380 years based on 2085 cessation of maintenance and surveillance. Geometric mean of failure frequency, 1×10^{-3} is used to estimate frequency of bin set failure during performance period.

o. Estimate of 1×10^{-4}/year of New Waste Calcining Facility operation for catastrophic failure of calciner cell is estimated using Safety Analysis Report for the facility.

p. Estimate based on vulnerability to catastrophic failure of operational control allowing aqueous material to enter melter cell. 1×10^{-3}/year used to estimate loss of operational control with factor of 10 reduction to catastrophic loss.

q. Estimate based on failure of double contingency criteria given two supposedly independent failures with a frequency of 1×10^{-3}. Factor of 10 increase used to address potential for common cause failure of contingency controls.

r. Where two bounding accident scenarios with the same consequences but different frequencies of occurrence and different windows of vulnerability are defined, risk from both scenarios is evaluated cumulatively.

s. The expected consequences of this event exceed DOE facility safety assurance criteria as stated in DOE 5480.23 and DOE STD 1027 are designed to ensure that credible radiological and chemical release accidents do not occur more frequently than 1×10^{-6}/year, or contribute more than a 1 in 1,000,000 increase in latent cancers over background.

This information in Table 5.2-40 supports comparison of treatment alternatives based on the risk of facility accidents.

- Alternatives that are vulnerable to bounding accident scenarios with the highest probabilities of occurrence exhibit the highest potential for risk due to facility accidents. Alternatives such as No Action and Continued Current Operations that do not address the basis issue of reducing releasable material inventories have the highest predicted combinations of likelihood and consequences for bounding accidents, thus posing risk to the public several orders of magnitude greater than alternatives that actively reduce risk over time.

- Alternatives requiring the use of separation technology could pose relatively high risk from facility accidents. Historically experience indicates that such processes could have a relatively high likelihood of accidents that result in significant and energetic release of materials. The Transuranic Separations Option, in particular, illustrates this vulnerability for the design basis event.

- Based on the results of the accident analysis, bounding accidents involving storage of calcine in bin sets indefinitely (the No Action and Continued Current Operations alternatives) would appear to exceed DOE safety assurance guidelines for facility operation. These results can be placed in perspective; however, since very conservative methods were used to forecast human health consequences in an accident.

5.3 Facility Disposition Impacts

Section 5.3 presents a discussion of potential impacts associated with the disposition of existing HLW facilities at INEEL and disposition of new facilities that would be built in support of the proposed waste processing alternatives. The discussion includes (1) the potential impacts of short-term actions in dispositioning new and existing HLW facilities, (2) the potential long-term impacts from the disposal of the grouted low-level waste fraction in either a new disposal facility at INTEC or in the Tank Farm and bin sets, and (3) the potential long-term impacts of residual contamination in closed HLW facilities. The six facility disposition alternatives are discussed in detail in Section 3.2.

Two kinds of facility disposition are discussed in Section 5.3. The first involves disposition of new facilities required under the five waste processing alternatives. These new facilities are shown in Table 3-3 of Section 3.2. Impacts from disposition of these new facilities are discussed by waste processing alternative rather than by facility disposition alternative. This presentation approach stems from the fact that (1) certain new facilities are required by certain waste processing alternatives and (2) any new facilities would be designed to facilitate a high degree of decontamination once processing ceases. As a result, the analysis assumes that DOE would select the Clean Closure Alternative for all of these new facilities.

The second kind of facility disposition involves disposition of existing HLW facilities. Impacts for disposition of existing facilities are presented by facility or facility group and facility disposition alternative rather than by waste processing alternative. Table 3-4 lists existing HLW facilities and alternatives DOE is considering for their disposition. DOE chose this method of presentation because disposition of existing facilities is independent of the waste processing alternatives evaluated in this EIS and is expected to occur regardless of which waste processing alternative is implemented.

Facility disposition encompasses a number of activities that would be carried out after HLW facilities are no longer operational. Once waste processing operations are completed, treatment and storage facilities at INTEC would be deactivated. DOE (1997) discusses the changing mission of INTEC and the planned disposition of surplus facilities. It notes that DOE's goal is to place surplus INEEL facilities in a safe, stable shutdown condition and monitor them while awaiting decommissioning. HLW facilities will be decontaminated to the extent practicable; then, depending on the facility disposition alternative selected and the facility in question, they would be entombed and left standing, partially removed, completely removed, or returned to (restricted) industrial use.

The EIS considers six facility disposition alternatives:

- No Action
- Clean Closure
- Performance-Based Closure
- Closure to Landfill Standards
- Performance-Based Closure with Class A Grout Disposal
- Performance-Based Closure with Class C Grout Disposal

Section 3.2.1 contains detailed descriptions of the various facility disposition alternatives.

The No Action Alternative for facility disposition is substantially the same as No Action for waste processing. Therefore Section 5.3 does not present environmental consequences for the facility disposition No Action Alternative over the period 2000 to 2035. Under No Action, there would be no decontamination and decommissioning of HLW facilities, and no activities that would produce incremental effluents or emissions. Surveillance and maintenance necessary to protect the environment and the safety and health of workers would be performed in the normal course of INTEC operation.

The No Action Alternative could, however, produce impacts in the years beyond 2035 because calcine would remain in the bin sets and mixed transuranic waste (SBW and newly generated liquid waste) would remain in the Tank Farm.

To capture these impacts, DOE analyzed the continued storage of calcine and the liquid mixed transuranic waste. The analysis is presented in Appendix C.9, Facility Closure Modeling. Potential impacts of continued storage of calcine and liquid mixed transuranic waste beyond the year 2035, an assumption of the No Action Alternative, are reported in Sections 5.3.5.2 (Water Resources), 5.3.6.2 (Ecological Resources), and 5.3.8.2 (Health and Safety).

5.3.1 LAND USE

Potential impacts to land use from facility disposition activities were evaluated by reviewing closure plans and project data sheets for RCRA-regulated facilities (Tank Farm, bin sets, Liquid Effluent Treatment and Disposal Facility, and Process Equipment Waste Evaporator) and project data sheets for other HLW facilities.

Regardless of the facility disposition alternative chosen, DOE would be required to maintain adequate institutional controls (e.g., fences or warning signs) to limit access to areas that pose a significant health or safety risk to workers until at least the year 2095, when DOE, for purposes of the analysis in this EIS, is assumed to relinquish institutional control.

After closure, most areas within INTEC formerly occupied by waste processing facilities could be designated restricted-use industrial areas. This is consistent with DOE's long-term planning strategy, outlined in DOE (1997), which encourages development in established facility areas (such as INTEC) and discourages new construction in previously-undisturbed or undeveloped areas. These areas could, in theory, be used for new industrial facilities or for warehouses or laydown areas. However, INTEC lies outside of INEEL's "preferred development area" (DOE 1997). Areas formerly occupied by waste processing facilities would not, as long as DOE maintains institutional control, be open to the public for recreational uses or added to the acreage leased to local ranchers for grazing.

In summary, these facility disposition alternatives could affect short- and intermediate-term land use within the secure confines of INTEC but would not affect land use outside of INTEC. None of the facility disposition alternatives would require development of new facilities outside of the secure perimeter fence, and no land currently committed to non-industrial uses (such as ecological research or permitted grazing) would be converted to industrial use. Land use outside of the INEEL would not be affected. Facility disposition activities would be consistent with current and planned uses of INTEC outlined in the *INEEL Comprehensive Facility and Land Use Plan* (DOE 1997). Activities would also be consistent with DOE guidance on facility and land use planning (DOE 1996). During the period of facility disposition, most existing INEEL waste disposal sites will likely be closed. New site(s) to provide capacity for INEEL wastes may be required and could be developed inside or outside the fenced INTEC boundary based on site suitability factors. Future disposal capacity and potential siting issues are outside the scope of this EIS and would be reviewed as part of appropriate environmental and permitting activities when a need for additional capacity is identified.

5.3.2 SOCIOECONOMICS

Activities associated with the ultimate disposition of HLW facilities could result in potential impacts to the socioeconomics of the INEEL region. Two categories of disposition are considered. The first involves the disposition of the various proposed new facilities that are required to support the waste processing alternatives. The second category covers the disposition of existing facilities. For each facility or group of facilities, DOE has characterized impacts in terms of total employment (direct and indirect) and income or wages (total regional earnings) that would be generated from the disposition of each facility.

The methods used to estimate employment and income levels are consistent with those used to estimate construction and operational employment and income levels described in Section 5.2.2. However, while employment and income levels for construction and operations are reported for the peak year, the employment and income levels for dispositioning activities are reported as either totals for the life of the activity, or as maximum annual employment and total income. For the proposed facilities that are grouped by a given alternative, employment and income levels are reported as totals. In the case of existing facilities, estimated annual employment and income levels are reported. During dispositioning activities, the durations of discrete project elements are relatively short, and activities do not always occur sequentially. Thus, peak year employment and income levels are not as meaningful as they would be for longer-term operations. However, employment associated with dispositioning is included in Appendix C.1, Figures C.1-17 through C.1-24.

5.3.2.1 Proposed New Facilities Associated with Waste Processing Alternatives

DOE has estimated the employment and income levels that would result from the dispositioning of the proposed new facilities needed to support waste processing alternatives. Table 5.3-1 presents these estimates by alternative and by proposed projects (which would be performed in yet-to-be-designed facilities). In general, employment and income levels required for facility disposition would be similar to the levels estimated for construction. Potential impacts would occur over shorter periods of time and would neither occur continuously nor simultaneously. The potential impacts to population and housing, community services, and public finance would be the same as described in Section 5.2.2 for construction.

5.3.2.2 Existing Facilities Associated with High-Level Waste Management

The facilities in this group are those that have been used at the INTEC to generate, treat, and store HLW. Because of the number of facilities involved, DOE has organized them in functional groups for purposes of analysis. DOE has analyzed the potential socioeconomic impacts of decontaminating and decommissioning these facilities. Table 5.3-2 estimates the total employment and regional income for the Tank Farm and bin sets for all five disposition alternatives. Table 5.3-3 summarizes annual employment and income by facility group for the facility disposition alternatives in Table 3-4.

As can be seen from the tables for existing facilities, the largest number of jobs would be required for Tank Farm Clean Closure (about 326 workers). The other scenarios would require relatively smaller numbers of workers and would in all cases be much fewer than the workers required for dispositioning the proposed new facilities.

For both new and existing facilities, DOE would retrain and reassign workers to conduct dispositioning activities whenever possible (see Section 5.2.2). In some cases, skill mix and the number of personnel available may dictate a reduction in force. The number of workers affected would depend on the alternative selected and the timing. History has shown that such reductions are generally small. The current operational workforce for this mix of existing facilities is currently about 1,100 (Beck 1998). Following the completion of its operational and dispositioning missions, reductions in the number of jobs would probably occur unless new missions have been identified.

Table 5.3-1. Summary of employment and income from dispositioning of facilities that would be constructed under the waste processing alternatives.

Number	Project description	Duration of dispositioning activity[a] (years)	Employment			Total earnings
			Direct[b]	Indirect	Total	(1996$)[c]
Continued Current Operations Alternative						
P1A	Calcine SBW including New Waste Calcining Facility Upgrades (MACT) and Storage Tanks	2	60	60	120	3,400,000
P1B	Newly Generated Liquid Waste and Tank Farm Heel Waste Management	1	50	50	100	2,800,000
Totals			110	110	220	6,200,000
Full Separations Option[d]						
P9A	Full (early) Separations	3	220	240	460	13,000,000
P9B	Vitrification Plant	3	70	80	150	4,200,000
P9C	Class A Grout Plant	2.5	120	240	360	6,900,000
P18	Remote Analytical Lab	2	90	90	180	5,100,000
P24	Vitrified Product Interim Storage	2.8	30	30	60	1,800,000
P27	Grout Disposal	2	140	140	280	7,900,000
P25A	Packaging and Loading Vitrified HLW at INTEC for Shipment to NGR	1	2	2	4	120,000
P35D	Class A Grout Packaging	2	30	30	60	1,700,000
P59A	Calcine Retrieval and Transport	1	160	170	330	9,300,000
P118	Separations Organic Incinerator	1	2	2	4	120,000
P133	Waste Treatment Pilot Facility	2	50	50	100	2,600,000
Totals			914	1,074	1,988	52,740,000
Planning Basis Option						
P1A	Calcine SBW including New Waste Calcining Facility Upgrade	2	40	40	80	2,400,000
P1B	Liquid Waste Tank Farm	1	50	50	100	2,800,000
P59A	Calcine Retrieval and Transport	1	160	170	330	9,300,000
P23A	Full Separations	3	220	240	460	13,000,000
P23B	Vitrification Plant	4	80	80	160	4,500,000
P23C	Class A Grout Plant	4	110	110	220	6,200,000
P24	Vitrified Product Interim Storage	2.8	30	30	60	1,800,000
P25A	Packaging and Loading Vitrified HLW at INTEC	1	2	2	4	120,000
P18	New Analytical Laboratory	2	90	90	180	5,100,000
P118	Separations Organic Incinerator	1	2	2	4	120,000
P133	Waste Treatment Pilot Facility	2	50	50	100	2,600,000
Totals			834	864	1,698	46,940,000

Table 5.3-1. (continued).

Number	Project description	Duration of dispositioning activity[a] (years)	Employment: Direct[b]	Employment: Indirect	Employment: Total	Total earnings (1996$)[c]
Transuranic Separations Option						
P18	New Analytical Lab	2	90	90	180	5,100,000
P27	Class A/C Grout in New Waste Disposal Facility	2	220	240	460	13,000,000
P39A	Packaging and Loading TRU at INTEC for Shipment to the Waste Isolation Pilot Plant	1.5	7	7	14	410,000
P49A	TRU-C Separations	3	150	150	300	8,500,000
P49C	Class C Grout Plant	2	90	100	190	5,400,000
P49D	Class C Grout Packaging and Shipping to INEEL Landfill	2	60	60	120	3,300,000
P59A	Calcine Retrieval and Transport	1	160	170	330	9,300,000
P118	Separations Organic Incinerator	2	2	2	4	120,000
P133	Waste Treatment Pilot Facility	2	50	50	100	2,600,000
Totals			829	869	1,698	47,730,000
Hot Isostatic Pressed Waste Option						
P1A	Calcine SBW including New Waste Calcining Facility Upgrades (MACT) and Storage Tanks	2	40	50	90	2,400,000
P1B	Newly Generated Liquid Waste and Tank Farm Heel Waste Management	1	50	50	100	2,800,000
P18	Remote Analytical Lab	2	90	90	180	5,100,000
P59A	Calcine Retrieval and Transport	1	160	170	330	9,300,000
P71	Mixing and HIPing	5	200	200	400	11,500,000
P72	HIP HLW Interim Storage	3	150	160	310	8,900,000
P73A	Packaging and Loading HIP Waste at INTEC for Shipment to a Geologic Repository	2.5	7	7	14	410,000
P133	Waste Treatment Pilot Facility	2	50	50	100	2,600,000
Totals			747	777	1,524	43,010,000
Direct Cement Waste Option						
P1A	Calcine SBW including New Waste Calcining Facility Upgrades (MACT) and Storage Tanks	2	40	50	90	2,400,000
P1B	Newly Generated Liquid Waste and Tank Farm Heel Waste Management	1	50	50	100	2,800,000
P18	Remote Analytical Lab	2	90	90	180	5,100,000
P59A	Calcine Retrieval and Transport	1	160	170	330	9,300,000
P80	Mixing and FUETAP Grout	3	160	170	330	9,500,000
P81	Unseparated Cementitious HLW Interim Storage	3	290	290	580	16,700,000
P83A	Packaging & Loading of Cement Waste at INTEC for Shipment to a Geologic Repository	3.5	7	7	14	410,000
P133	Waste Treatment Pilot Facility	2	50	50	100	2,600,000
Totals			847	877	1,724	48,810,000

Table 5.3-1. (continued).

Number	Project description	Duration of dispositioning activity[a] (years)	Employment			Total earnings
			Direct[b]	Indirect	Total	(1996$)[c]
Early Vitrification Option						
P18	Remote Analytical Lab	2	90	90	180	5,200,000
P59A	Calcine Retrieval and Transport	1	160	170	330	9,300,000
P61	Vitrified HLW Interim Storage	3	250	260	510	14,500,000
P62A	Packaging/Loading Vitrified HLW at INTEC for Shipment to a Geologic Repository	3	10	10	20	580,000
P88	Vitrifying SBW and Calcine including MACT Upgrades	5	120	120	240	6,800,000
P90A	Packaging & Loading Vitrified SBW at INTEC for Shipment to the Waste Isolation Pilot Plant	1.5	7	7	14	410,000
P133	Waste Treatment Pilot Facility	2	50	50	100	2,600,000
Totals			687	707	1394	39,390,000
Minimum INEEL Processing Alternative[e]						
P18	Remote Analytical Lab	2	90	90	180	5,200,000
P24	Remote Analytical Lab	2.8	30	30	60	1,800,000
P25A	Packaging and Loading Vitrified HLW at INTEC for Shipment to NGR	1	2	2	4	120,000
P27	Vitrified Product Interim Storage	3	140	140	280	7,900,000
P59A	Calcine Retrieval and Transport	1	160	170	330	9,300,000
P111	SBW and Newly Generated Liquid Waste Treatment with CsIX to CH TRU Grout and LLW Grout	1	100	110	210	6,000,000
P112A	Packaging and Loading CH-TRU for Transport to the Waste Isolation Pilot Plant	4.5	7	7	14	410,000
P117A	Packaging and Loading Calcine for Transport to Hanford	2	50	60	110	3,000,000
P133	Waste Treatment Pilot Facility	2	50	50	100	2,600,000
Totals			629	659	1,288	36,330,000

a. Source: Data from Project Data Sheets in Appendix C.6.
b. Source: Data from Project Data Sheets in Appendix C.10.
c. Source: IDOL (1998) presented in 1996 dollars.
d. Table presents bounding scenario for low-level waste fraction disposal.
e. Table presents the bounding scenario.

CH = Contact-handled; CsIX = cesium ion exchange; FUETAP = formed under elevated temperature and pressure; HIP = hot isostatic press; LLW = low-level waste; MACT = Maximum Achievable Control Technology; NGR = National Geologic Repository; TRU = transuranic waste.

Table 5.3-2. Summary of annual employment and income for dispositioning the Tank Farm and bin sets by facility disposition alternative.[a]

Facility	Annual employment and income (1996$)	Facility disposition alternative: Clean closure	Performance-based closure	Closure to landfill standards	Performance-based closure with Class A grout disposal	Performance-based closure with Class C grout disposal
Tank Farm	Direct employment	300	20	10	10	50
	Indirect employment	300	20	10	10	50
	Total employment	600	40	20	20	100
	Total income	16,300,000	1,200,000	700,000	700,000	2,800,000
Bin sets	Direct employment	60	50	30	10	50
	Indirect employment	60	60	30	10	50
	Total employment	120	110	60	20	100
	Total income	3,400,000	3,200,000	1,600,000	600,000	2,800,000

a. Source: Data from Project Data Sheets in Appendix C.6.

Table 5.3-3. Summary of annual employment and income for dispositioning existing HLW facility groups.[a]

Facility	Annual employment: Direct	Indirect	Total	Annual income (1996$)
Tank Farm-related facilities (ancillary facilities)	2	0	2	0
Bin set-related facilities (ancillary facilities)	<1	0	<1	0
Process Equipment Waste Evaporator & related facilities	52	30	82	1,700,000
Fuel Processing Building and related facilities				
Performance-based closure	40	30	70	1,300,000
Closure to landfill standards	32	40	72	2,300,000
Fluorinel and Storage Facility and related facilities	54	60	114	3,100,000
Transport line group	3	3	6	170,000
New Waste Calcining Facility				
Performance-based closure	47	20	67	1,200,000
Closure to landfill standards	44	10	54	700,000
Remote Analytical Laboratory	7	7	14	410,000

a. Source: Data from Project Data Sheets in Appendix C.6.

The potential impacts associated with population and housing, community services, and public finance would be the same as described for construction in Section 5.2.2.

5.3.3 GEOLOGY AND SOILS

Facility disposition activities would be carried out after HLW facilities are no longer operational. Section 3.2 provides descriptions of the facility disposition alternatives being considered and explains how the various HLW facilities would be closed. HLW facilities would be decontaminated to the extent required by the selected alternative, then, depending on the facility disposition alternative selected and the facility in question, they would be entombed and left standing, partially removed, completely removed, or returned to (restricted) industrial use. Impacts to unique geologic features are not anticipated.

The Clean Closure Alternative could require the use of engineered caps for stabilized structures and the replacement of contaminated soil with topsoil for revegetation and backfill. The impacts of expanding existing INEEL gravel/borrow pits were addressed in Section 5.6.2 of the SNF & INEL EIS (DOE 1995). New source development for soil for facility closures was evaluated in a separate National Environmental Policy Act document entitled the *Environmental Assessment and Plan for New Silt/Clay Source Development and Use at the Idaho National Engineering Laboratory* (DOE 1997).

Under Clean Closure, radioactive and hazardous constituents would be removed from the site or treated so that residual contamination is indistinguishable from background levels. This could require removal of all buildings, vaults, tanks, transfer piping, and contaminated soil. This alternative would require the largest quantity of soil for backfilling and would also require topsoil for revegetation.

Under Performance-Based Closure, most above-grade structures would be razed and most below-grade structures (tanks, vaults, and transfer piping) would be decontaminated, stabilized with grout, and left in place. This alternative would require some topsoil for revegetation but would require minimal amounts of soil for backfilling.

Under the Closure to Landfill Standards Alternative, waste residues within tanks, vaults, and piping would be stabilized with grout in order to minimize the release of contaminants into the environment. This alternative would require the use of an engineered cap to cover stabilized structures.

Under Performance-Based Closure with Class A Grout Disposal, facilities would be closed as described under the Performance-Based Closure Alternative, but following completion of these activities low-level waste Class A type Grout (produced under the Full Separations Option) would be disposed of in the Tank Farm and bin sets. This alternative would require some topsoil for revegetation but would require minimal amounts of soil for backfilling.

Under Performance-Based Closure with Class C Grout Disposal, facilities would be closed as described under the Performance-Based Closure Alternative, but following completion of these activities low-level waste Class C type Grout would be disposed of in the Tank Farm and bin sets. This alternative would require some topsoil for revegetation, but would require minimal amounts of soil for backfilling.

5.3.4 AIR RESOURCES

Activities associated with the ultimate disposition of HLW facilities would result in potential impacts on air resources in the INEEL region. Two categories of disposition are considered. The first involves the dispositioning of the various proposed new facilities that are required to support the waste processing alternatives. The second category embraces all the existing facilities as grouped in Table 3-4. For each category, DOE has characterized impacts that would result from the dispositioning of each facility according to candidate cleanup criteria. These impacts are described in terms of total airborne emissions, radiation dose to onsite and offsite receptors, and maximum nonradiological pollutant concentrations at onsite and offsite locations. This section presents summaries of emissions

estimates and impact assessments. Additional detail, including emissions of individual facilities (or groups of similar facilities), is provided in Appendix C.2. The methods used to estimate emissions are consistent with those used for operational and construction emissions, and are described Appendix C.2.

5.3.4.1 Proposed New Facilities Associated with Waste Processing Alternatives

DOE has estimated the radionuclide and nonradiological pollutant emissions that would result from the dispositioning of proposed new facilities required to support the waste processing alternatives. These emissions are temporary in nature and would persist for a few (1 to 4) years following the operating lifetime of individual facilities. Table 5.3-4 summarizes the annual and cumulative release estimates by waste processing alternative (see Appendix C.2 for emissions for individual projects). Figure 5.3-1 compares criteria pollutant and fugitive dust emissions by alternative. In general, radionuclide emission levels from dispositioning of facilities would be much lower than those that would result from operating the involved facilities. Exceptions would be those facilities that process or store waste in sealed form (such as packaging or interim storage facilities), which would have little or no operational emissions. Figure 5.3-2 summarizes the radiation doses that would be associated with these emissions. In all cases, doses would be exceedingly low and very small fractions of natural background levels and applicable standards. Nonradiological impacts are illustrated in Figures 5.3-3 (for criteria pollutants) and 5.3-4 (for toxic air pollutants). When baseline levels are added to projected nonradiological impacts, criteria pollutant levels would remain well below applicable standards for all alternatives. Toxic air pollutant levels would also well below reference levels for all alternatives.

5.3.4.2 Existing Facilities Associated with High-Level Waste Management

The facilities in this group are those that have historically been used at the INTEC to generate, treat, and store HLW. Because of the number of facilities involved, DOE has grouped them in functional groups for purposes of analysis (see Table 3-4). DOE analyzed the HLW tanks and bin sets for closure under all five disposition scenarios; however, facilities that support the Tank Farm and bin sets were analyzed under a single disposition alternative. As shown in Table 3-4, the facility disposition alternative for most supporting facilities is Closure to Landfill Standards. (Two exceptions are the Liquid Effluent Treatment and Disposal Building and the West Side Waste Holdup projects, which would be dispositioned by Clean Closure. Emissions from disposition of the Tank Farm and bin sets are shown in Table 5.3-5. DOE estimated emissions from all other facilities for the one or two closure scenarios as identified in Section 3.2; the results are in Table 5.3-6.

DOE estimated emissions for the maximum year and over the entire duration of each project.

Table 5.3-4. Summary of annual and cumulative emissions from dispositioning facilities that would be constructed under the waste processing alternatives.

	Annual emission rate and total project emissions [a]									
	Radionuclides [b]		Criteria pollutants [c]		Toxic air pollutants		Carbon dioxide[d]		Fugitive dust	
Alternative	Curies per year	Curies	Tons per year	Tons	Pounds per year	Pounds	Tons per year	Tons	Tons per year	Tons
No Action Alternative	–	–	–	–	–	–	–	–	–	–
Continued Current Operations Alternative	1.2×10^{-7}	2.3×10^{-7}	150	200	170	230	3.3×10^{3}	4.4×10^{3}	35	51
Separations Alternative										
Full Separations Option[e]	3.5×10^{-7}	8.2×10^{-7}	490	1.1×10^{3}	550	1.3×10^{3}	1.1×10^{4}	2.5×10^{4}	480	1.1×10^{3}
Planning Basis Option[e]	4.1×10^{-7}	1.1×10^{-6}	590	1.3×10^{3}	680	1.4×10^{3}	1.3×10^{4}	2.8×10^{4}	190	480
Transuranic Separations Option[f]	2.9×10^{-7}	5.9×10^{-7}	410	840	460	960	9.0×10^{3}	1.8×10^{4}	420	890
Non-Separations Alternative										
Hot Isostatic Pressed Waste Option	2.3×10^{-7}	7.0×10^{-7}	430	900	490	1.0×10^{3}	9.4×10^{3}	2.0×10^{4}	180	650
Direct Cement Waste Option	2.3×10^{-7}	5.8×10^{-7}	480	990	550	1.1×10^{3}	1.1×10^{4}	2.2×10^{4}	230	610
Early Vitrification Option	1.9×10^{-7}	5.4×10^{-7}	390	1.1×10^{3}	440	1.3×10^{3}	8.5×10^{3}	2.4×10^{4}	140	460
Minimum INEEL Processing Alternative[g]	3.5×10^{-7}	8.1×10^{-7}	450	820	510	940	9.9×10^{3}	1.8×10^{4}	410	860

a. Maximum annual emissions represent the highest emission rate for any single year; total emissions value is the product of annual emissions for each decontamination and decommissioning project and the duration (in years) of that project. Source: Project Data Sheets (Appendix C.6).
b. Radionuclide emissions would consist primarily of strontium-90/yttrium-90 and cesium-137, with much smaller amounts of transuranic isotopes (plutonium, americium, etc.).
c. See Figure 5.3-1 for emissions of individual criteria pollutants.
d. Carbon dioxide is listed because this gas has been implicated in global warming.
e. Assumes disposal of low-level waste Class A type grout either offsite or in new INEEL landfill facility; impacts of disposal in Tank Farm and bin sets are addressed in Table 5.3-5.
f. Assumes disposal of low-level waste Class C type grout in new facility; impacts of disposal in Tank Farm and bin sets are addressed in Table 5.3-5.
g. Assumes "just-in-time" shipping scenario; nonradiological emissions impacts of the interim storage shipping scenario would be somewhat less.

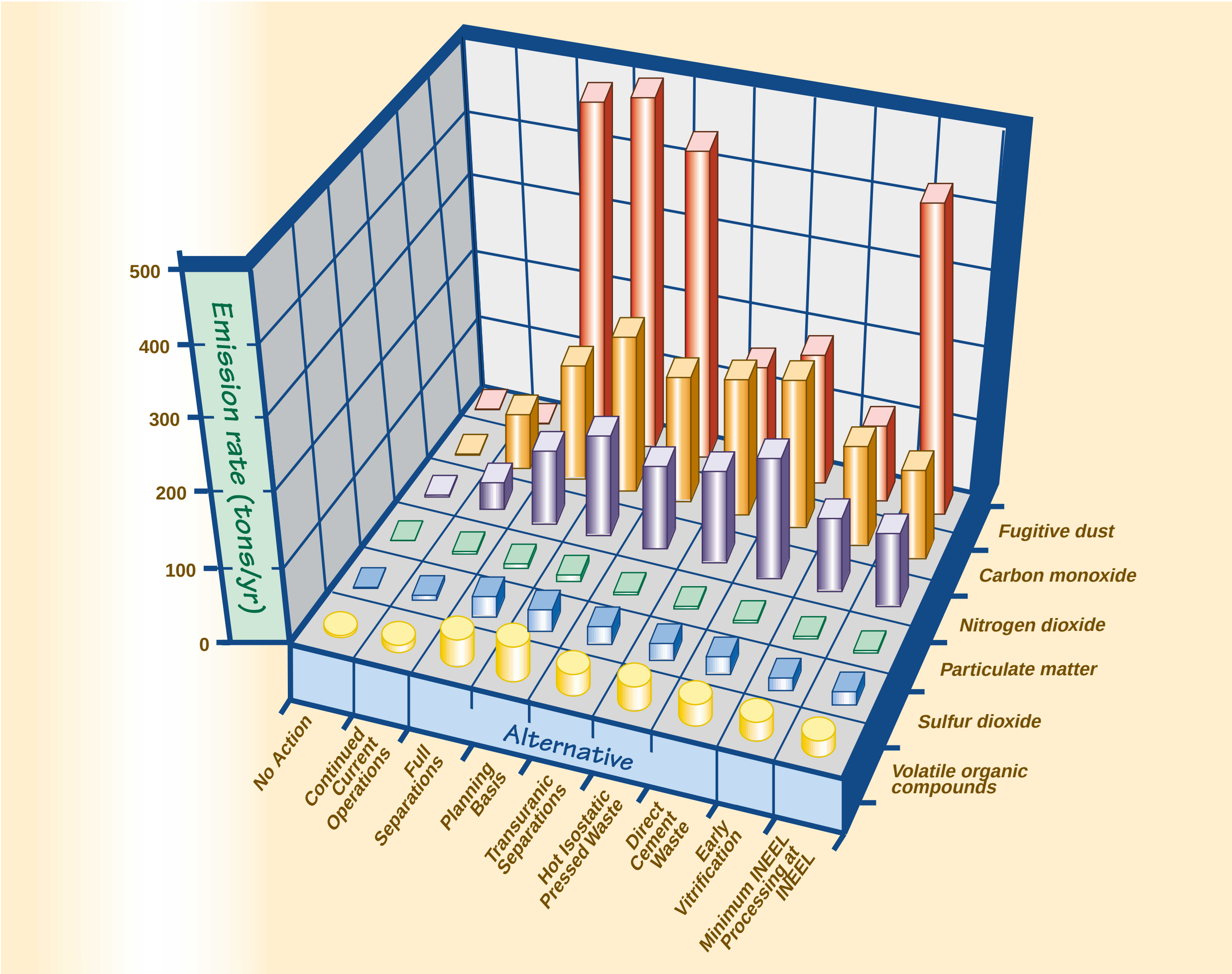


FIGURE 5.3-1.
Comparison of criteria pollutant and fugitive dust emission rates for dispositioning of facilities associated with waste processing alternatives.

Radionuclide emissions would result primarily from the mechanical disturbance of contaminated surfaces. These emissions would be minimized by the use of control systems such as enclosures with high efficiency particulate air filtration systems, and would be discharged through controlled release points (such as the INTEC Main Stack). Use of fuel-burning equipment (e.g., cranes, trucks) is the primary source of nonradiological pollutants, which would be released near ground-level. The disturbance of ground surfaces by vehicles would also result in the generation of fugitive dust. As a result of differences in release conditions, the location of maximum impact is different for radiological than for nonradiological impacts.

DOE also assessed the radiation doses and nonradiological impacts that would be associated with dispositioning the Tank Farm, bin sets, and other facilities. Figures 5.3-5 through 5.3-7 compare the results of the assessments for the Tank Farm, bin sets, and related facilities under the alternative closure scenarios. Figures 5.3-8 through 5.3-10 show the radiological and nonradiological impacts of dispositioning other existing facilities. All radiological and nonradiological ambient air impacts would be well below applicable standards.

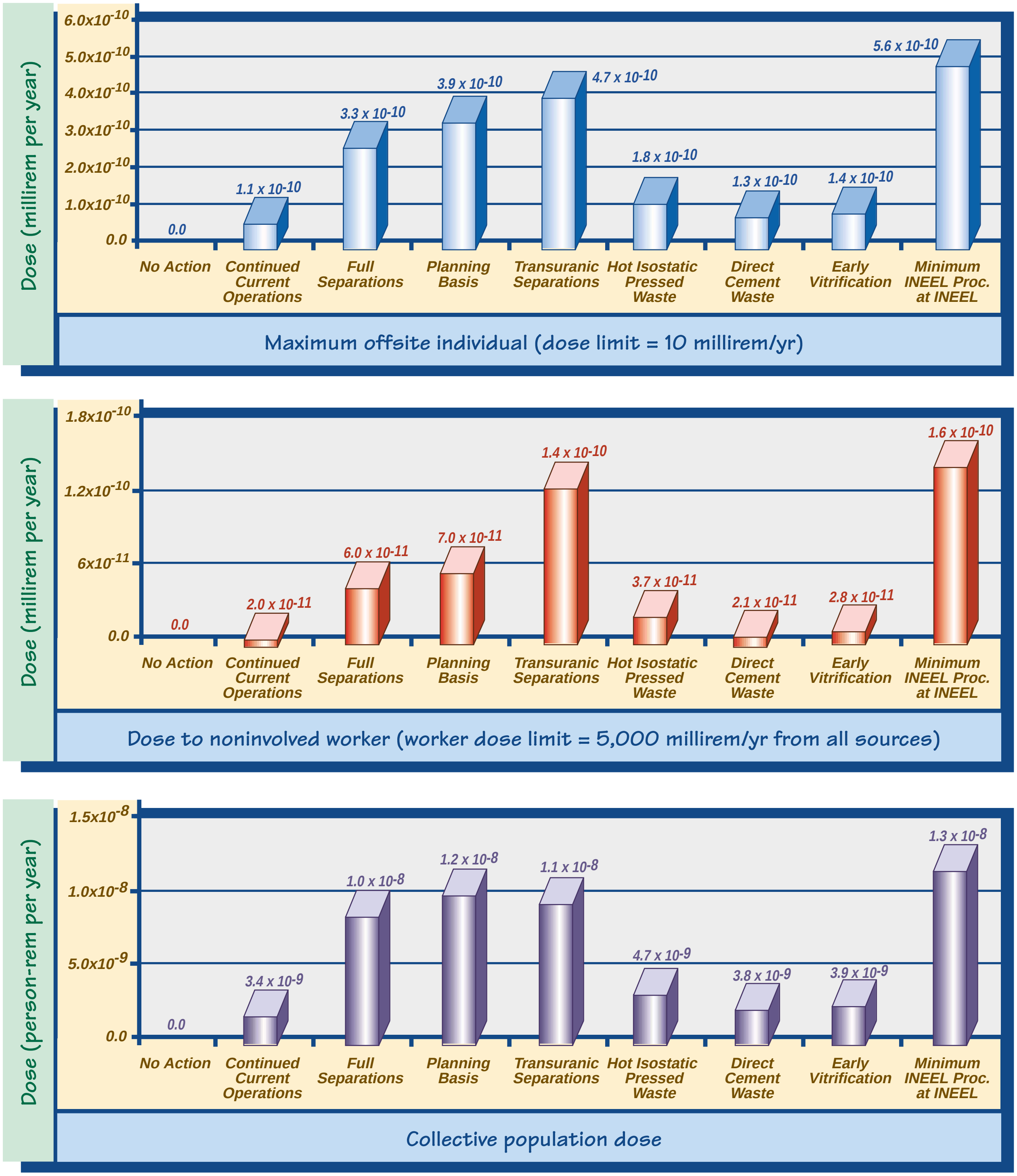
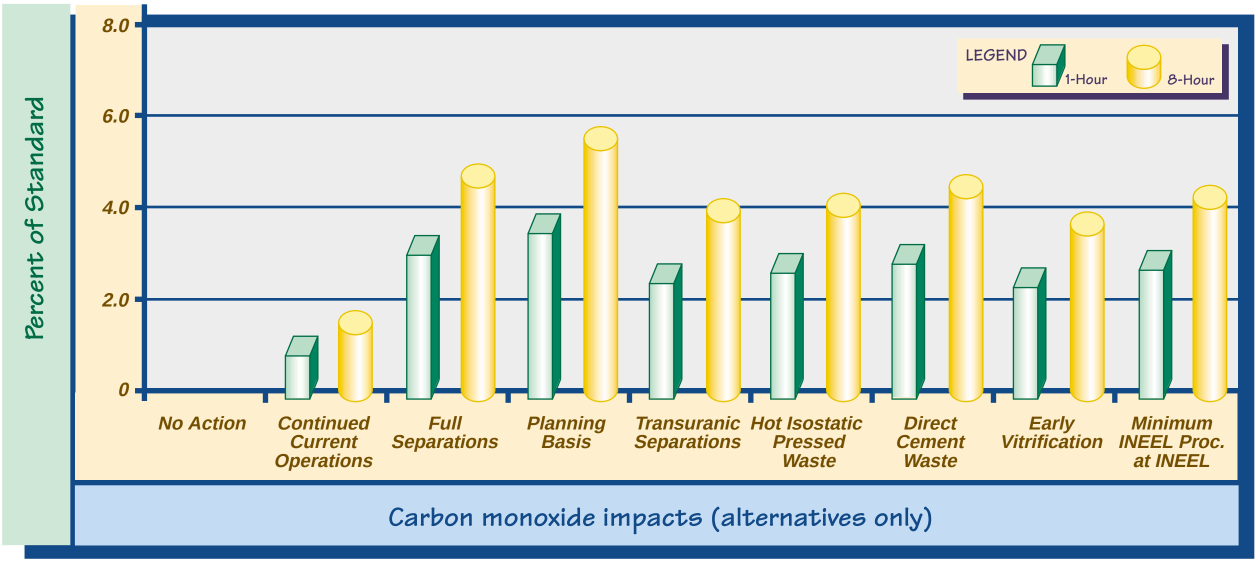


FIGURE 5.3-2.
Comparison of air pathway doses for dispositioning facilities associated with waste processing alternatives.



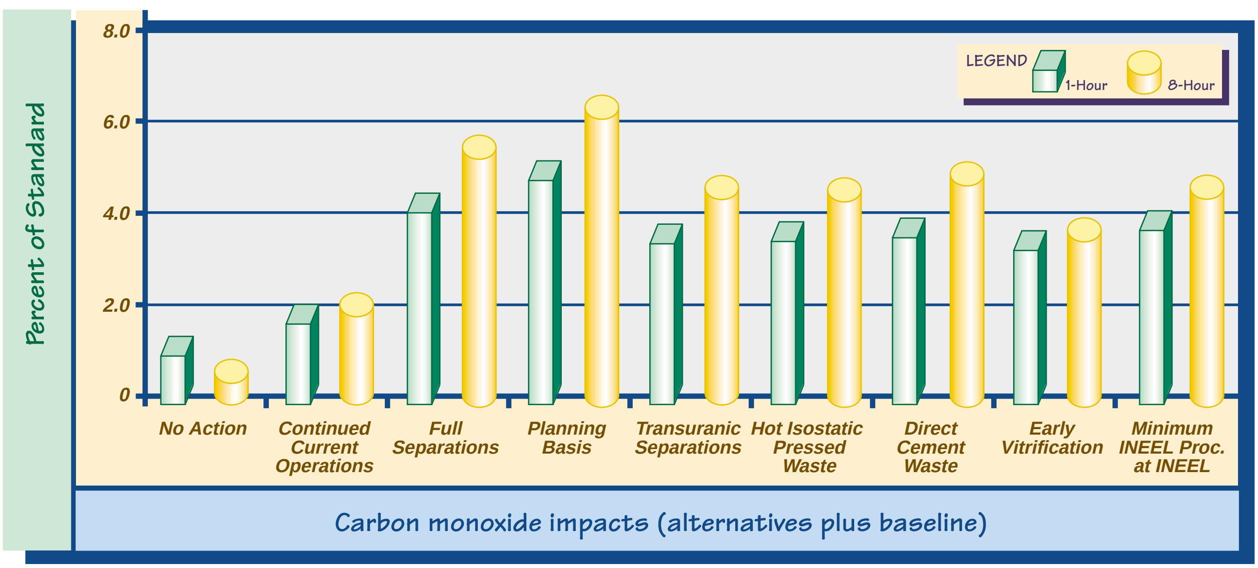
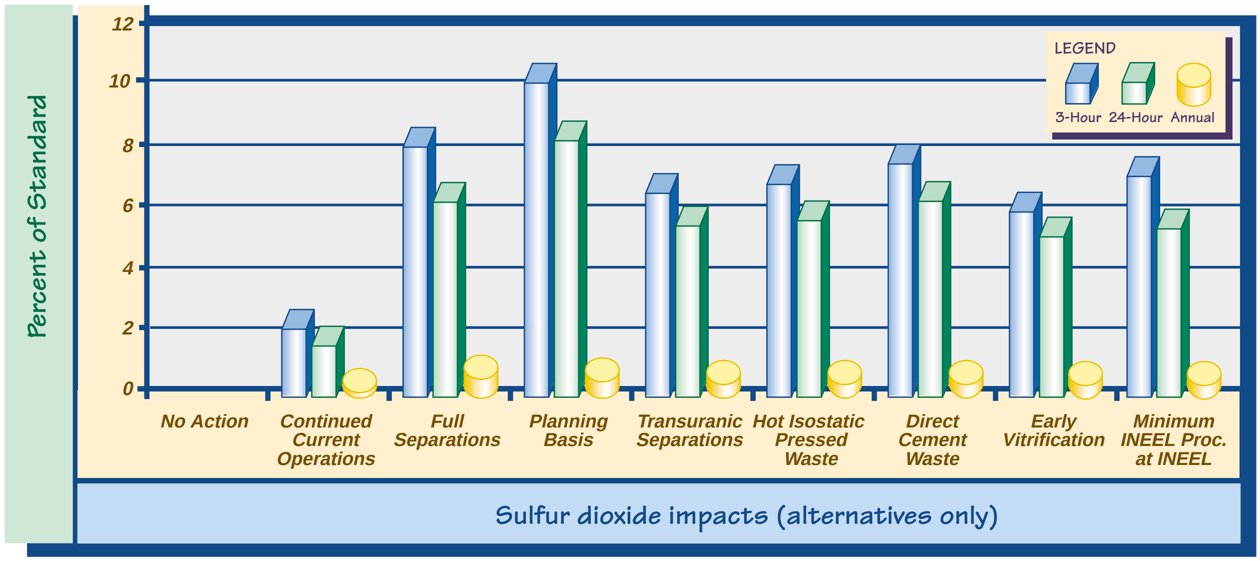


FIGURE 5.3-3. (1 of 4)
Comparison of criteria air pollutant impacts for dispositioning facilities associated with waste processing alternatives.



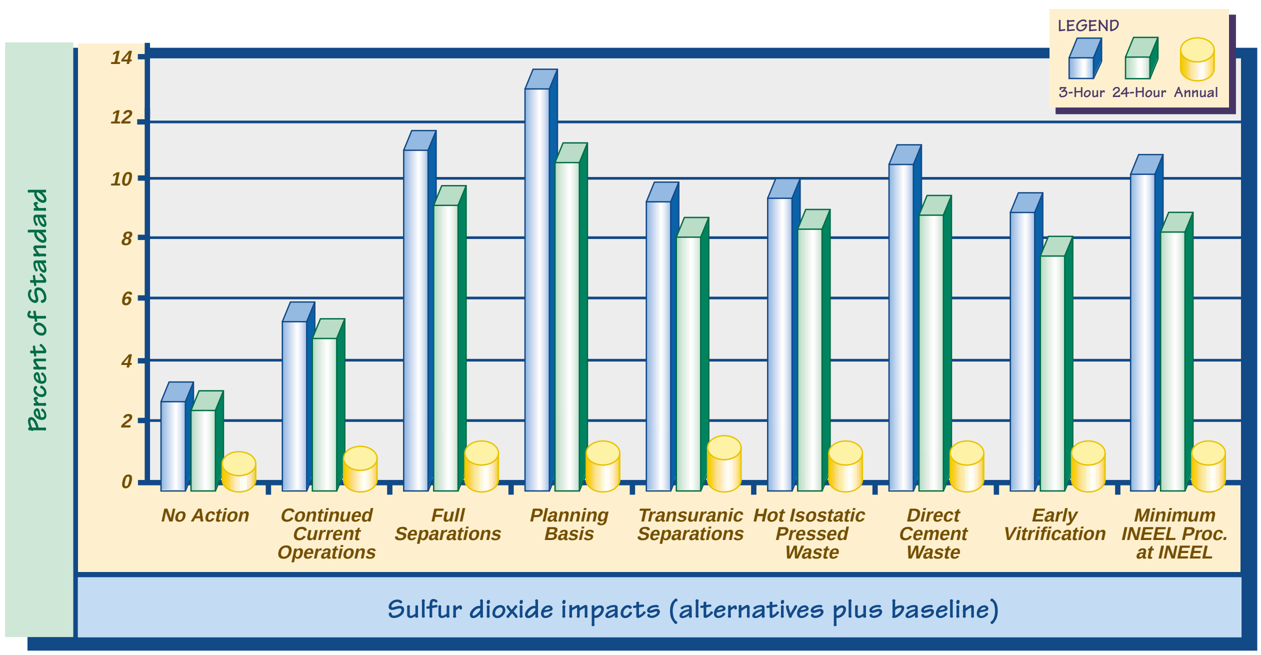
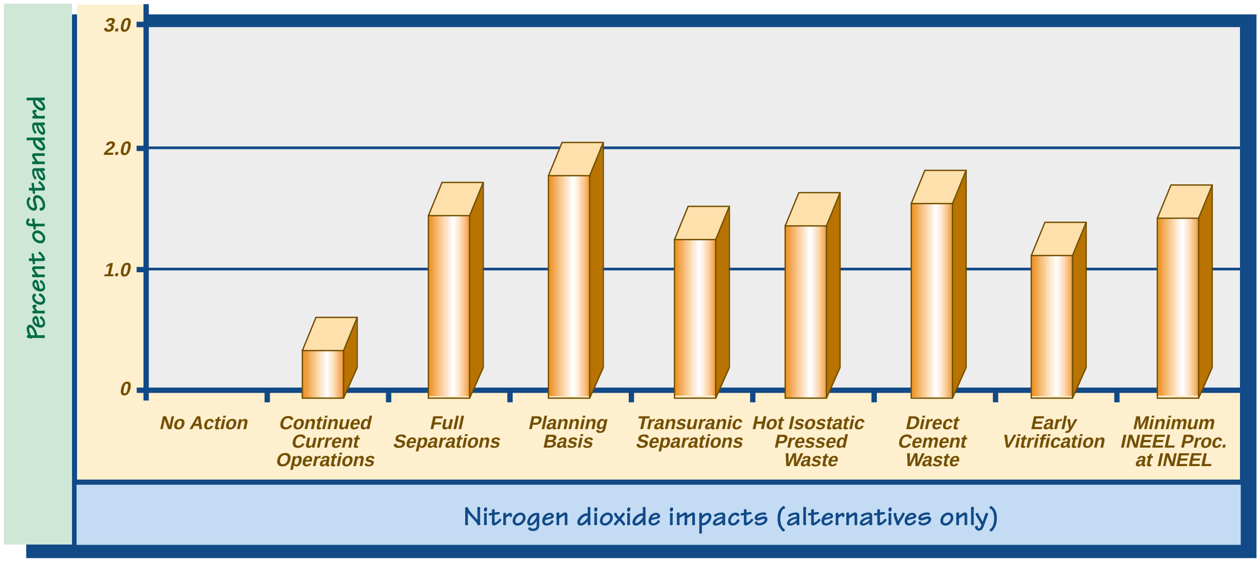


FIGURE 5.3-3. (2 of 4)
Comparison of criteria air pollutant impacts for dispositioning facilities associated with waste processing alternatives.



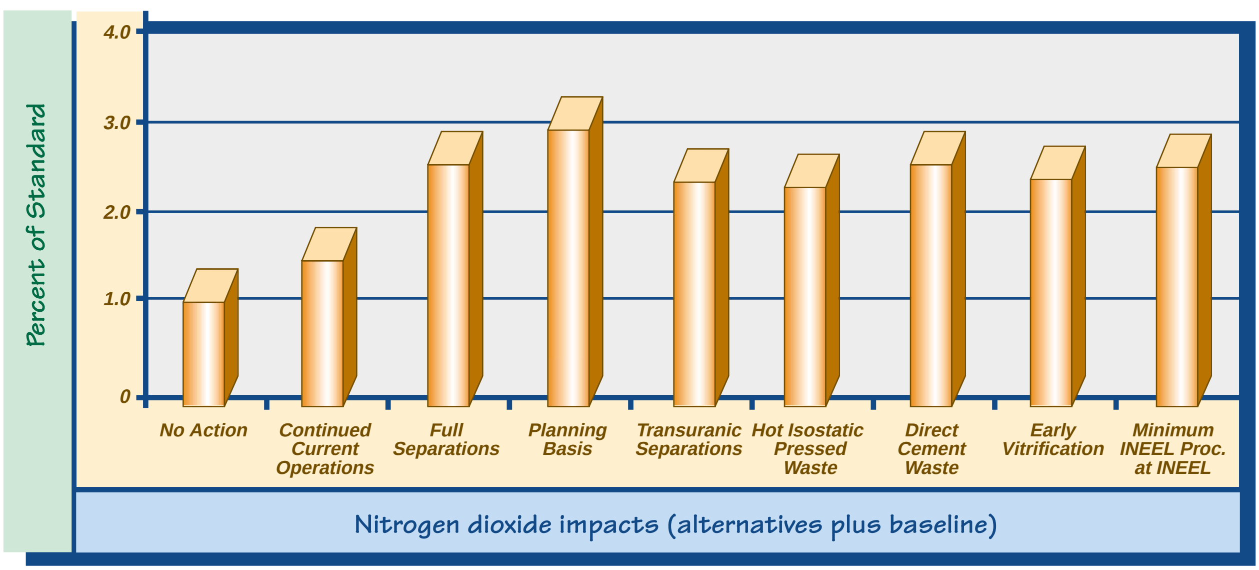
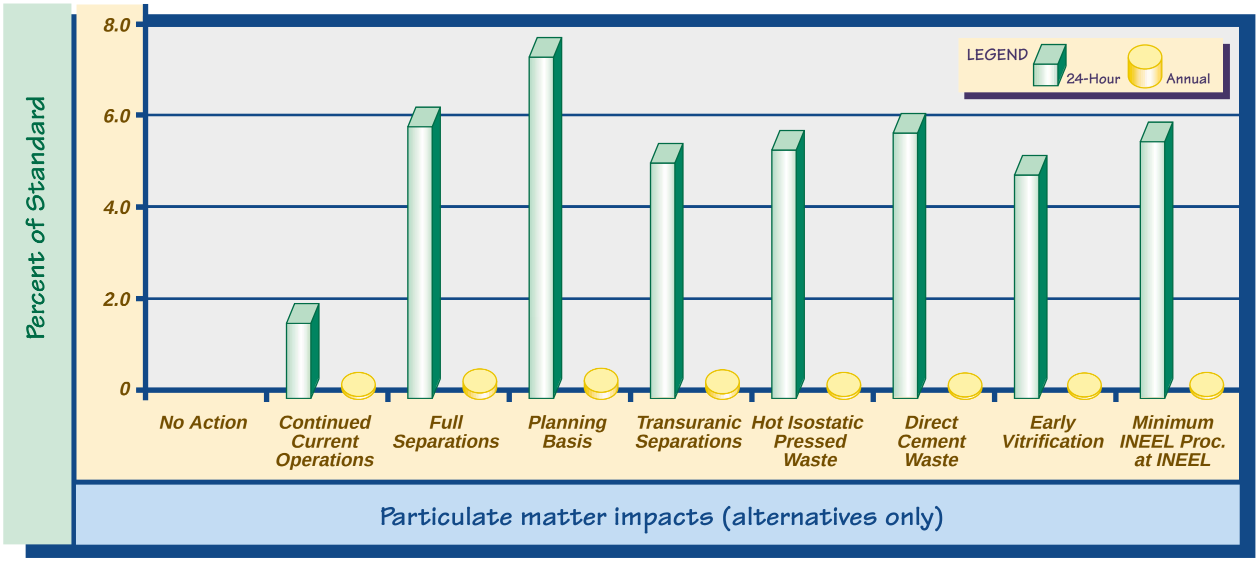


FIGURE 5.3-3. (3 of 4)
Comparison of criteria air pollutant impacts for dispositioning facilities associated with waste processing alternative.



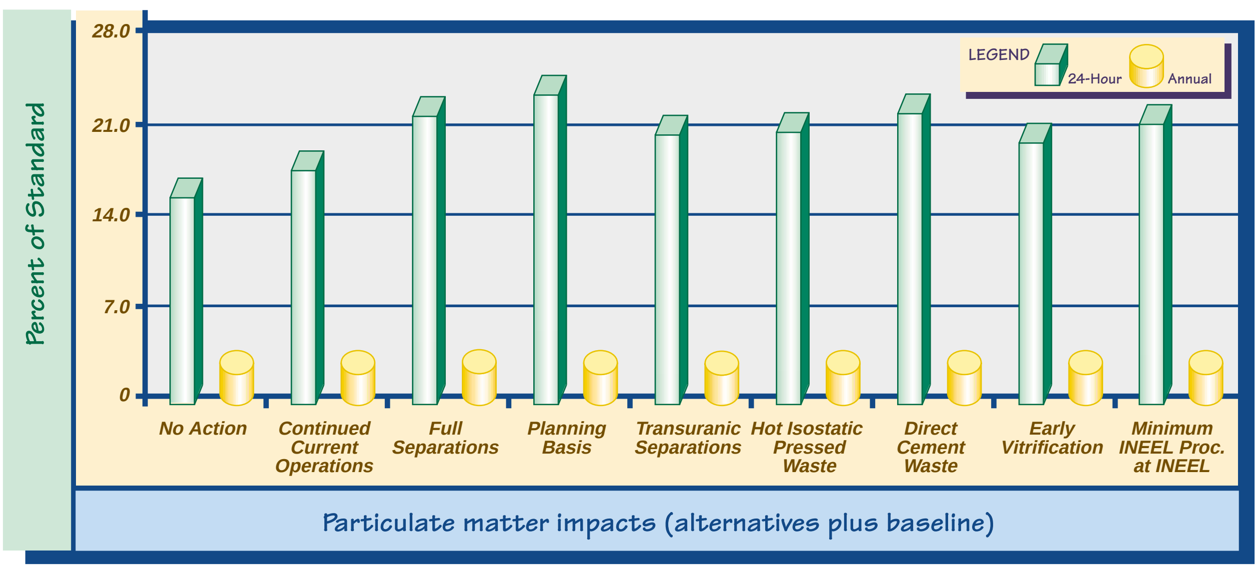
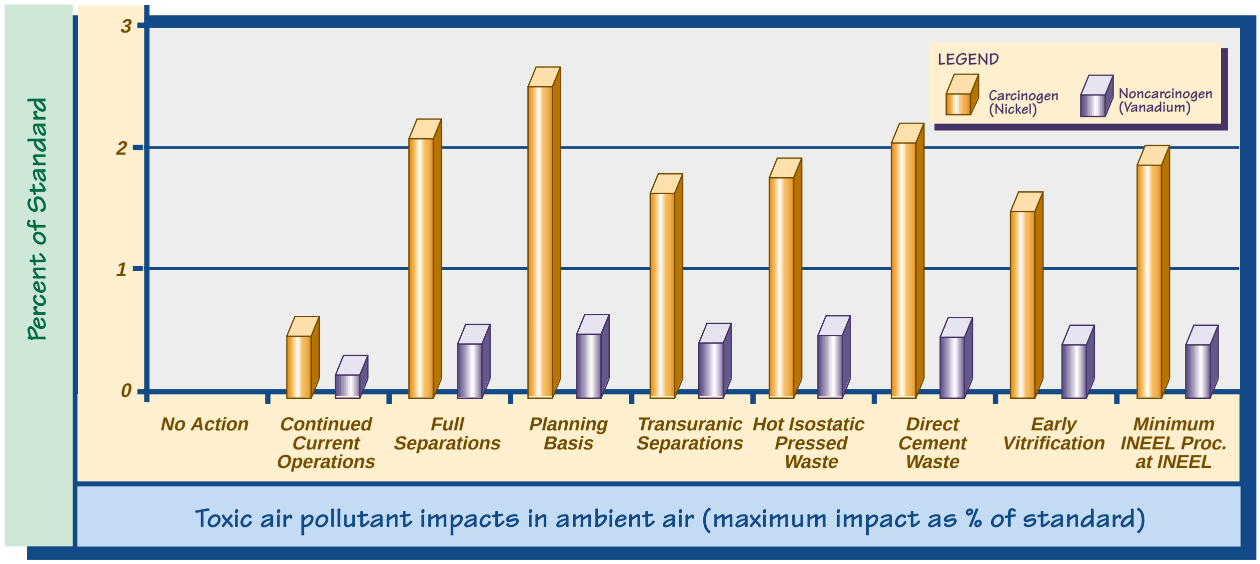


FIGURE 5.3-3. (4 of 4)
Comparison of criteria air pollutant impacts for dispositioning facilities associated with waste processing alternative.



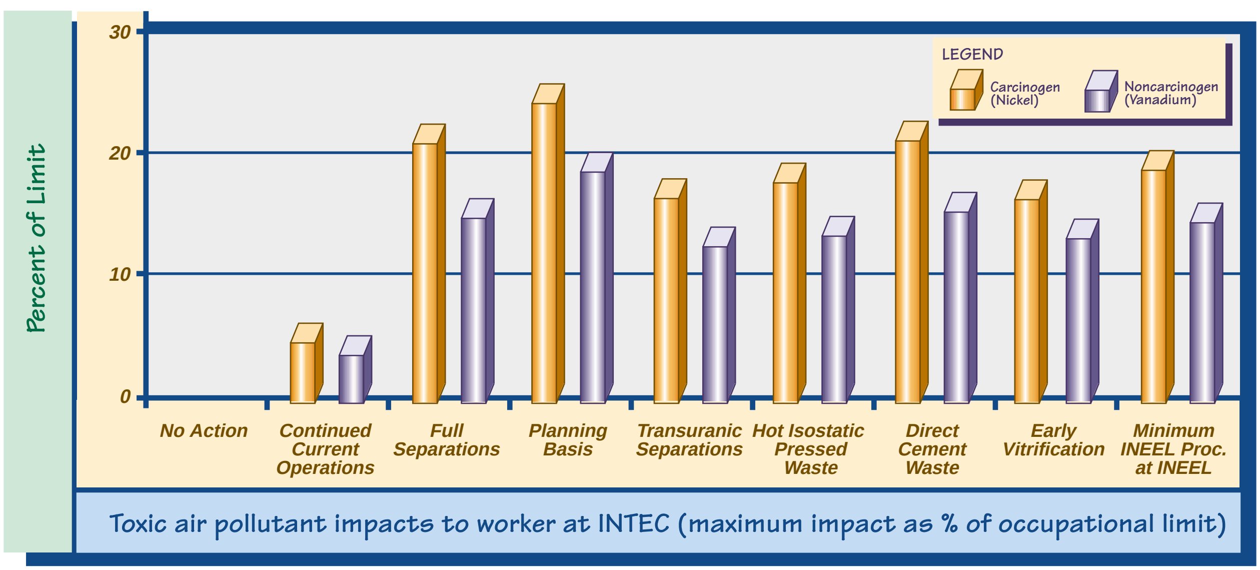


FIGURE 5.3-4.
Toxic air pollutants impacts for dispositioning of facilities associated with waste processing alternatives.

Table 5.3-5. Summary of annual and cumulative emissions from dispositioning the Tank Farm and bin sets under alternative closure scenarios.

Facility	Pollutant	Units	Maximum annual and total emissions [a]			
			Clean closure	Performance-based closure	Closure to landfill standards	Performance-based closure with Class A or C grout disposal
Tank Farm		Years (duration) [b]	17	17	17	27
	Radionuclides[c]	Curies per year	8.6×10^{-7}	1.1×10^{-7}	7.8×10^{-7}	1.1×10^{-7}
		Total curies	1.5×10^{-5}	1.8×10^{-6}	1.3×10^{-5}	2.5×10^{-6}
	Criteria pollutants[d]	Tons per year	43	8.5	6	5.3
		Total tons	730	140	100	110
	Toxic air pollutants	Tons per year	0.024	4.8×10^{-3}	3.4×10^{-3}	3.0×10^{-3}
		Total tons	0.41	0.081	0.057	0.06
	Carbon dioxide[e]	Tons per year	1.5×10^{3}	180	130	110
		Total tons	2.6×10^{4}	3.0×10^{3}	2.1×10^{3}	2.3×10^{3}
	Fugitive dust	Tons per year	130	19	19	37
		Total tons	2.2×10^{3}	150	160	670
Bin sets		Years (duration) [b]	20	20	21	18
	Radionuclides[c]	Curies per year	1.3×10^{-7}	1.7×10^{-7}	1.2×10^{-6}	1.7×10^{-7}
		Total curies	2.6×10^{-6}	3.4×10^{-6}	$2.4\text{x}10^{-5}$	2.5×10^{-6}
	Criteria pollutants[d]	Tons per year	2.1	1.8	1.8	2.7
		Total tons	42	36	36	33
	Toxic air pollutants	Tons per year	1.2×10^{-3}	1.0×10^{-3}	1.0×10^{-3}	1.5×10^{-3}
		Total tons	0.024	0.02	0.02	0.015
	Carbon dioxide[e]	Tons per year	44	37	38	55
		Total tons	870	740	760	680
	Fugitive dust	Tons per year	53	33	33	66
		Total tons	1.1×10^{-3}	660	660	860

a. Maximum annual emissions represent the highest emission rate for any single year; total emissions value is the product of annual emissions for each activity (project) required to support the closure alternative and the duration (in years) of that activity.
b. The value listed is the longest duration for any combination of projects required to support the closure alternative. In some cases, the highest emission rates result from projects that are short in duration.
c. Radionuclide emissions would consist primarily of strontium-90/yttrium-90 and cesium-137, with small amounts of transuranic isotopes (plutonium, americium, etc.). For Tank Farm waste, the assumed fractions are 48.6 percent strontium-90/yttium-90; 51.1 percent cesium-137; and 0.33 percent transuranics; for bin set waste, the assumed values are 89.7 percent strontium-90/yttrium-90; 10.3 percent cesium-137; and 0.003 percent transuranics.
d. The specific pollutants and approximate relative percentages are as follows: carbon monoxide - 45 percent; sulfur dioxide - 7 percent; nitrogen dioxide - 38 percent; particulate matter - 2 percent; and volatile organic compounds - 8 percent.
e. Carbon dioxide is listed because this gas has been implicated in global warming.

Table 5.3-6. Summary of maximum annual and cumulative emissions from decontaminating and decommissioning other existing facilities associated with high-level waste management.

		Maximum annual emission rate and total emissions[a]									
		Radionuclides[d]		Criteria pollutants[e]		Toxic air pollutants		Carbon Dioxide[f]		Dust	
Facility Group[b]	Duration of dispositioning activity[c] (years)	Curies per year	Curies	Tons per year	Tons	Tons per year	Tons	Tons per year	Tons	Tons per year	Tons
Tank Farm-related (ancillary) facilities	8	5.8×10^{-8}	3.8×10^{-7}	61	390	0.034	0.22	1.2×10^{3}	7.9×10^{3}	0.72	4.3
Bin set-related (ancillary) facilities	6	8.7×10^{-8}	5.2×10^{-7}	450	2.7×10^{3}	0.25	1.5	9.3×10^{3}	5.6×10^{4}	0	0
Process Equipment Waste Evaporator and Related Facilities	6	8.7×10^{-8}	6.1×10^{-7}	420	2.5×10^{3}	0.23	1.4	8.6×10^{3}	5.1×10^{4}	65	390
Fuel Processing Building and Related Facilities											
Performance-based closure	10	1.7×10^{-7}	1.7×10^{-6}	150	1.5×10^{3}	0.084	0.84	3.1×10^{3}	3.1×10^{4}	71	710
Closure to landfill standards	10	1.7×10^{-7}	1.7×10^{-6}	150	1.5×10^{3}	0.084	0.84	3.1×10^{3}	3.1×10^{4}	71	710
FAST and Related Facilities	6	5.8×10^{-8}	3.5×10^{-7}	50	300	0.028	0.17	1.1×10^{3}	6.1×10^{3}	120	690
Transport Lines Group	1	–	–	36	36	0.02	0.02	750	750	7.2	7.2
New Waste Calcining Facility[g]											
Performance-based closure	3	5.8×10^{-8}	1.7×10^{-7}	50	150	0.028	0.84	1.1×10^{3}	3.1×10^{3}	63	190
Closure to landfill standards	3	5.8×10^{-8}	1.7×10^{-7}	50	150	0.028	0.84	1.1×10^{3}	3.1×10^{3}	63	190
Remote Analytical Laboratory	6	2.9×10^{-8}	1.7×10^{-7}	33	200	0.018	0.11	680	4.7×10^{3}	8.6	52

a. Maximum annual emissions represent the highest emission rate for any single year and are the sum of annual emission rates for each activity within a group that may occur during a common year; total emissions value is the product of cumulative emissions (annual rate multiplied by duration in years) for each individual activity within a group.

b. See Table 3-4 for facility disposition alternatives that apply to each group. The Fuel Processing Building and Related Facilities and the New Waste Calcining Facility could be dispositioned by either performance-based closure or closure to landfill standards. Individual facilities within all other groups would be dispositioned according to a single closure method.

c. Duration refers to total number of calendar years during which decontamination and decommissioning of facilities within the listed groups would occur.

d. Radionuclide emissions would consist primarily of strontium-90/yttrium-90 and cesium-137, with much smaller amounts of transuranic isotopes.

e. The specific pollutants and approximate relative percentages are as follows: carbon monoxide – 45 percent; sulfur dioxide - 7 percent; nitrogen dioxide - 38 percent; particulate matter - 2 percent; and volatile organic compounds - 8 percent.

f. Carbon dioxide is listed because this gas has been implicated in global warming.

g. The decontamination and decommissioning of this facility is also included in some of the waste processing alternatives presented in Table 5.3.4-1.

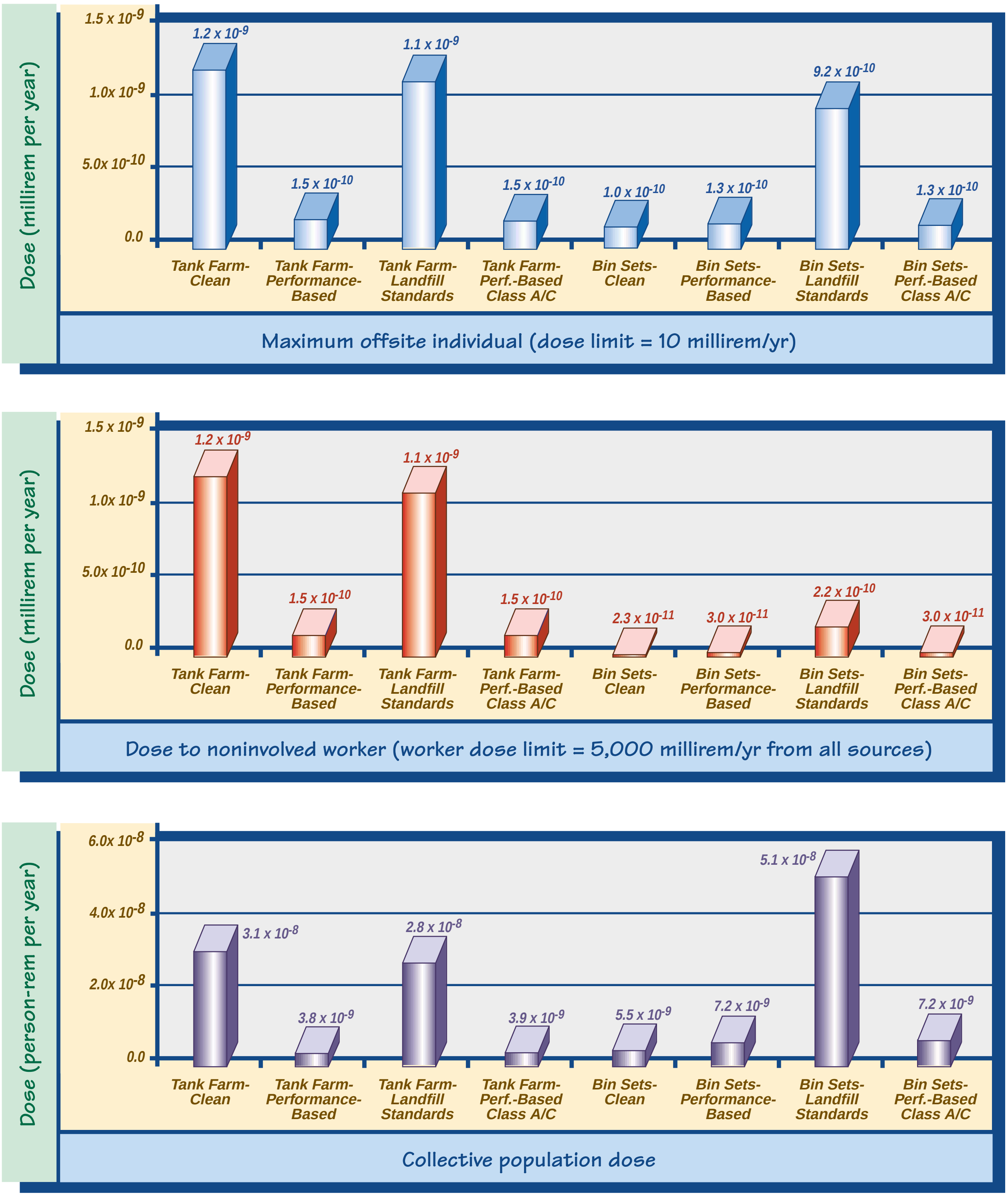
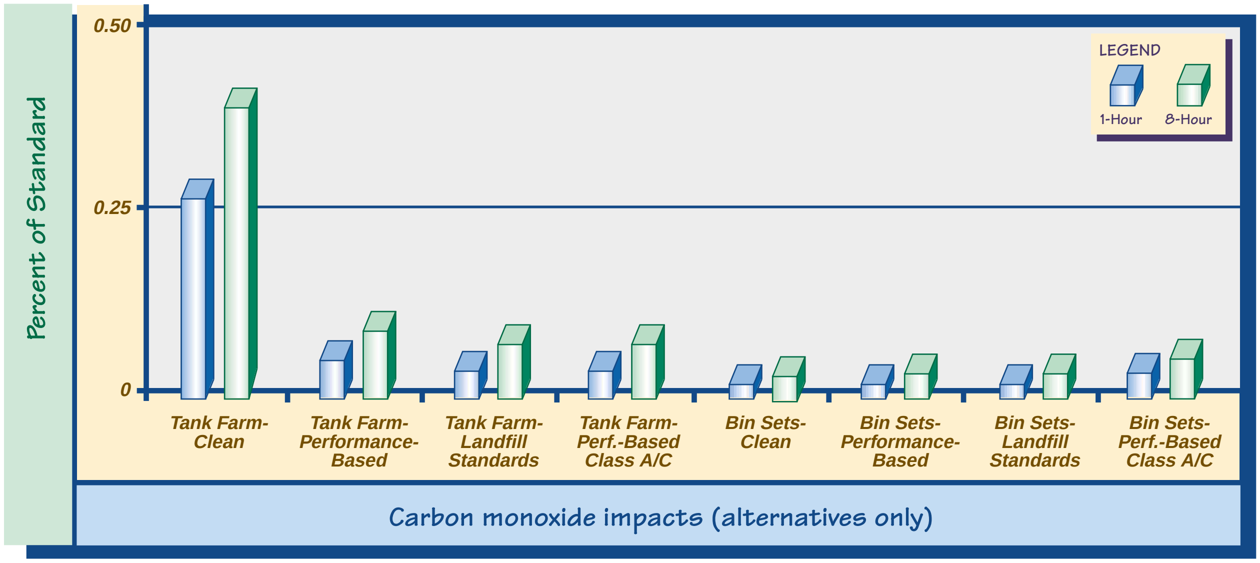


FIGURE 5.3-5.
Air pathway doses by Tank Farm and bin set closure option.



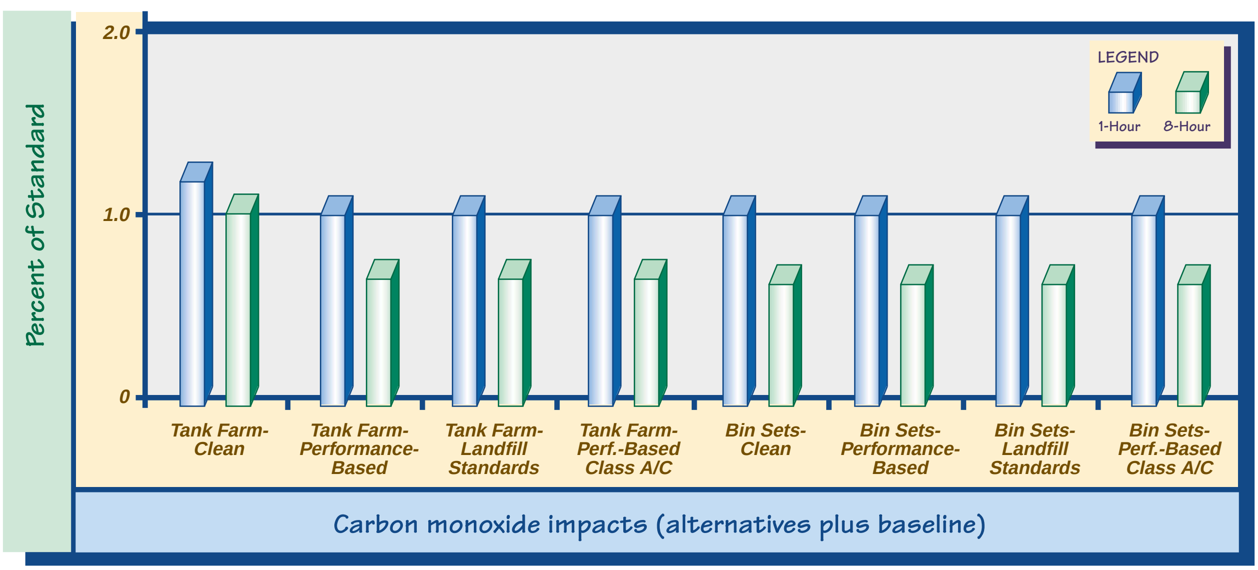
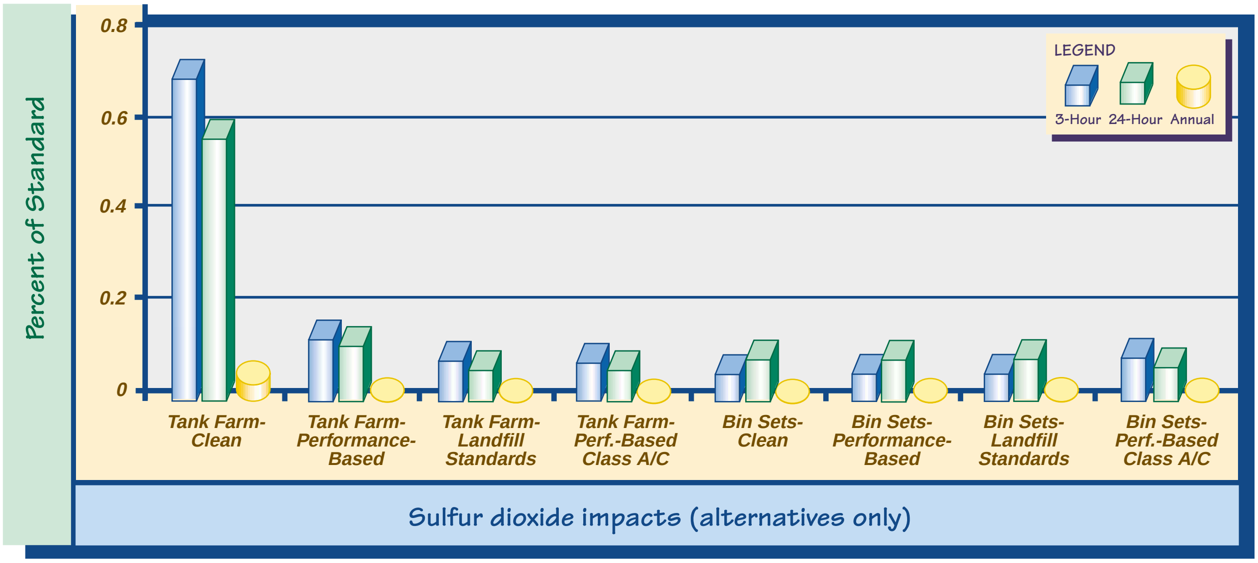


FIGURE 5.3-6. (1 of 4)
Criteria air pollutant impacts by Tank Farm and bin set closure alternative.



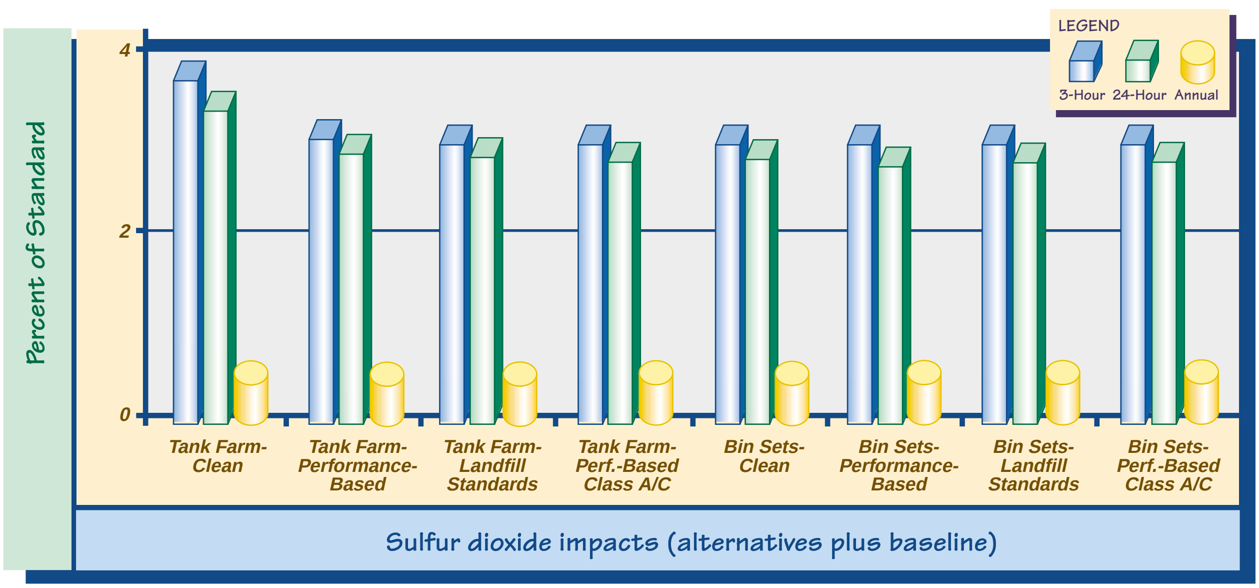
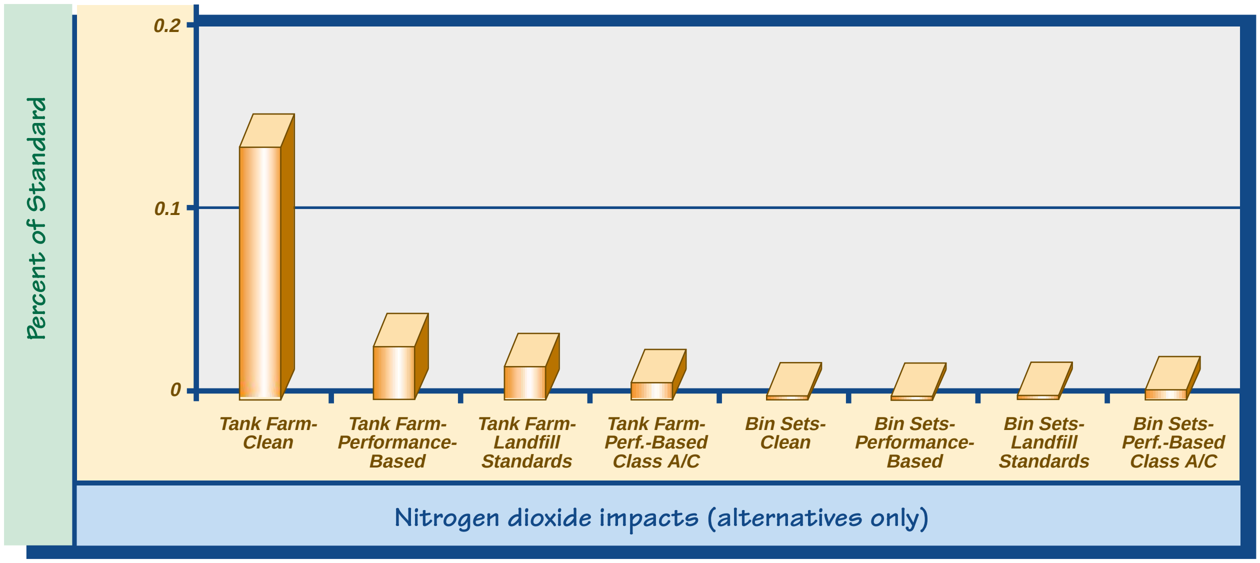


FIGURE 5.3-6. (2 of 4)
Criteria air pollutant impacts by Tank Farm and bin set closure alternative.



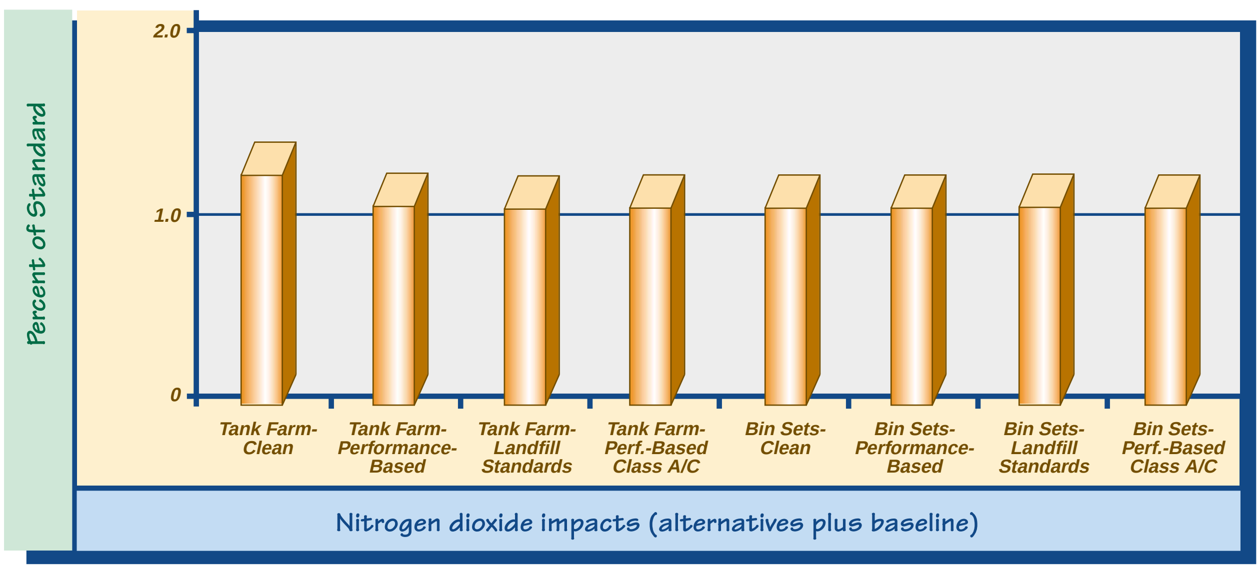
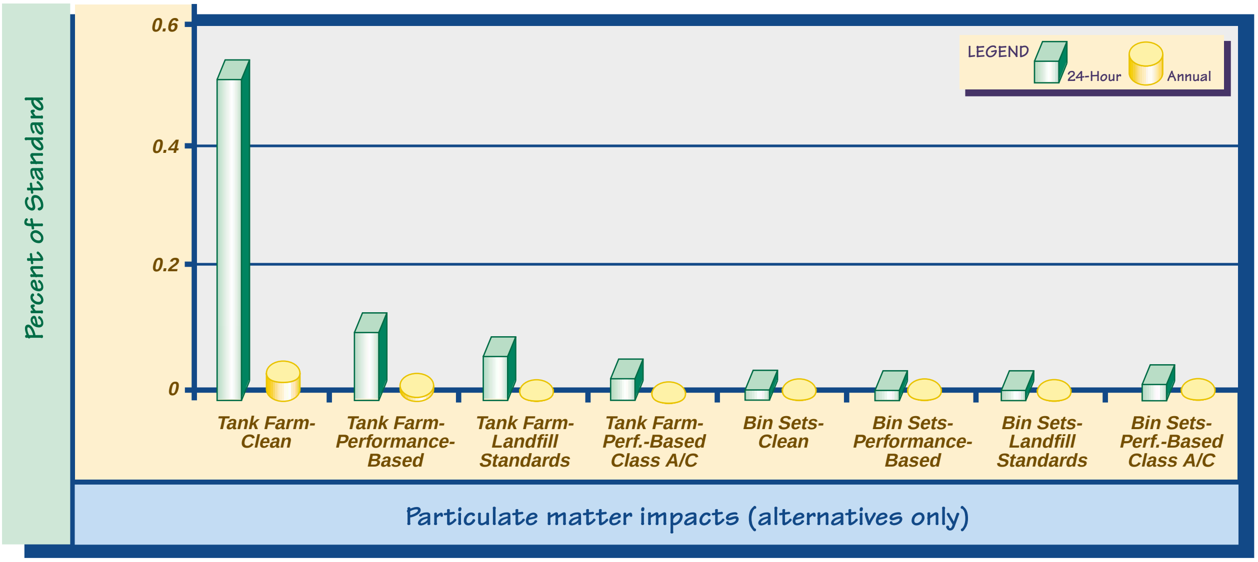


FIGURE 5.3-6. (3 of 4)
Criteria air pollutant impacts by Tank Farm and bin set closure alternative.



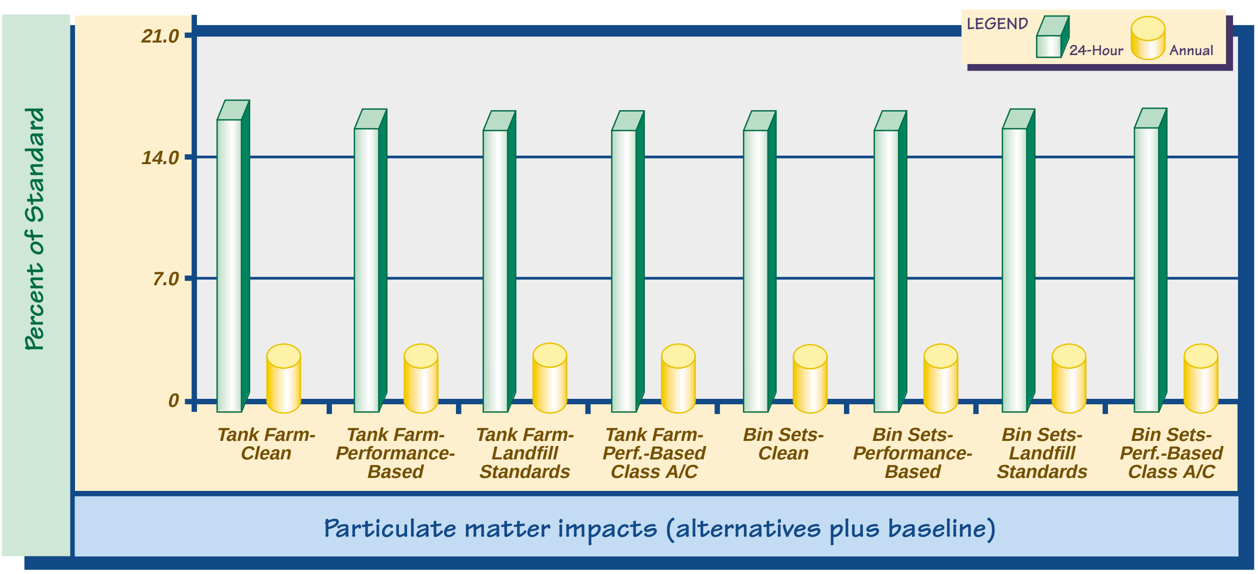
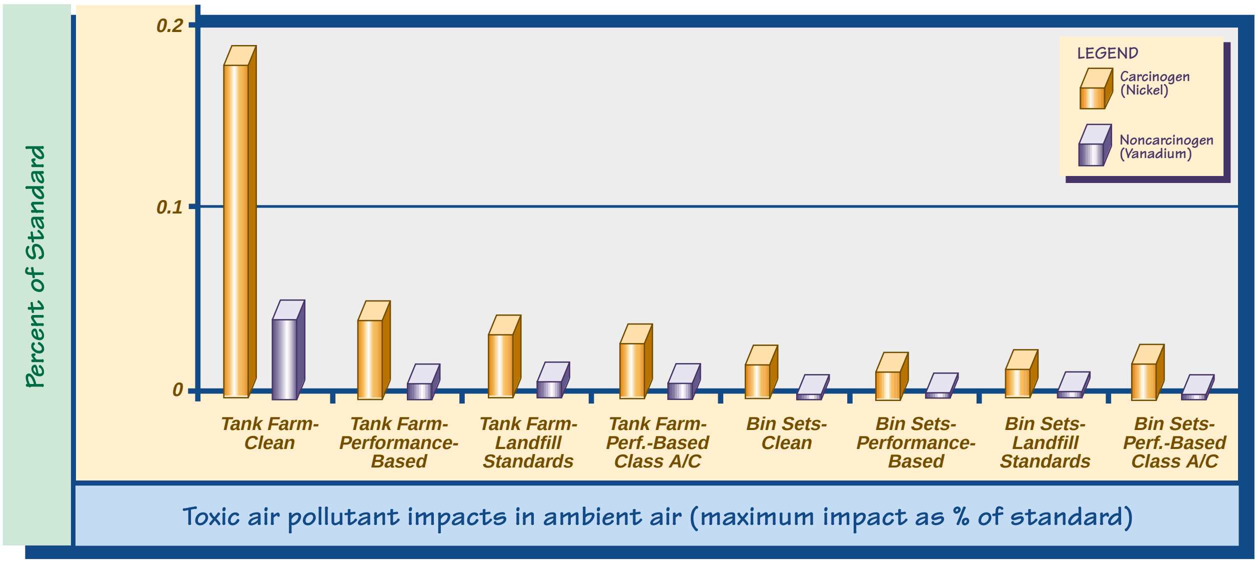


FIGURE 5.3-6. (4 of 4)
Criteria air pollutant impacts by Tank Farm and bin set closure alternative.



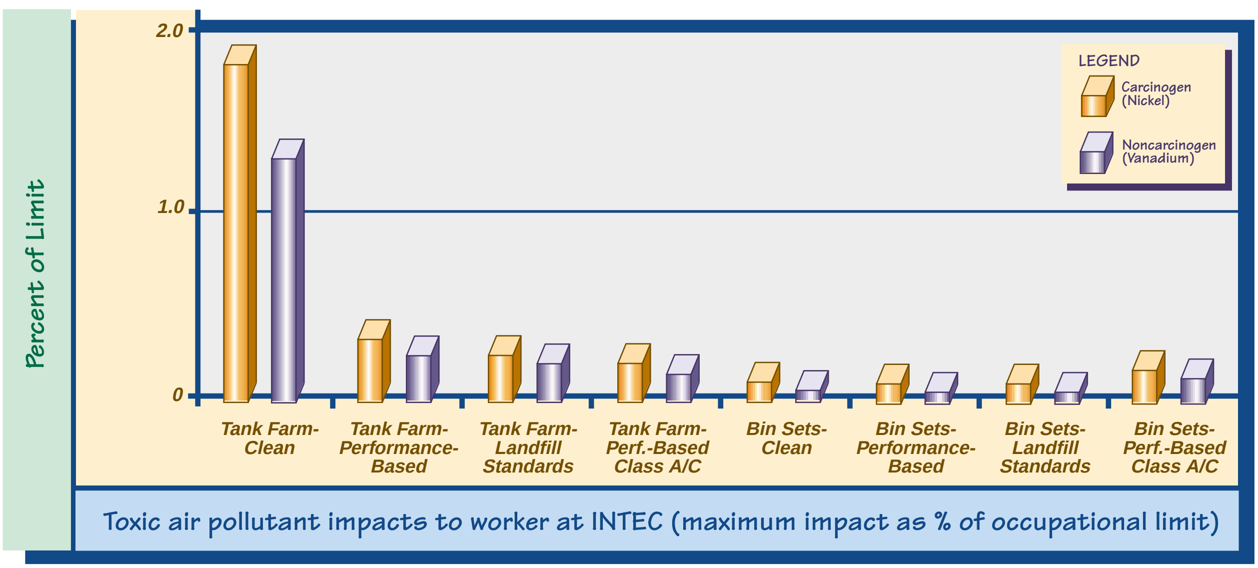


FIGURE 5.3-7.
Toxic air pollutant impacts for Tank Farm and bin set closure options.

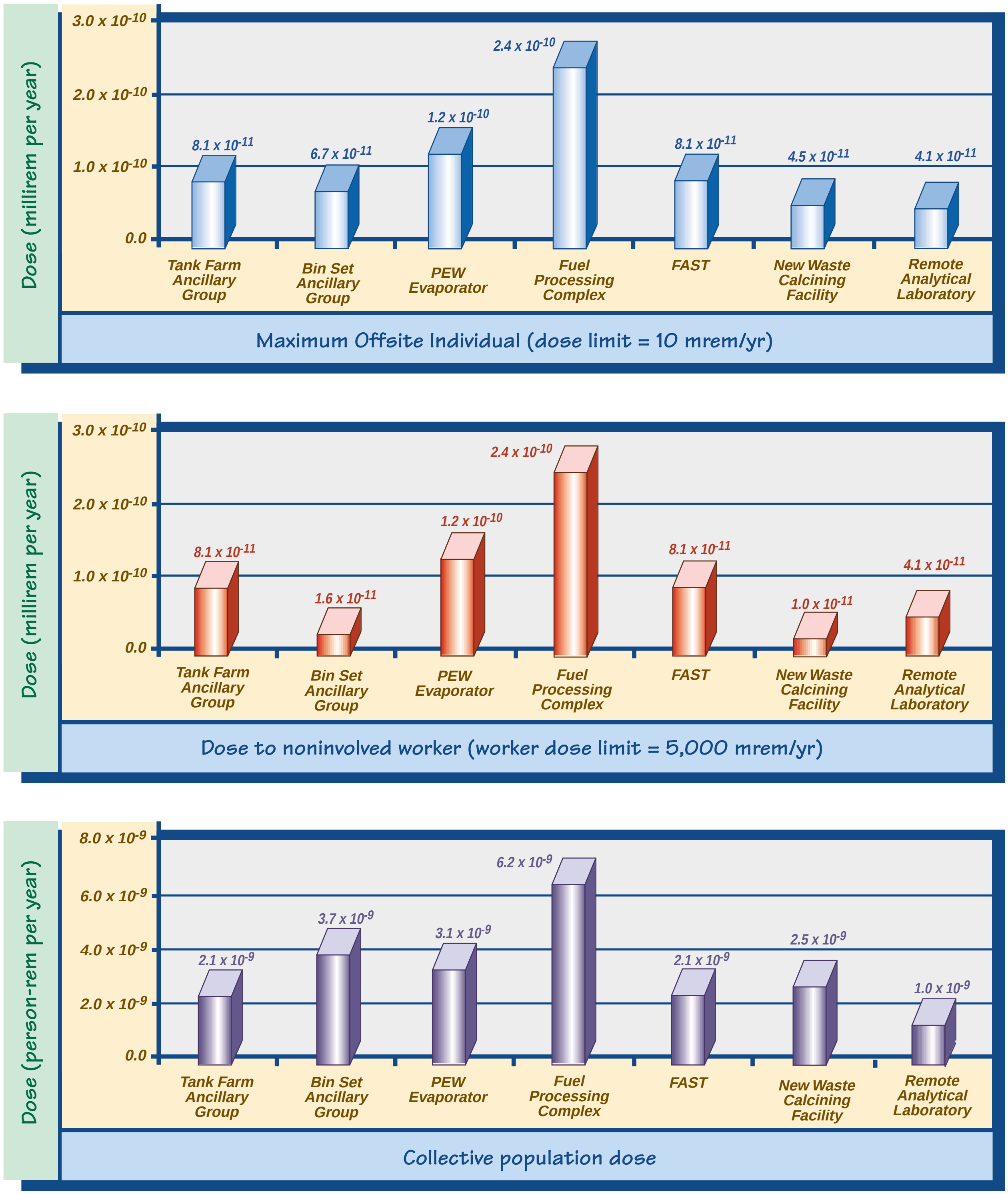
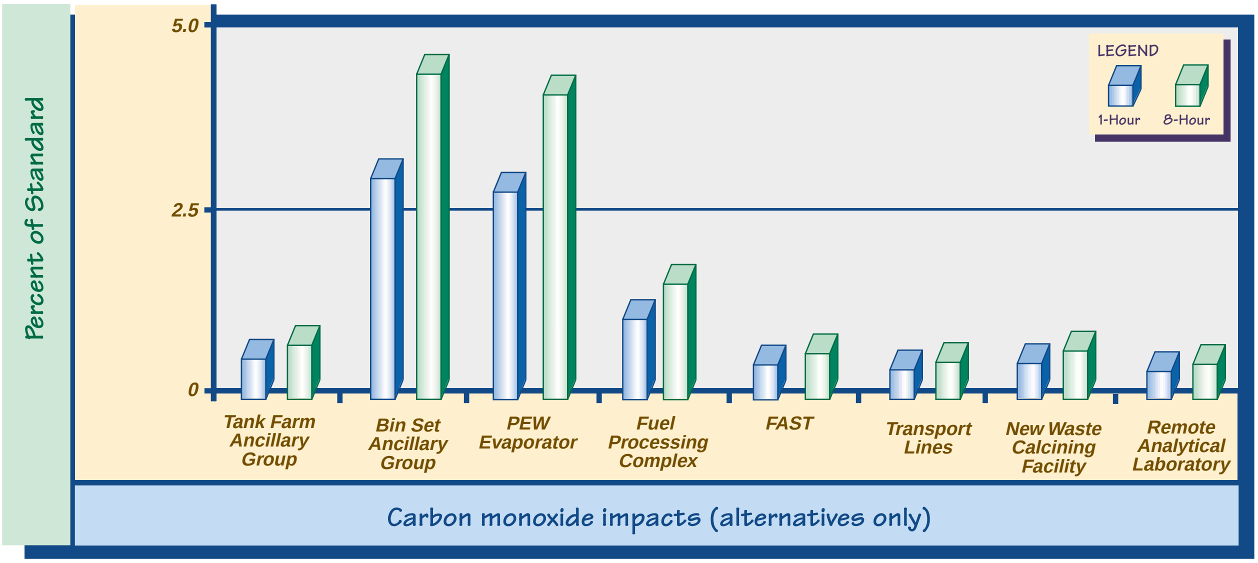


FIGURE 5.3-8.
Air pathway doses for dispositioning existing INTEC facilities associated with high-level waste management.



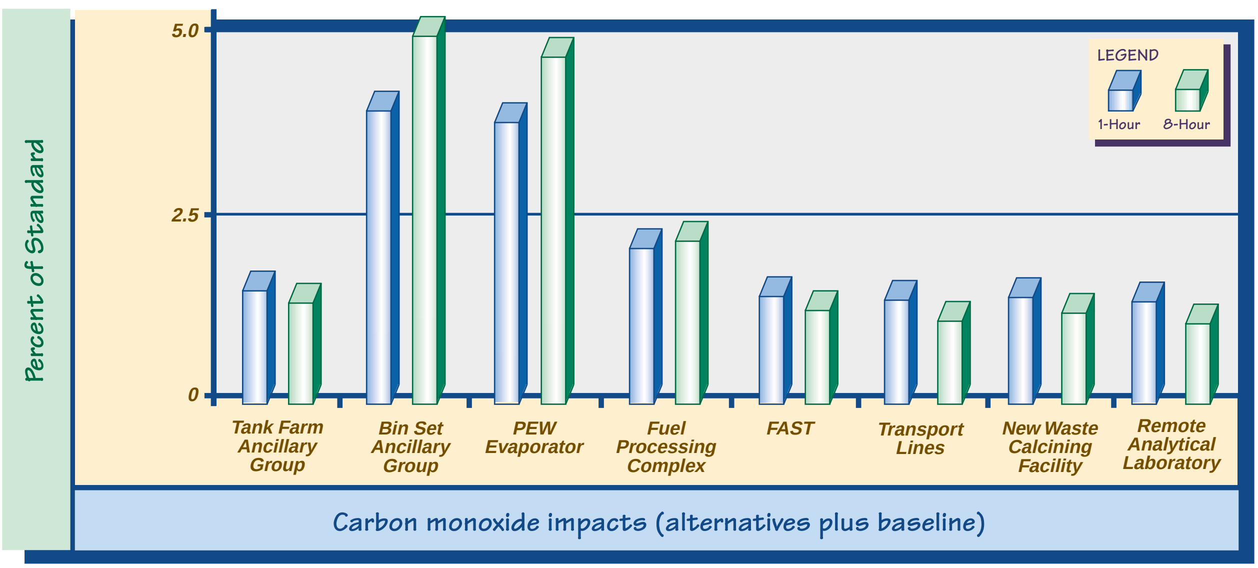
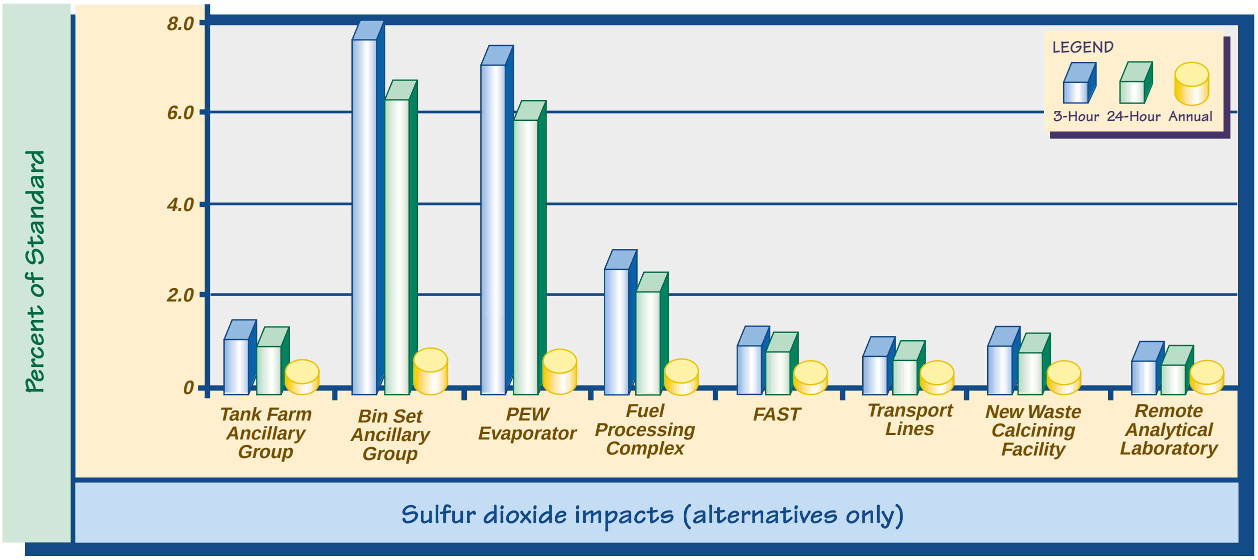


FIGURE 5.3-9. (1 of 4)
Comparison of criteria air pollutant impacts for dispositioning existing INTEC facilities associated with high-level waste management.



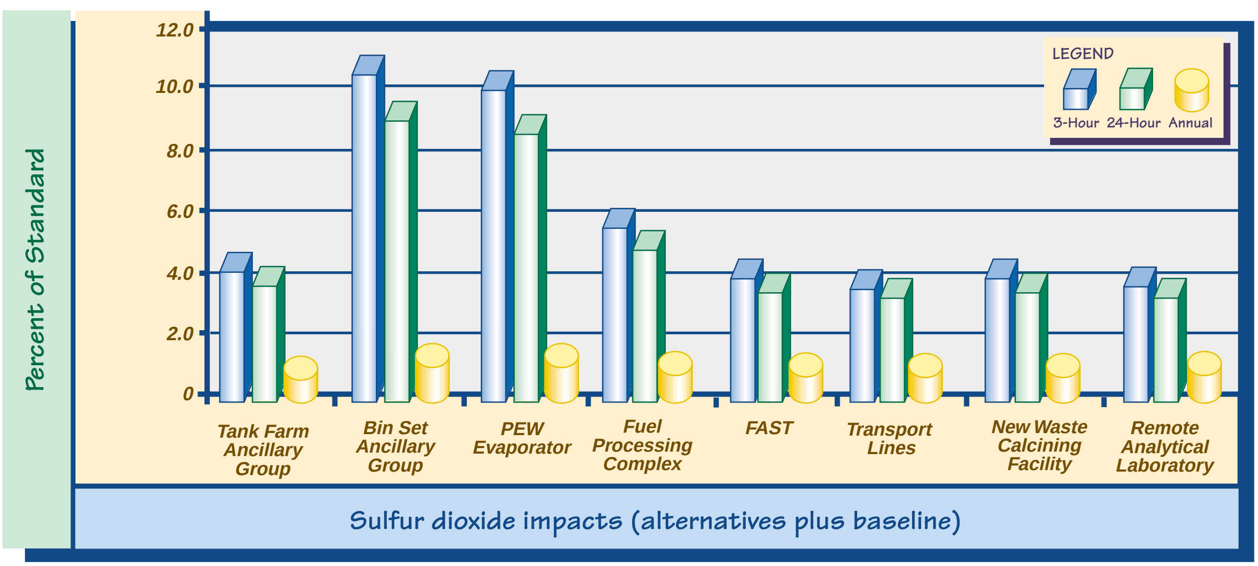
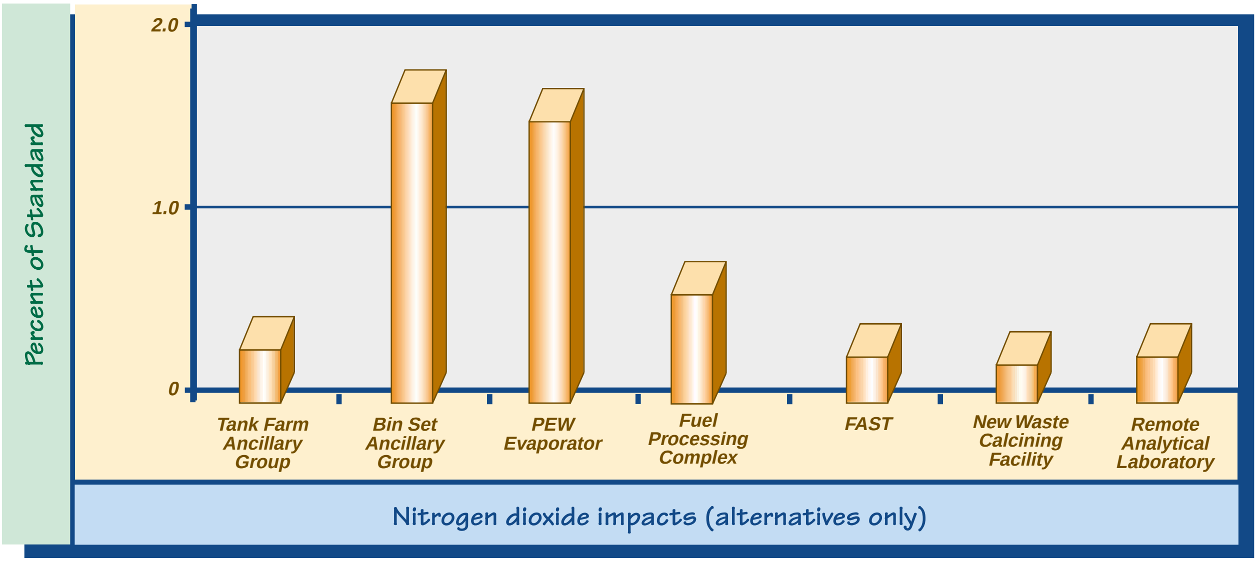


FIGURE 5.3-9. (2 of 4)
Comparison of criteria air pollutant impacts for dispositioning existing INTEC facilities associated with high-level waste management.



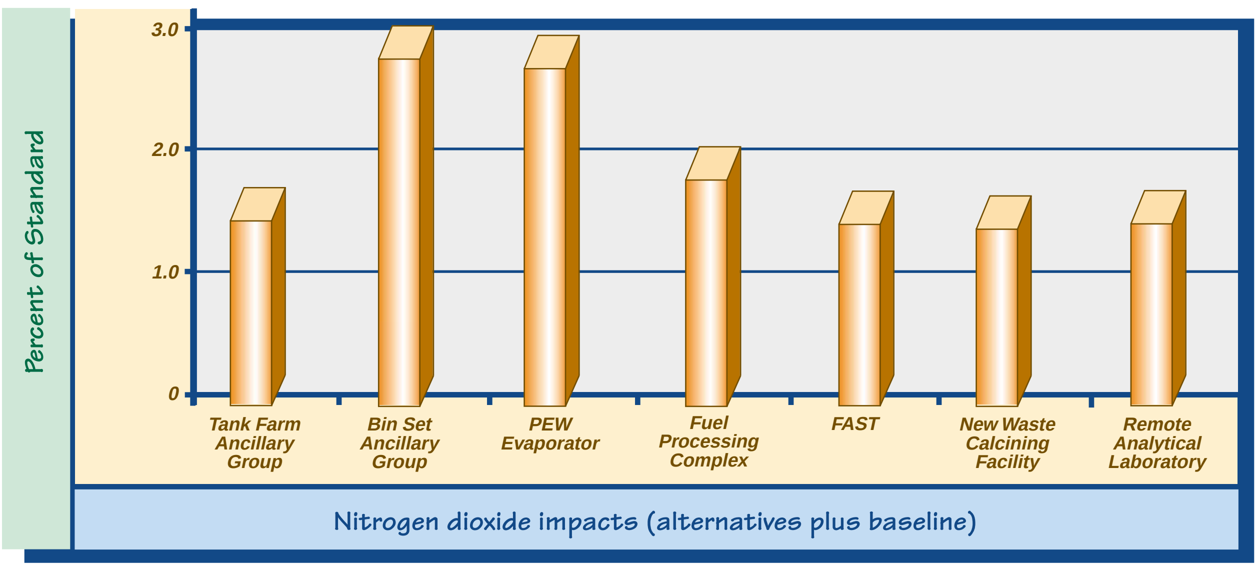
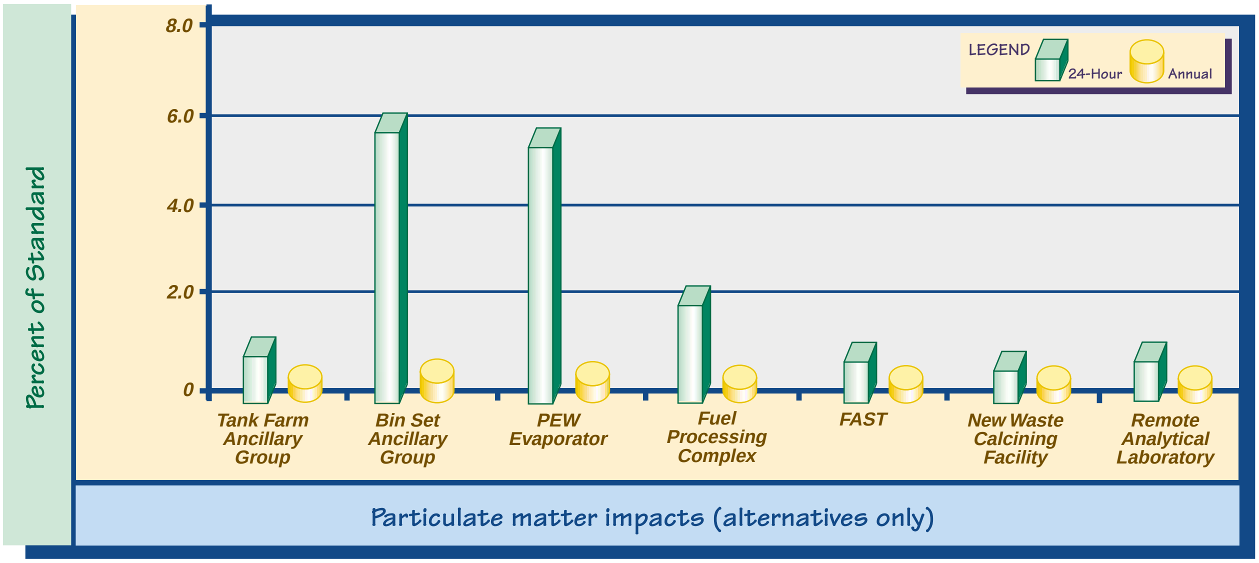


FIGURE 5.3-9. (3 of 4)
Comparison of criteria air pollutant impacts for dispositioning existing INTEC facilities associated with high-level waste management.



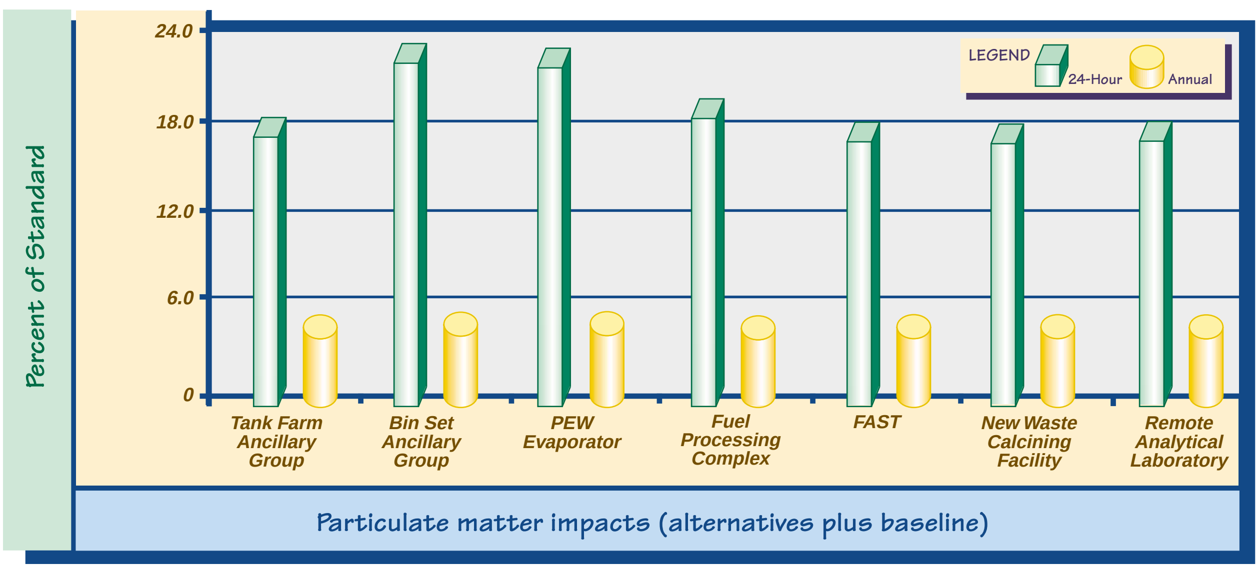
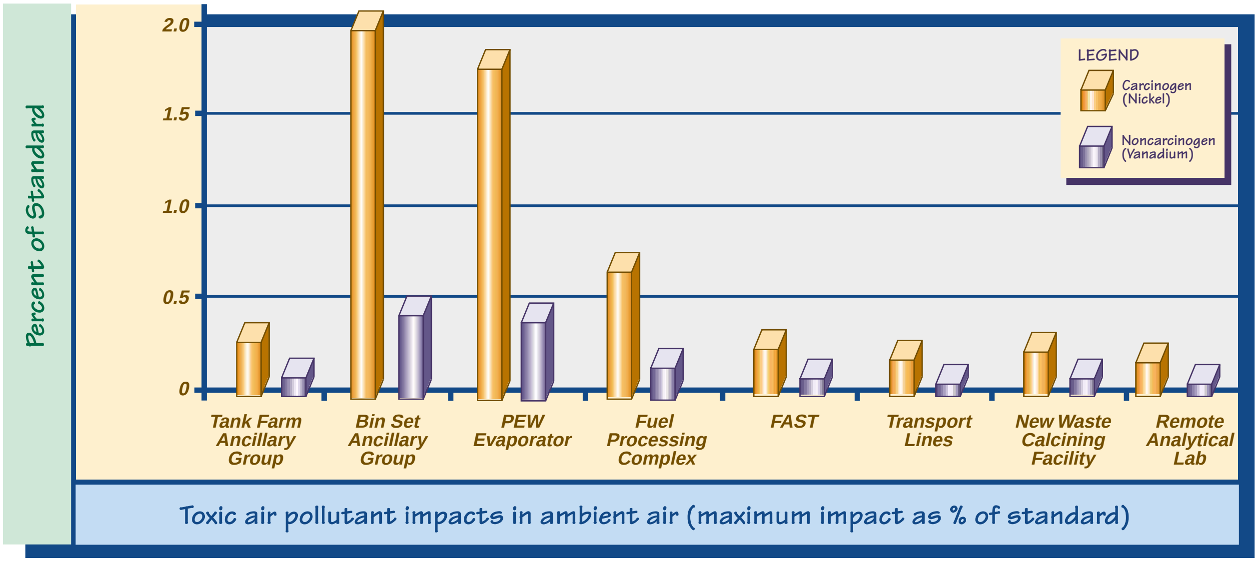


FIGURE 5.3-9. (4 of 4)
Comparison of criteria air pollutant impacts for dispositioning existing INTEC facilities associated with high-level waste management.



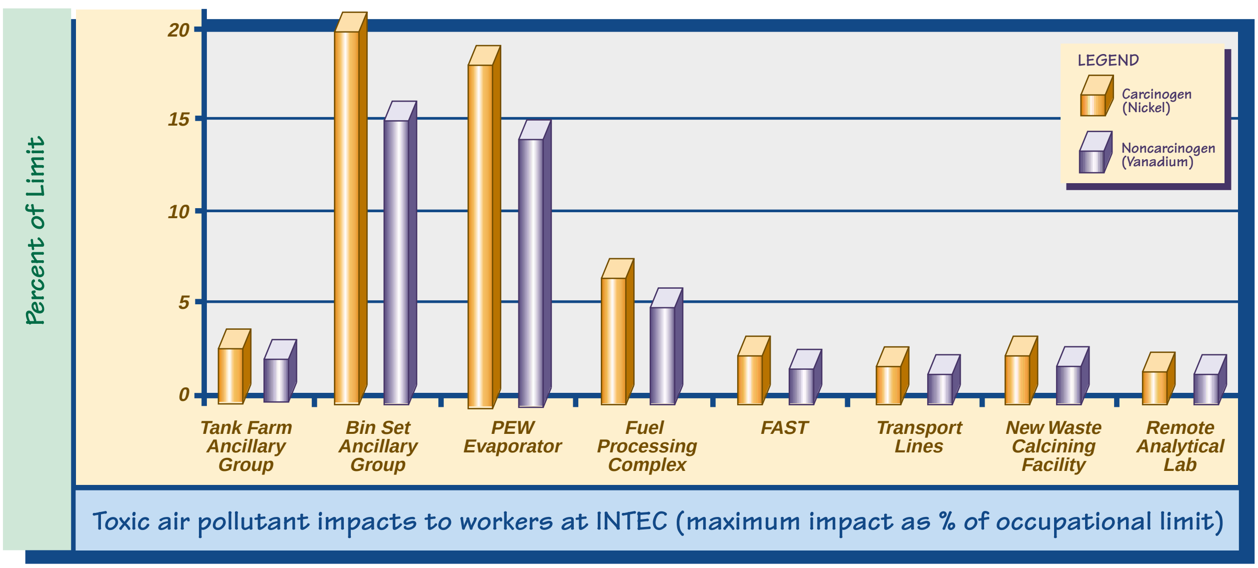


FIGURE 5.3-10.
Comparison of toxic air impacts for dispositioning existing INTEC facilities.

5.3.5 WATER RESOURCES

5.3.5.1 Short-Term Impacts

Facility disposition activities would be carried out after HLW facilities are no longer operational. HLW facilities would be decontaminated to the extent practicable, then, depending on the facility disposition option selected and the facility in question, they would be entombed and left standing, partially removed, completely removed, or returned to (restricted) industrial use. Long-term impacts to human health from transport of residual contamination in environmental media such as groundwater are discussed in Appendix C.9 and summarized in Section 5.3.8.

New facilities for all alternatives would be located primarily in the northern portion of INTEC. A U.S. Geological Survey modeling study (Berenbrock and Kjelstrom 1998) indicates that those areas are in the 100-year floodplain. However, Big Lost River flows and frequencies based on paleohydrologic geomorphic, stream gauge, and two-dimensional modeling data indicate that no part of INTEC would be inundated by Big Lost River 100- and 500-year flow events (BOR 1999).

Under Clean Closure, radioactive and hazardous constituents would be removed from the site or treated so that residual contamination is no higher than background levels. This could require removal of all buildings, vaults, tanks, transfer piping, and contaminated soil. Under Clean Closure, no post-closure monitoring would be required because potential sources of contamination would no longer be present. Unrestricted industrial use of clean-closed facilities and sites will be permissible. Impacts to water resources would not be expected for this alternative.

For Performance-Based Closure, most above-ground structures would be razed and most below-ground structures (tanks, vaults, and transfer piping) would be decontaminated, stabilized with grout, and left in place. The concentration of residual waste would be reduced to meet the closure performance standard(s) in an approved closure plan. Under Performance-Based Closure, small amounts of residual waste could leach into groundwater; however, concentrations of these wastes in groundwater would be below levels known to cause adverse health effects (see Section 5.3.8). The closed facility would be monitored for the long term, as would groundwater in the vicinity.

For the Closure to Landfill Standards Alternative, waste residues within tanks, vaults, and piping would be stabilized with grout to minimize the release of contaminants into the environment. An engineered cap would be placed over vaults and tanks to minimize the intrusion of water that could leach waste residues into the environment. The structural integrity and effectiveness of the cap would be monitored in accordance with state and Federal regulations for closure effectiveness, as would groundwater in the vicinity. Closure to Landfill Standards would also have potential for impacts to water resources because waste residues would be left in place, although stabilized with grout. Section 5.3.8 analyzes potential human health impacts from these residual concentrations of contaminants.

Under Performance-Based Closure with Class A Grout Disposal, facilities would be closed as described under the Performance-Based Closure Alternative, but following completion of these activities low-level waste Class A type grout (produced under the Full Separations Option or Planning Basis Option) would be disposed of in the Tank Farm and bin sets. Under this alternative, small amounts of residual waste could leach into groundwater; however, concentrations of these wastes in groundwater would be below levels known to cause adverse health effects (see Section 5.3.8). The closed facility would be monitored for the long term, as would groundwater in the vicinity.

Under Performance-Based Closure with Class C Grout Disposal, facilities would be closed as described under the Performance-Based Closure Alternative, but following completion of these activities low-level waste Class C type Grout (produced under the Transuranic Separations Option) would be disposed of in the Tank Farm and bin sets. Under this alternative, small amounts of residual waste could leach into groundwater; however, concentrations of these wastes in groundwater would be below levels known to cause adverse health effects (see Section 5.3.8). The closed facility would be monitored for the long term, as would groundwater in the vicinity.

5.3.5.2 Long-Term Impacts

In addition to the short-term impacts evaluated in Section 5.3.5.1, DOE has also calculated the potential long-term impacts that may occur as a result of closure activities. Because the residual contamination that could be released to the environment is underground, the primary means by which contamination could reach receptors is through leaching into the soil surrounding the facilities and eventually into aquifers near the facilities.

DOE performed modeling of the movement of contaminants using the computer codes MEPAS and TETRAD. Contaminants were postulated to leach from the facilities following an assumed instantaneous structural failure at 500 years post-closure. After this structural failure occurs, rainwater is assumed to infiltrate and leach some of the contaminants and transport them downward to the aquifer.

DOE calculated the maximum concentration of the individual contaminants in the aquifer for comparison to the EPA drinking water standards in 40 CFR 141. Concentrations of nonradiological constituents may be directly compared to the standards while beta-gamma emitting contaminants must be compared to the Drinking Water Standards in terms of radiation dose based on a postulated individual who drinks the water.

Table 5.3-7 shows a comparison of the concentrations (for nonradiological constituents), radiation dose (for radiological contaminants), and Drinking Water Standards for the various facility disposition alternatives. As the table demonstrates, there are no instances where the peak groundwater concentration would exceed the respective maximum contaminant level.

Table 5.3-7. Comparison of groundwater quality with Maximum Contaminant Levels in 40 CFR 141.

Contaminant	No Action	Performance-Based Closure/closure to Landfill Standards	Performance-Based Closure with Class A type grout disposal	Performance-Based Closure with Class C type grout disposal	Disposal of Class A type grout in low-activity waste disposal facility	Disposal of Class C type grout in low-activity waste disposal facility	Maximum Contaminant Level
Peak annual dose (millirem per year)[a]							
Iodine-129	0.29	0.45	1.1	2.1	1.1	2.1	4.0[a]
Technetium-99	0.17	7.8×10^{-4}	1.6×10^{-3}	1.6×10^{-3}	3.1×10^{-3}	4.8×10^{-3}	4.0[a]
Peak concentration in aquifer (milligrams per liter)							
Fluoride	0.039	2.5×10^{-4}	0.058	0.13	0.69	0.7	4.0
Nitrate	0.066	1.4×10^{-4}	6.6×10^{-4}	6.6×10^{-4}	2.7×10^{-4}	2.7×10^{-4}	44[b]
Cadmium	1.2×10^{-8}	1.8×10^{-9}	1.5×10^{-8}	1.5×10^{-8}	4.2×10^{-7}	4.5×10^{-7}	0.005

a. Under 40 CFR 141, when multiple beta-gamma emitting radionuclides are present, the maximum contaminant level applies to the total dose from the radionuclides. However, the peak doses from Iodine-129 and Technium-99 do not overlap in time; therefore, it is appropriate to apply the maximum contaminant level to the individual radionuclides.

b. The maximum contaminant level for nitrate is expressed in 40 CFR 141 as 10 mg/L for the nitrogen component, which equates to approximately 44 mg/L of nitrate.

5.3.6 ECOLOGICAL RESOURCES

Facility disposition includes a number of activities that would occur after HLW facilities are no longer operational. After waste management operations are completed, HLW treatment and storage facilities at INTEC would be deactivated. DOE (1997) discusses the changing mission of INTEC and the planned disposition of surplus facilities. It notes that DOE's goal is to place surplus INEEL facilities in a safe, stable shutdown condition and monitor them while awaiting decommissioning. HLW facilities would be decontaminated to the extent practicable, then, depending on the facility disposition option selected and the facility in question, they would be entombed and left standing, partially removed, completely removed, or returned to (restricted) industrial use. Potential impacts to ecological resources from facility disposition activities were evaluated by reviewing closure plans and project data sheets for disposition of HLW facilities.

After closure, and during the institutional control period, from present to 2095, most areas within the INTEC boundaries will likely be designated restricted-use industrial areas. This use would be consistent with the long-term planning strategy outlined in DOE (1997), which encourages development in established facility areas such as INTEC and discourages the development of undisturbed areas. Following the period of institutional control, legal and administrative use restrictions may be placed on the land. However, for purposes of the analysis in this EIS, the loss of institutional control also means the loss of legal and administrative restrictions, such as deed restrictions. This being the case, any use may be made of the land, including residential or farming, though this is unlikely.

The methods used in this section are the same as those described in Section 5.2.8.

5.3.6.1 Short-Term Impacts

The facility disposition options being considered would primarily affect previously disturbed areas within the existing perimeter of INTEC. None of the closure options being considered would require construction of new facilities outside the existing secure INTEC perimeter. Therefore, no loss or alteration of habitat would occur.

Based on the number of employees required to disposition new facilities (see Section 5.3.2), the largest impacts to ecological resources would be for the Full Separations Option, followed by the Direct Cement Waste Option, Planning Basis Option, Transuranic Separations Option, Hot Isostatic Pressed Waste Option, and Early Vitrification Option. Facility disposition activities under these options would expose wildlife to movement of personnel and vehicles, noise (from construction equipment, trucks, buses, and automobiles), and night lighting for as long as 4 years. Because the INTEC area provides poor-quality wildlife habitat, impacts would be limited to disturbance of wildlife in areas adjacent to INTEC. Representative impacts would include disruption of normal feeding, foraging, and nesting activities and, if the intensity of the disturbance is sufficient, displacement of less disturbance tolerant individuals. Other alternatives and options would require fewer employees and would produce generally lower levels of disturbance.

For disposition of existing facilities, the largest impacts would be expected under Clean Closure of the Tank Farm and under Performance-Based Closure of the bin sets. Impacts would be similar to those described in the previous paragraph but would be smaller because fewer employees would be required to disposition these existing facilities.

5.3.6.2 Long-Term Impacts

DOE has evaluated the potential for long-term impacts on the ecology surrounding the facilities after disposition decisions are enacted. Residual contamination at INTEC would occur in the soil or on buried facility surfaces either below grade or within above-grade engineered soil covers. Contaminants could be transported and spread by leaching into the aquifer or by erosion or penetration of contaminated soil by plant roots and vertebrate and invertebrate burrowing animals. This would result in a contaminant pathway to biological receptors. Contaminants brought to the surface may also be carried offsite by animals as plant material or prey or washed into the Big Lost River by erosion. DOE does not foresee that contaminants would concentrate in individuals of a certain species. There is no reason to anticipate long-term impacts to ecological resources within or near the INTEC boundaries.

5.3.7 TRAFFIC AND TRANSPORTATION

No waste or other materials would be shipped offsite from facility disposition activities, so DOE would not expect transportation impacts. This section analyzes impacts to traffic on Highway 20 (from Idaho Falls to INEEL) from workers involved with facility disposition activities.

5.3.7.1 Methodology for Traffic Impact Analysis

DOE assessed potential traffic impacts based on the number of employees associated with the disposition of each facility or group of facilities (Section 5.3.2). The impacts associated with facility disposition activities were evaluated relative to baseline or historic traffic volumes on Highway 20. Changes in traffic were used to assess potential changes in level-of-service on the road.

Section 5.2.9 describes the methodology used in the determination of level of service on Highway 20. The level of service is a qualitative measure of operational conditions within a traffic stream as perceived 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 (TRB 1985).

5.3.7.2 Traffic Impacts

As noted previously in Section 5.2.9, Highway 20 between Idaho Falls and INEEL is designated Level-of-Service A, which represents free flow.

INEEL employment levels are expected to decrease during the period prior to initiation of facility dispositioning activities due to completion of INEEL missions and most waste processing activities. DOE would retrain and reassign its existing workforce to conduct dispositioning activities for both new and existing facilities.

Employment levels for facility dispositioning activities are presented in Table 5.3-1 (new facilities), Table 5.3-2 (Tank Farm and bin sets), and

Table 5.3-3 (existing HLW facility groups). Employment levels for disposition of new facilities would be similar to the levels estimated for construction associated with these facilities. With the exception of the Tank Farm facility, employment levels for dispositioning of existing facilities would be lower than for the waste processing alternatives discussed in Chapter 3.

Based on predicted levels of INEEL employment for facility disposition, DOE expects that traffic flows for Highway 20 would be virtually unaffected and the level of service would remain the same.

5.3.8 HEALTH AND SAFETY

This section describes potential health and safety impacts to INEEL workers and the offsite public from implementation of the facility disposition alternatives described in Chapter 3.

5.3.8.1 Short-Term Impacts

Short-term activities toward facility disposition could result in health impacts to INEEL workers and the public. DOE is considering two categories of disposition of HLW facilities. The first involves disposition of new facilities required to support the waste processing alternatives. The second category involves the existing HLW facilities as grouped in Table 3-4 in Chapter 3. The sections below provide DOE's estimates of radiological and nonradiological health and safety impacts for these facilities.

Impacts from Dispositioning New Facilities Associated with Waste Processing Alternatives

Tables 5.3-8 through 5.3-10 present potential health and safety impacts to involved workers from radiological and nonradiological sources by facility or groups of facilities for new facilities associated with the HLW waste processing alternatives.

Table 5.3-8 presents radiological impacts in terms of collective dose to workers and the resultant estimated number of latent cancer fatalities (LCFs) for the entire period of dispositioning. DOE bases dose estimates on the projected number of workers for each option and historic INEEL operations dose-per-worker data. No dispositioning activities would be associated with the No Action Alternative. The highest annual average collective dose would occur for the Planning Basis Option with 140 person-rem. The Full Separations Option would be the second highest with a dose of 120 person-rem. Likewise, DOE expects the highest total collective dose for the entire dispositioning period to occur for the Planning Basis Option because this option would yield several projects that would require more workers. The total collective worker dose is estimated to be 295 person-rem and would result in 0.10 LCF under this option.

Table 5.3-9 provides a summary of annual radiation dose and health impacts associated with airborne radionuclide emissions. These values are based on the doses for closing each new facility presented in Section 5.3.4. Dose impacts are presented for the maximally exposed offsite and onsite individuals and the population within 50 miles of INEEL. The estimated increase in the number of LCFs is presented for the collective population. The annual radiation doses to the maximally-exposed individuals (onsite and off-

Table 5.3-8. Estimated radiological impacts to involved workers during dispositioning activities for new facilities.

Project number	Description	Workers/year	Total workers	Average annual dose (millirem/year)	Processing time (years)	Annual collective dose (person-rem/year)	Total dose (person-rem)	Estimated increase in latent cancer fatalities
Continued Current Operations Alternative								
P1A[a]	Calcine SBW including New Waste Calcining Facility Upgrades	37	74	250	2	9.3	19	0.01
P1A[b]	Calcine SBW including New Waste Calcining Facility Upgrades	31	62	250	2	7.8	16	0.01
P1B	Newly Generated Liquid Waste and Tank Farm Heel Waste Management	36	36	250	1	9	9	0.00
P1F	Bin Set 1 Closure	110	220	250	2	28	55	0.02
P18MC	Remote Analytical Laboratory Operations	30	60	250	2	7.5	15	0.01
Totals		240	450			62	110	0.05
Full Separations Option								
P9A	Full Separations	100	310	250	3	26	77	0.03
P9B	Vitrification Plant	45	140	250	3	11	34	0.01
P9C	Class A Grout Plant	74	220	250	3	19	56	0.02
P18	New Analytical Laboratory	30	60	250	2	7.5	15	0.01
P59A	Calcine Retrieval and Transport	100	100	250	1	26	26	0.01
P118	Separations Organic Incinerator	2	4	250	2	0.5	1	0.00
P27	Class A Grout Disposal in New INEEL Landfill Facility	88	180	250	2	22	44	0.02
P35D	Class A Grout Packaging and Shipping to INEEL Landfill	20	40	250	2	5	10	0.00
Totals		460	1.0×10^3			120	260	0.10
Planning Basis Option								
P1A[a]	Calcine SBW including New Waste Calcining Facility Upgrades	37	74	240	2	9.3	19	0.01
P1A[b]	Calcine SBW including New Waste Calcining Facility Upgrades	31	62	250	2	7.8	16	0.01
P1B	Newly Generated Liquid Waste and Tank Farm Heel Waste	36	36	250	1	9	9	0.00
P59A	Calcine Retrieval and Transport	100	100	250	1	26	26	0.01
P23A	Full Separations	100	310	250	3	26	77	0.03
P23B	Vitrification Plant	49	130	250	2.8	12	34	0.01
P23C	Class A Grout Plant	67	180	250	2.8	17	46	0.02
P18	New Analytical Laboratory	30	60	250	2	7.5	15	0.01
P118	Separations Organic Incinerator	2	4	250	2	0.5	1	0.00
P35D	Class A Grout Packaging and Shipping to INEEL Landfill	20	40	250	2	5	10	0.00
P27	Class A Grout Disposal in New INEEL Landfill Facility	88	180	250	2	22	44	0.02
Totals		560	1.2×10^3			140	300	0.10

Table 5.3-8. Estimated radiological impacts to involved workers during dispositioning activities for new facilities (continued).

Project number	Description	Workers/year	Total workers	Average annual dose (millirem/year)	Processing time (years)	Annual collective dose (person-rem/year)	Total dose (person-rem)	Estimated increase in latent cancer fatalities
Transuranic Separations Option								
P18	New Analytical Laboratory	30	60	250	2	7.5	15	0.01
P49A	TRU/Class C Separations	81	240	250	3	20	61	0.02
P49C	Class C Grout Plant	64	130	250	2	16	32	0.01
P59A	Calcine Retrieval and Transport	100	100	250	1	26	26	0.01
P118	Separations Organic Incinerator	2	4	250	2	0.5	1	0.00
P27	Class A Grout Disposal in New INEEL Landfill Facility	88	180	250	2	22	44	0.02
P49D	Class C Grout Packaging and Shipping to INEEL Landfill	41	82	250	2	10	21	0.01
Totals		410	800			100	200	0.08
Hot Isostatic Pressed Waste Option								
P1A[a]	Calcine SBW including New Waste Calcining Facility Upgrades	37	74	250	2	9.3	19	0.01
P1A[b]	Calcine SBW including New Waste Calcining Facility Upgrades	31	62	250	2	7.8	16	0.01
P1B	Newly Generated Liquid Waste and Tank Farm Heel Waste Management	36	36	250	1	9	9	0.00
P18	New Analytical Laboratory	30	60	250	2	7.5	15	0.01
P59A	Calcine Retrieval and Transport	100	100	250	1	26	26	0.01
P71	Mixing and Hot Isostatic Pressing	150	730	190	5	28	140	0.06
P72	Mixing and Hot Isostatic Pressed Waste	16	48	250	3	4	12	0.00
Totals		400	1.1×10^3			91	230	0.09
Direct Cement Waste Option								
P1A[a]	Calcine SBW including New Waste Calcining Facility Upgrades	37	74	250	2	9.2	19	0.01
P1A[b]	Calcine SBW including New Waste Calcining Facility Upgrades	31	62	250	2	7.8	16	0.01
P1B	Newly Generated Liquid Waste and Tank Farm Heel Waste Management	36	36	250	1	9	9	0.00
P18	New Analytical Laboratory	30	60	250	2	7.5	15	0.01
P59A	Calcine Retrieval and Transport	100	100	250	1	26	26	0.01
P80	Direct Cement Process	120	360	250	3	30	91	0.04
P81	Unseparated Cementitious HLW Interim Storage	90	260	250	3	22	66	0.03
Totals		450	960			110	240	0.10

Table 5.3-8. Estimated radiological impacts to involved workers during dispositioning activities for new facilities (continued).

Project number	Description	Workers/year	Total workers	Average annual Rad dose (millirem/year)	Processing time (years)	Annual collective dose (person-rem/year)	Total dose (person-rem)	Estimated increase in latent cancer fatalities
Early Vitrification Option								
P18	New Analytical Laboratory	30	60	250	2	7.5	15	0.01
P59A	Calcine Retrieval and Transport	100	100	250	1	26	26	0.01
P61	Unseparated Vitrified Product Interim Storage	25	76	250	3	6.3	19	0.01
P88	Early Vitrification with MACT	78	390	250	5	20	98	0.04
Totals		240	630			59	160	0.06
Minimum INEEL Processing Alternative								
P18	New Analytical Laboratory	30	60	250	2	7.5	15	0.01
P24	Vitrified Product Interim Storage at INEEL	3	9	250	3	0.75	2.3	0.00
P27	Class A Grout Disposal in New INEEL Landfill Facility	88	180	250	2	22	44	0.02
P111	SBW & NGLW Treatment with CsIX to CH TRU Grout & LLW Grout	59	59	250	1	15	15	0.01
P59A	Calcine Retrieval and Transport	100	100	250	1	26	26	0.01
P117A	Packaging & Loading Calcine for Transport to Hanford	33	99	250	3	8.3	25	0.01
Totals		320	510			79	130	0.05

a. For the New Waste Calcining Facility MACT Facility.
b. For the liquid waste storage tank.
CH TRU = contact-handled transuranic waste; CsIX = cesium ion exchange; LLW = low-level waste; MACT = Maximum Achievable Control Technology; NGLW = newly generated liquid waste; TRU = transuranic.

Table 5.3-9. Summary of radiation dose impacts associated with airborne radionuclide emissions from dispositioning of facilities associated with waste processing alternatives.

			Separations Alternative			Non-Separations Alternative			
Case[a] (units)	No Action Alternative	Continued Current Operations Alternative	Full Separations Option[b]	Planning Basis Option	Transuranic Separations Option[c]	Hot Isostatic Pressed Waste Option	Direct Cement Waste Option	Early Vitrification Option	Minimum INEEL Processing Alternative
Dose to maximally-exposed offsite individual (millirem per year)	-	1.1×10^{-10}	3.3×10^{-10}	4.4×10^{-10}	4.7×10^{-10}	1.8×10^{-10}	1.3×10^{-10}	1.4×10^{-10}	3.7×10^{-10}
Estimated annual increase in probability of LCF to the maximally exposed offsite individual	-	5.5×10^{-17}	1.7×10^{-16}	2.2×10^{-16}	2.4×10^{-16}	9.0×10^{-17}	6.5×10^{-17}	7.0×10^{-17}	1.9×10^{-16}
Dose to noninvolved worker (millirem per year)[d]	-	2.0×10^{-11}	6.0×10^{-11}	8.0×10^{-11}	1.4×10^{-10}	3.7×10^{-11}	2.1×10^{-11}	2.8×10^{-11}	1.1×10^{-10}
Estimated annual increase in probability of LCF to the noninvolved worker	-	8.0×10^{-18}	2.4×10^{-17}	3.2×10^{-17}	5.6×10^{-17}	1.5×10^{-17}	8.4×10^{-18}	1.1×10^{-17}	4.4×10^{-17}
Collective dose to population within 50 miles of INTEC (person-rem per year)[e]	-	3.4×10^{-9}	1.0×10^{-8}	1.2×10^{-8}	1.1×10^{-8}	4.7×10^{-9}	3.8×10^{-9}	3.9×10^{-9}	1.3×10^{-8}
Estimated annual increase in number of latent cancer fatalities to population	-	1.7×10^{-12}	5.0×10^{-12}	6.0×10^{-12}	5.5×10^{-12}	2.4×10^{-12}	1.9×10^{-12}	2.0×10^{-12}	6.5×10^{-12}

a. Doses are maximum values over any single year during which decontamination and decommissioning occurs.
b. Impacts do not include disposal of low-level waste Class A type Grout in Tank Farm and bin sets, which is presented in Section 5.3.4, Table 5.3-5.
c. Impacts do not include disposal of low-level waste Class C type Grout in Tank Farm and bin sets, which is presented in Section 5.3.4, Table 5.3-5.
d. Location of highest onsite dose would be Central Facilities Area.
e. Assumes that population would grow from 118,644 in 1990 to about 202,000 during the period of decontamination and decommissioning.

Table 5.3-10. Estimated worker injury impacts during dispositioning activities of new facilities at INEEL by alternative.

Project number	Description	Total number of workers per year	Total number of workers	Processing time (years)	Annual lost workdays[a]	Annual total recordable cases[b]	Total lost workdays	Total recordable cases
	Continued Current Operations Alternative							
P1A[c]	Calcine SBW including New Waste Calcining Facility Upgrades	58	120	2	18	2.2	37	4.4
P1A[d]	Calcine SBW including New Waste Calcining Facility Upgrades	42	84	2	13	1.6	27	3.2
P1B	Newly Generated Liquid Waste and Tank Farm Heel Waste	48	48	1	11	1.5	11	1.5
P1F	Bin Set 1 Closure	110	220	2	35	4.2	70	8.4
P18MC	Remote Analytical Laboratory Operations	88	180	2	20	2.8	40	5.6
Totals		350	640		110	13	200	25
	Full Separations Options							
P9A	Full Separations	220	670	3	71	8.5	210	26
P9B	Vitrification Plant	72	220	3	23	2.7	68	8.2
P9C	Class C Grout Plant	120	360	3	38	4.5	113	14
P18	New Analytical Laboratory	88	180	2	28	3.3	56	6.7
P24	Vitrified Product Interim Storage	31	93	3	9.8	1.2	29	3.5
P25A	Packaging and Loading Vitrified HLW at INTEC for Shipment to a Geologic Repository	2.1	0.63	0.3	0.66	0.08	0.20	0.02
P59A	Calcine Retrieval and Transport	160	160	1	51	6.1	51	6.1
P118	Separations Organic Incinerator	2	4	2	0.63	0.08	1.3	0.15
P133	Waste Treatment Pilot Plant	45	90	2	14	1.7	28	3.4
P35D	Class A Grout Packaging and Shipping to INEEL Landfill	30	60	2	9.5	1.1	19	2.3
P27	Class A Grout Disposal in New INEEL Landfill Facility	140	270	2	43	5.2	86	10
Totals		910	2.2×10^3		290	35	660	80
	Planning Basis Option							
P1A[c]	Calcine SBW including New Waste Calcining Facility Upgrades	58	120	2	18	2.2	37	4.4
P1A[d]	Calcine SBW including New Waste Calcining Facility Upgrades	42	84	2	13	1.6	27	3.2
P1B	Newly Generated Liquid Waste and Tank Farm Heel Waste	48	48	1	15	1.8	15	1.8
P59A	Calcine Retrieval and Transport	160	160	1	51	6.1	51	6.1
P23A	Full Separations	220	670	3	71	8.5	210	26

Table 5.3-10. Estimated worker injury impacts during dispositioning activities of new facilities at INEEL by alternative (continued).

Project number	Description	Total number of workers per year	Total number of workers	Processing time (years)	Annual lost workdays[a]	Annual total recordable cases[b]	Total lost workdays	Total recordable cases
P23B	Vitrification Plant	72	270	4	23	2.7	75	10
P23C	Class C Grout Plant	120	400	4	34	4.1	130	15
P24	Vitrified Product Interim Storage	31	93	3	9.8	1.2	29	3.5
P25A	Packaging and Loading Vitrified HLW at INTEC for Shipment to a Geologic Repository	2.1	0.63	0.3	0.66	0.08	0.20	0.02
P18	New Analytical Laboratory	88	180	2	28	3.3	56	6.7
P118	Separations Organic Incinerator	2	4	2	0.63	0.08	1.3	0.15
P133	Waste Treatment Pilot Plant	45	90	2	14	1.7	28	3.4
P35E	Class A Grout Packaging and Loading for Off-site Disposal	30	60	2	9.5	1.1	19	2.3
Totals		910	2.2×10^3	23	290	35	690	80
	Transuranic Separations Option							
P18	New Analytical Laboratory	140	270	2	43	5.2	86	10
P27	Class A Grout Disposal in New INEEL Landfill Facility	88	180	2	28	3.3	56	6.7
P39A	Packaging and Loading TRU at INTEC for Shipment to the Waste Isolation Pilot Plant	7	11	1.5	2.2	0.27	3.3	0.40
P49A	TRU/Class C Separations	150	440	3	46	5.6	140	17
P49C	Class C Grout Plant	93	190	2	29	3.5	59	7.1
P59A	Calcine Retrieval and Transport	160	160	1	51	6.1	51	6.1
P118	Separations Organic Incinerator	2	4	2	0.63	0.08	1.3	0.15
P133	Waste Treatment Pilot Plant	45	90	2	14	1.7	28	3.4
P49D	Class C Grout Packaging and Shipping to INEEL Landfill	57	110	2	18	2.2	36	4.3
Totals		740	1.5×10^3	18	230	28	460	55
	Hot Isostatic Pressed Waste Option							
P1A[c]	Calcine SBW including New Waste Calcining Facility Upgrades	58	120	2	18	2.2	37	4.4
P1A[d]	Calcine SBW including New Waste Calcining Facility Upgrades	42	84	2	13	1.6	27	3.2
P1B	Newly Generated Liquid Waste and Tank Farm Heel Waste	48	48	1	15	1.8	15	1.8
P18	New Analytical Laboratory	88	180	2	28	3.3	56	6.7
P59A	Calcine Retrieval and Transport	160	160	1	51	6.1	51	6.1

Table 5.3-10. Estimated worker injury impacts during dispositioning activities of new facilities at INEEL by alternative (continued).

Project number	Description	Total number of workers per year	Total number of workers	Processing time (years)	Annual lost workdays[a]	Annual total recordable cases[b]	Total lost workdays	Total recordable cases
P71	Mixing and Hot Isostatic Pressing	200	990	5	63	7.5	310	38
P72	Mixing and Hot Isostatic Pressed Waste	150	460	3	49	5.9	150	18
P73A	Packaging and Loading Hot Isostatic Pressed Waste at INTEC for Shipment to a Geologic Repository	7	18	2	2.2	0.27	5.5	0.67
P133	Waste Treatment Pilot Plant	45	90	2	14	1.7	28	3.4
Totals		800	2.2×10^3	20	250	30	680	80
	Direct Cement Waste Option							
P1A[c]	Calcine SBW including New Waste Calcining Facility Upgrades	58	120	2	18	2.2	37	4.4
P1A[d]	Calcine SBW including New Waste Calcining Facility Upgrades	42	84	2	13	1.6	27	3.2
P1B	Newly Generated Liquid Waste and Tank Farm Heel Waste	48	48	1	15	1.8	15	1.8
P18	New Analytical Laboratory	88	180	2	28	3.3	56	6.7
P59A	Calcine Retrieval and Transport	160	160	1	51	6.1	51	6.1
P80	Direct Cement Process	160	490	3	52	6.2	160	19
P81	Unseparated Cementitious HLW Interim Storage	290	860	3	91	11	270	33
P83A	Packaging & Loading Cementitious Waste at INTEC for Shipment to a Geologic Repository	7	25	3.5	2.2	0.27	7.7	0.93
P133	Waste Treatment Pilot Plant	45	90	2	14	1.7	28	3.4
Totals		900	2.1×10^3	20	280	34	650	78
	Early Vitrification Option							
P18	New Analytical Laboratory	88	180	2	28	3.3	56	6.7
P59A	Calcine Retrieval and Transport	160	160	1	51	6.1	51	6.1
P61	Unseparated Vitrified Product Interim Storage	250	750	3	79	9.5	240	28
P62A	Packaging & Loading of Vitrified HLW at INTEC for Shipment to a Geologic Repository	10	30	3	3.2	0.38	9.5	1.1
P88	Early Vitrification with MACT	110	560	5	35	4.2	180	21

Table 5.3-10. Estimated worker injury impacts during dispositioning activities of new facilities at INEEL by alternative. (continued).

Project number	Description	Total number of workers per year	Total number of workers	Processing time (years)	Annual lost workdays[a]	Annual total recordable cases[b]	Total lost workdays	Total recordable cases
P90A	Packaging & Loading Vitrified SBW at INTEC for Shipment to the Waste Isolation Pilot Plant	7	11	1.5	2.2	0.27	3.3	0.40
P133	Waste Treatment Pilot Plant	45	90	2	14	1.7	28	3.4
Totals		670	1.8×10^3	18	210	25	560	67
	Minimum INEEL Processing Alternative							
P18	New Analytical Laboratory	88	180	2	28	3.3	56	6.7
P24	Vitrified Product Interim Storage	31	93	3	9.8	1.2	29	3.5
P25A	Packaging and Loading Vitrified HLW at INTEC for Shipment to a Geologic Repository	2.1	0.63	0.3	0.66	0.08	0.20	0.02
P27	Class A Grout Disposal in New INEEL Landfill Facility	140	27	2	43	5.2	86	10.3
P59A	Calcine Retrieval and Transport	160	160	1	51	6.1	51	6.1
P111	SBW & NGLW Treatment with CsIX to CH TRU Grout & LLW Grout	100	100	1	33	4.0	33	4.0
P112A	Packaging & Loading Contact Handled TRU (from SBW & NGLW CsIX-Grout Treatment) for Shipment to WIPP	7	32	4.5	2.2	0.27	10	1.2
P117A	Packaging & Loading Calcine for Transport to Hanford	110	320	3	34	4.1	100	12
P133	Waste Treatment Pilot Plant	45	90	2	14	1.7	28	3.4
Totals		680	1.2×10^3	19	220	26	390	47

a. Lost workdays = The number of workdays beyond the day of injury or onset of illness the employee was away from work or limited to restricted work activity because of an occupational injury or illness.

b. Total Recordable Case = A recordable case includes work-related death, illness, or injury which resulted in loss of consciousness, restriction of work or motion, transfer to another job, or required medical treatment beyond first aid.

c. For the New Waste Calcining Facility with Maximum Achievable Control Technology upgrades.

d. For the liquid waste storage tank.

CH TRU = contact-handled transuranic waste; CsIX = cesium ion exchange; FUETAP = formed under elevated temperature and process; HLW = high-level waste; LLW = low-level waste; NGLW = newly generated liquid waste; TRU = transuranic waste; WIPP = Waste Isolation Pilot Plant.

site) as well as to the population for all of the options are at insignificant levels. The maximum number of LCFs is associated with the Planning Basis Option and is much less than one (7.0×10^{-12}).

Table 5.3-10 provides estimates of occupational safety impacts for new and existing workers involved with dispositioning activities. Impacts are presented in terms of the number of lost workdays and total recordable cases on an annual and total dispositioning period basis. A lost workday is the number of lost workdays beyond the onset of injury or illness. A total recordable case is a recordable case that includes work-related death, illness, or injury that resulted in loss of consciousness, restriction of work or motion, transfer to another job, or required medical attention beyond first aid. DOE estimated the lost workdays and total recordable cases for each option based on the projected number of workers and the five-year average lost workdays and total recordable cases rates from INEEL construction workforce data from 1993 to 1997 (Millet 1998).

As shown in Table 5.3-10, the highest number of lost workdays and total recordable cases during an average employment year would occur under the Full Separations Option and the Planning Basis Option. DOE estimates 290 lost workdays and 35 total recordable cases during an average year under these options. The Hot Isostatic Pressed Waste Option and the Direct Cement Waste Option would present slightly fewer lost workdays and total recordable cases occurrences. All other options would result in fewer occupational safety impacts on an annual basis. The highest impacts for the entire dispositioning period for new facilities associated with waste processing would also be expected under the Planning Basis Option. DOE estimates a total of 690 lost workdays and 80 total recordable cases under this option. The Full Separations Option, Hot Isostatic Pressed Waste Option, Direct Cement Waste Option and the Early Vitrification Option would have a similar number of lost workdays and total recordable cases occurrences with all other options resulting in lesser impacts for the entire dispositioning period of activity.

Impacts from Dispositioning Existing Facilities Associated with HLW Management

Tables 5.3-11 through 5.3-14 present potential health and safety impacts from closure of existing HLW facilities by alternative. These facilities would be closed as specified in Table 3-4.

Table 5.3-11 provides radiological impacts in terms of collective dose to workers and the resultant estimated number of LCFs for the entire dispositioning period of activity. As expected, the collective worker dose is highest for the Tank Farm Clean Closure Alternative due to the extensive decontamination efforts required for removing contaminated materials in order to reduce radioactivity to minimum detectable levels. Tank Farm Clean Closure would involve the largest number of workers and a longer duration of dispositioning activities for any of the Tank Farm options and therefore would result in a larger collective dose. DOE expects the annual collective and total collective worker doses to be 280 and 7,600 person-rem, respectively. The total collective worker dose for the Clean Closure alternative would result in an estimated 3 LCFs. The estimated total collective worker doses for all other Tank Farm closure options, bin sets and related facilities, and other new facilities associated with HLW management are much lower and would result in less than 1 LCF for each option.

Table 5.3-12 provides a summary of annual radiation dose and health impacts associated with airborne radionuclide emissions from the Tank Farm and bin sets under alternative closure scenarios. Dose impacts are presented for the maximally exposed offsite and onsite individuals and the population within 50 miles of INEEL. The highest radiation dose impacts are associated with the Bin Set Closure to Landfill Standards Alternative. However, these doses are still significantly less than the applicable standard for annual exposure. The maximum collective population dose of 5.1×10^{-8} person-rem for the Bin Set Closure to Landfill Standards Alternative results in an increase in the number of latent cancer fatalities of 2.6×10^{-11}. All other radiation dose impacts are lower.

Table 5.3-11. Estimated radiological health impacts from dispositioning activities for existing facilities (annual and total dose).

Facility description	Annual average number of workers	Annual collective worker dose (person-rem)	Total collective dose for dispositioning period (person-rem)	Estimated LCFs from total collective dose (person-rem)
Tank Farm				
Clean Closure	280	280	7,600	3.0
Performance-Based Closure	11	12	270	0.10
Closure to Landfill Standards	11	14	220	0.09
Performance-Based Closure with Class A Grout Disposal	22	16	300	0.12
Performance-Based Closure with Class C Grout Disposal	23	28	490	0.19
Tank Farm related facilities	1.8	0.46	2.3	<0.01
Bin Sets				
Clean Closure	58	35	940	0.38
Performance-Based Closure	49	43	850	0.34
Closure to Landfill Standards	27	19	400	0.16
Performance-Based Closure with Class A Grout Disposal	92	39	950	0.38
Performance-Based Closure with Class C Grout Disposal	98	75	1,200	0.46
Bin Sets related facilities	0.17	0.04	0.26	<0.01
PEWE and related facilities	47	21	130	0.05
Fuel Processing Building and related facilities				
Performance-Based Closure	25	6.3	63	0.03
Closure to Landfill Standards	20	5	50	0.02
FAST/FAST Stack	34	8.4	50	0.02
New Waste Calcining Facility				
Performance-Based Closure	35	8.8	44	0.02
Closure to Landfill Standards	32	8	40	0.02
Remote Analytical Laboratory	6	1.5	15	<0.01

Source: Data from Project Data Sheets in Appendix C.6.
FAST = Fluorinel and Storage Facility; LCF = latent cancer fatality; PEWE = Process Equipment Waste Evaporator.

Table 5.3-13 provides a summary of annual radiation dose and health impacts from radionuclide emissions from the other existing facilities associated with HLW facility dispositioning activities. Dose impacts are presented for the maximally exposed offsite and onsite individuals and the population within 50 miles of INEEL. All of the dose impacts are negligible with the highest collective population dose and increase in number of latent cancer fatalities being estimated for the Fuel Processing Building and Related Facilities. However, all dose impact values are significantly less than one.

Table 5.3-14 provides estimates of occupational safety impacts for new and existing workers involved with dispositioning activities. DOE estimated the lost workdays and total recordable cases for each option based on the projected number of workers and the 5-year average lost workdays and total recordable cases rates from INEEL construction workforce data from 1993 to 1997 (Millet 1998).

As shown in Table 5.3-14, DOE expects the highest number of lost workdays and total recordable cases to occur for the Tank Farm

Table 5.3-12. Summary of radiation dose impacts associated with airborne radionuclide emissions from dispositioning of the Tank Farm and bin sets under alternative closure scenarios.

Case	Applicable standard	Maximum annual radiation dose[a]			
		Clean closure	Performance-based closure	Closure to landfill standards	Performance-based closure with Class A or C grout disposal [b]
Tank Farm					
Dose to maximally exposed offsite individual (millirem per year)	10[c]	1.2×10^{-9}	1.7×10^{-10}	1.2×10^{-9}	1.5×10^{-10}
Estimated annual increase in probability of LCF to the maximally exposed offsite individual	NA	6.0×10^{-16}	8.5×10^{-17}	6.0×10^{-16}	7.5×10^{-17}
Dose to noninvolved worker (millirem per year)[d]	5.0×10^{3}[e]	1.2×10^{-9}	1.7×10^{-10}	1.2×10^{-9}	1.5×10^{-10}
Estimated annual increase in probability of LCF to the noninvolved work	NA	4.8×10^{-16}	6.8×10^{-17}	4.8×10^{-16}	6.0×10^{-17}
Collective dose to population within 50 miles of INTEC (person-rem per year)[f]	NA	3.1×10^{-8}	4.3×10^{-9}	3.0×10^{-8}	3.9×10^{-9}
Estimated annual increase in number of latent cancer fatalities to population	NA	1.6×10^{-11}	2.2×10^{-12}	1.5×10^{-11}	2.0×10^{-12}
Bin sets					
Dose to maximally exposed offsite individual (millirem per year)	10[c]	1.0×10^{-10}	1.3×10^{-10}	9.2×10^{-10}	1.3×10^{-10}
Estimated annual increase in probability of LCF to the maximally exposed offsite individual	NA	5.0×10^{-17}	6.5×10^{-17}	4.6×10^{-16}	6.5×10^{-17}
Dose to noninvolved worker (millirem per year)[d]	5.0×10^{3}[e]	2.3×10^{-11}	3.0×10^{-11}	2.2×10^{-10}	3.0×10^{-11}
Estimated annual increase in probability of LCF to the noninvolved work	NA	9.2×10^{-18}	1.2×10^{-17}	8.8×10^{-17}	1.2×10^{-17}
Collective dose to population within 50 miles of INTEC (person-rem per year)[f]	NA[g]	5.5×10^{-9}	7.2×10^{-9}	5.1×10^{-8}	7.2×10^{-9}
Estimated annual increase in number of latent cancer fatalities to population	NA	2.8×10^{-12}	3.6×10^{-12}	2.6×10^{-11}	3.6×10^{-12}

a. Doses are maximum values over any single year during which decontamination and decommissioning occur.
b. Radiation dose impacts for Class A and Class C type grouting disposal techniques are the same since analyses indicate that the primary exposure results from the cleaning portion of the operation rather than the filling.
c. EPA dose limit specified in 40 CFR 61.92; applies to effective dose equivalent from air releases only.
d. Location of highest onsite dose is Central Facilities Area.
e. Occupational dose limit per 10 CFR 835.202; applies to sum of doses from all exposure pathways.
f. Applies to future projected population of about 202,000 people.
g. NA = not applicable.

Table 5.3-13. Summary of radiation dose impacts associated with airborne radionuclide emissions from dispositioning other existing facilities associated with HLW management.

		Maximum annual radiation dose[a]						
Case	Applicable standard	Tank Farm related facilities	Bin set related facilities	Process Equipment Waste Evaporator & related facilities	Fuel processing building & related facilities	FAST and related facilities	New Waste Calcining Facility	Remote Analytical Laboratory
Dose to maximally exposed offsite individual (millirem per year)	10[b]	6.7×10^{-11}	1.9×10^{-10}	1.2×10^{-10}	2.4×10^{-10}	8.1×10^{-11}	4.5×10^{-11}	4.1×10^{-11}
Estimated annual increase in probability of LCF to the maximally exposed offsite individual	NA	3.4×10^{-17}	9.5×10^{-17}	6.0×10^{-17}	1.2×10^{-16}	4.1×10^{-17}	2.3×10^{-17}	2.1×10^{-17}
Dose to noninvolved worker (millirem per year)[c]	5.0×10^{3}[d]	1.6×10^{-11}	1.9×10^{-10}	1.2×10^{-10}	2.4×10^{-10}	8.1×10^{-11}	1.0×10^{-11}	4.1×10^{-11}
Estimated annual increase in probability of LCF to the noninvolved worker	NA	6.4×10^{-18}	7.6×10^{-17}	4.8×10^{-17}	9.6×10^{-17}	3.2×10^{-17}	4.0×10^{-18}	1.6×10^{-17}
Collective dose to population within 50 miles of INTEC (person-rem per year)[e]	NA[f]	3.7×10^{-9}	2.6×10^{-9}	3.1×10^{-9}	6.2×10^{-9}	2.1×10^{-9}	2.5×10^{-9}	1.0×10^{-9}
Estimated annual increase in number of LCFs to population	NA	1.9×10^{-12}	1.3×10^{-12}	1.6×10^{-12}	3.1×10^{-12}	1.1×10^{-12}	1.3×10^{-12}	5.0×10^{-13}

a. Doses are maximum values over any single year during which decontamination and decommissioning occurs.
b. EPA dose limit specified in 40 CFR 61.92; applies to effective dose equivalent from air releases only.
c. Location of highest onsite dose is Central Facilities Area.
d. Occupational dose limit per 10 CFR 835.202; applies to sum of doses from all exposure pathways.
e. Applies to future projected population of about 202,000 people.
f. NA = not applicable.

FAST = Fluorinel and Storage Facility.

Source: Data from Project Data Sheets in Appendix C.6.

Table 5.3-14. Estimated worker injury impacts from dispositioning activities for existing facilities.

Facility description	Annual average number of workers	Annual lost workdays[a]	Annual total recordable cases[b]	Total lost workdays	Total recordable cases
Tank Farm					
Clean Closure	280	88	11	2,400	290
Performance-Based Closure	16	3	0	76	10
Closure to Landfill Standards	11	3	0.42	59	6
Performance-Based Closure with Class A Grout Disposal	27	7	0.84	97	9
Performance-Based Closure with Class C Grout Disposal	28	7	0.87	97	9
Tank Farm related facilities	2	1	0.07	4	1
Bin Sets					
Clean Closure	58	18	2	500	60
Performance-Based Closure	55	15	2	310	37
Closure to Landfill Standards	27	9	1	180	22
Performance-Based Closure with Class A Grout Disposal	92	29	3	360	3
Performance-Based Closure with Class C Grout Disposal	100	31	4	380	3
Bin Sets related Facilities	0.27	0.09	0.01	1	0
PEWE and related facilities	52	16	2	99	12
Fuel Processing Building and related Facilities	32	10	1	120	15
Performance-Based Closure	40	130	2	130	15
Closure to Landfill Standards	32	10	1	100	12
FAST/FAST Stack	54	17	2	100	12
New Waste Calcining Facility					
Performance-Based Closure	47	15	2	74	9
Closure to Landfill Standards	44	14	2	70	8
Remote Analytical Laboratory	7	2	0	11	1

a. Lost workdays - the number of workdays beyond the onset of injury or illness.
b. Total recordable case - a recordable case includes work-related death, illness, or injury which resulted in loss of consciousness, restriction of work or motion, transfer to another job, or required medical attention beyond first aid.
FAST = Fluorinel and Storage Facility; LCF = latent cancer fatalities; PEWE = Process Equipment Waste Evaporator.
Source: Data from Project Data Sheets in Appendix C.6.

Clean Closure Alternative due to the larger number of workers and duration of dispositioning activities associated with that option. DOE expects the annual and total lost workdays to be 88 days and 2,400 days, respectively. The annual and total recordable cases are expected to be 11 cases and 290 cases, respectively. As shown in Table 5.3-14, worker occupational health and safety impacts for all other alternatives would be much lower.

5.3.8.2 Long-Term Impacts

In addition to the short term impacts evaluated in Section 5.3.8.1, DOE has also estimated the potential long-term impacts that may occur as a result of facility disposition activities. Because the residual contamination that could be released to the environment is underground, the primary means by which contamination could reach receptors is through leaching into the soil sur-

rounding the facilities and eventually into aquifers near the facilities.

DOE evaluated the potential for other removal mechanisms for contaminants but has concluded that they are not likely except for the bin sets under the No Action Alternative, for which DOE has postulated a potential air release as discussed in Appendix C.9. For the No Action Alternative for other facilities, the residual contamination would be sufficiently far underground and enclosed within the facilities to preclude access by burrowing animals or weathering. The Performance-Based Closure, Closure to Landfill Standards, and variations of those alternatives involve placement of a cementitous grout material in the facilities, which would further preclude access by burrowing animals or weathering.

DOE evaluated the potential impacts over the 10,000-year period following facility disposition. This timeframe is consistent with the period of analysis for long-term impacts in other DOE EISs. It also represents the longest time period for the performance standards in potentially applicable regulations and DOE Orders governing facility disposition activities. This analysis involved calculating the peak concentration of contaminants in the aquifer and then estimating the impact to an individual who drills a well into the contaminated material.

For radiological constituents, DOE calculated the radiation dose and estimated the corresponding number of LCFs that could result from the radiation exposure. For nonradiological constituents, the cancer risk (for carcinogens) or the hazard quotient (for noncarcinogens) was calculated. A summary of radiation dose is presented for each receptor and facility closure scenario in Table 5.3-15 as lifetime doses in millirem. Table 5.3-15 also provides estimates of additional cancer risk for an assumed population of 1000 people.

Doses are highest for receptor categories under the scenarios that involve either exposure to air releases from a bin set system under the No Action alternative, or exposure to groundwater releases after disposal of Class C grout in INEEL facilities (either in the Tank Farm and bin sets or in a new low-activity waste disposal facility). For all receptors except the INEEL worker and intruders, doses from the groundwater pathway are primarily due to iodine-129 intake via groundwater and food product ingestion. Even under very conservative assumptions (i.e., the maximally exposed resident), these doses are small fractions of those received from natural background sources (typically about 360 millirem per year). Intruder and INEEL worker doses and risks result mainly from external exposure to radionuclides in closed facilities. For intruders, the dose would be highest under the alternative involving disposal of Class C grout in the Tank Farm and bin sets, while for INEEL workers it would be very low in all cases but highest under the No Action scenario. The

Table 5.3-15. Summary of total lifetime radiation dose and excess cancer risk from exposure to radionuclides according to receptor and facility closure scenario.

	Facility closure scenario					
Receptor	No Action	Performance-Based Closure/ Closure to Landfill Standards	Performance-Based Closure with Class A Grout Disposal	Performance-Based Closure with Class C Grout Disposal	Disposal of Class A grout in low-activity waste disposal facility	Disposal of Class C grout in low-activity waste disposal facility
Lifetime radiation dose to potential receptors (millirem)						
Maximally exposed resident farmer	8.7[a]	13	18	50	21	51
Average resident farmer	4.8	2.7	3.7	10	4.2	10
INEEL worker	5.3	8.9×10^{-11}	9.0×10^{-11}	3.8×10^{-9}	8.9×10^{-11}	9.1×10^{-11}
Construction worker	1.4	1.4	2	5.4	2.2	5.4
Indoor worker	1.4	1.4	2	5.4	2.2	5.4
Unauthorized intruder [b]	0.29	0.023	2.4×10^{-3}	1.5	0.023	0.023
Uninformed intruder [c]	0.047	3.8×10^{-3}	7.7×10^{-3}	0.25	3.8×10^{-3}	3.8×10^{-3}
Recreational user	0.22	0.31	0.42	1.2	0.48	1.2
Excess cancer risk (per thousand people) [d]						
Maximally exposed resident farmer	4.4×10^{-3}[e]	6.7×10^{-3}	9.2×10^{-3}	0.025	0.01	0.025
Average resident farmer	2.4×10^{-3}	1.4×10^{-3}	1.9×10^{-3}	5.1×10^{-3}	2.1×10^{-3}	5.1×10^{-3}
INEEL worker	2.7×10^{-3}	4.5×10^{-14}	4.5×10^{-14}	1.9×10^{-12}	4.5×10^{-14}	4.5×10^{-14}
Construction worker	6.9×10^{-4}	7.2×10^{-4}	9.8×10^{-4}	2.7×10^{-3}	1.1×10^{-3}	2.7×10^{-3}
Indoor worker	6.8×10^{-4}	7.2×10^{-4}	9.8×10^{-4}	2.7×10^{-3}	1.1×10^{-3}	2.7×10^{-3}
Unauthorized intruder [b]	1.4×10^{-4}	1.1×10^{-5}	1.2×10^{-6}	7.5×10^{-4}	1.1×10^{-5}	1.1×10^{-5}
Uninformed intruder [c]	2.4×10^{-5}	1.9×10^{-6}	3.9×10^{-6}	1.3×10^{-4}	1.9×10^{-6}	1.9×10^{-6}
Recreational user	1.1×10^{-4}	1.5×10^{-4}	2.1×10^{-4}	5.8×10^{-4}	2.4×10^{-4}	5.8×10^{-4}

a. An air pathway dose of 170 millirem is calculated based on the maximally exposed individual dose due to failure of a single bin set system.
b. Timeframe for receptor exposure is during period of institutional control.
c. Timeframe for receptor exposure is distant future.
d. Assumes that a population of 1,000 local residents is exposed to a similar lifetime dose.
e. The risk from radiation dose due to failure of a single bin set is calculated to be 0.085 latent cancer fatality for an assumed population of 1,000 persons.

magnitude of these external dose estimates is highly influenced by assumed occupancy times and proximity to the bin sets. Under the conditions assumed here, the maximum intruder dose is estimated at about 3 millirem, while the maximum INEEL worker dose would be a small fraction of a millirem.

Nonradiological risks are reported both for cancer and noncancer health effects. Cancer risk is reported in terms of probability of individual excess cancer resulting from lifetime exposure. In the cases assessed here, cancer risk results only from inhalation of cadmium entrained in fugitive dust. Noncancer effects are reported in terms of a health hazard quotient, which is the ratio of the contaminants of potential concern intake to the applicable inhalation or oral reference dose. A hazard quotient of greater than unity indicates that the intake is higher than the reference value. Noncancer risk is incurred from intake of cadmium via ingestion, inhalation and dermal absorption, and fluorides and nitrates via ingestion and dermal absorption.

For all receptors and scenarios, cancer risk from cadmium exposure is very low (less than one in a trillion). Noncancer risk would be higher for

Table 5.3-16. Summary of estimated noncarcinogenic health hazard quotients from exposure to nonradiological contaminants according to receptor and facility closure scenario.

Exposure scenario and pathway	No Action	Performance -Based Closure/ Closure to Landfill Standards	Performance - Based Closure with Class A Grout Disposal	Performance - Based Closure with Class C Grout Disposal	Disposal of Class A grout in low-activity waste disposal facility	Disposal of Class C grout in low-activity waste disposal facility
Health hazard quotient due to cadmium intake						
Maximally exposed resident farmer	4.3×10^{-7}	6.5×10^{-8}	4.6×10^{-7}	4.8×10^{-7}	1.5×10^{-5}	1.6×10^{-5}
Average resident farmer	6.7×10^{-8}	1.0×10^{-8}	7.1×10^{-8}	7.5×10^{-8}	2.3×10^{-6}	2.5×10^{-6}
Construction worker	7.0×10^{-8}	1.1×10^{-8}	7.5×10^{-8}	7.8×10^{-8}	2.4×10^{-6}	2.6×10^{-6}
Indoor worker	7.0×10^{-8}	1.1×10^{-8}	7.5×10^{-8}	7.8×10^{-8}	2.4×10^{-6}	2.6×10^{-6}
Recreational user	3.7×10^{-9}	1.2×10^{-9}	8.7×10^{-9}	9.1×10^{-9}	2.8×10^{-7}	3.1×10^{-7}
Health hazard quotient due to fluoride intake						
Maximally exposed resident farmer	0.08	5.2×10^{-4}	0.12	0.27	1.4	1.4
Average resident farmer	0.04	2.6×10^{-4}	0.058	0.13	0.69	0.71
Construction worker	6.4×10^{-3}	4.2×10^{-5}	9.4×10^{-3}	0.021	0.11	0.11
Indoor worker	6.4×10^{-3}	4.2×10^{-5}	9.4×10^{-3}	0.021	0.11	0.11
Recreational user	1.8×10^{-3}	1.2×10^{-5}	2.6×10^{-3}	4.1×10^{-3}	0.032	0.032
Health hazard quotient due to nitrate intake						
Maximally exposed resident farmer	6.5×10^{-3}	3.0×10^{-5}	1.1×10^{-4}	1.1×10^{-4}	3.0×10^{-5}	3.0×10^{-5}
Average resident farmer	2.9×10^{-3}	1.3×10^{-5}	5.0×10^{-5}	5.0×10^{-5}	1.3×10^{-5}	1.3×10^{-5}
Construction worker	4.0×10^{-4}	1.9×10^{-6}	7.1×10^{-6}	7.1×10^{-6}	1.9×10^{-6}	1.9×10^{-6}
Indoor worker	4.0×10^{-4}	1.9×10^{-6}	7.1×10^{-6}	7.1×10^{-6}	1.9×10^{-6}	1.9×10^{-6}
Recreational user	8.4×10^{-5}	3.9×10^{-7}	1.5×10^{-6}	1.5×10^{-6}	3.9×10^{-7}	3.9×10^{-7}

some receptors and scenarios, most notably those cases involving fluoride releases from landfill disposal of Class A or C grout. In those cases, a hazard quotient of 1.5 is estimated for the maximally exposed resident farmer, due mainly to ingestion of fluoride in groundwater and food products irrigated or raised with contaminated groundwater. The effect of concern for fluoride intake is objectionable dental fluorosis, which is considered more of a cosmetic effect than an adverse health effect (EPA 1998).

Table 5.3-16 presents a summary of noncancer hazard quotients for intakes of fluoride, nitrate, and cadmium.

Additional details on the modeling methodology used by DOE is included in Appendix C.9 of this EIS.

5.3.9 ENVIRONMENTAL JUSTICE

As discussed in Section 5.2.11, Executive Order 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations, directs each Federal agency to "make…achieving environmental justice part of its mission" and to identify and address "…disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority and low-income populations." The Council on Environmental Quality, which oversees the Federal government's compliance with Executive Order 12898 and the National Environmental Policy Act, subsequently developed guidelines to assist Federal agencies in incorporating the goals of Executive Order 12898 in the NEPA process. This guidance, published in 1997, was intended to "…assist Federal agencies with their NEPA procedures so that environmental justice concerns are effectively identified and addressed."

5.3.9.1 Methodology

The methods used to assess potential environmental justice impacts in Section 5.2.11 (Waste Processing) were also used to assess potential environmental justice impacts during facility disposition. The approach was based primarily on Council on Environmental Quality guidance (CEQ 1997).

Although no high and adverse impacts were predicted for the activities analyzed in this EIS, DOE nevertheless considered whether there were any means for minority or low-income populations to be disproportionately affected. The basis for making this determination would be a comparison of areas predicted to experience human health or environmental impacts with areas in the region of influence known to contain high percentages of minority or low-income populations as reported by the U.S. Bureau of the Census.

5.3.9.2 Facility Disposition Impacts

Relatively small numbers of workers would be required for facility disposition activities. DOE intends to retrain and reassign workers to conduct dispositioning activities to the extent practicable. Any socioeconomic impacts would be positive.

None of the facility disposition alternatives is expected to significantly affect land use, cultural resources, or ecological resources because no previously-undisturbed onsite land would be required and no offsite lands are affected.

DOE estimated emissions of radiological and nonradiological pollutants from dispositioning new and existing facilities required to support the various waste processing alternatives. These emissions would be temporary, lasting for a few (1 to 4) years following the shutdown of a facility. In general, radionuclide emission levels from dispositioning facilities would be lower than those resulting from operating the same facilities. In all cases, doses from dispositioning new facilities would be exceedingly low and a very small fraction of natural background levels and applicable standards. Criteria pollutant levels would remain well below applicable standards for all facility disposition alternatives. Toxic air pollutants would also be well below reference levels for all alternatives.

DOE also assessed the emissions from dispositioning existing facilities including the Tank Farm and bin sets. In all cases, radiological doses from emissions would be low and nonradiological air impacts would be well below applicable standards.

DOE assessed short- and long-term impacts to groundwater that may occur as a result of facility disposition (closure) activities. Depending on the facility disposition alternative selected, small amounts of residual waste could reach into groundwater beneath INTEC. Based on computer modeling results, there are no instances where the peak groundwater concentration of a radiological or nonradiological contaminant would exceed its EPA Drinking Water Standard.

The annual radiation doses to the maximally-exposed onsite and offsite individuals and the offsite public (population within 50 miles of INTEC) from disposition of new facilities would be insignificant. The highest collective dose to the population with 50 miles of INTEC (1.4×10^{-8} person-rem per year) would be associated with disposition of new facilities under the Separations Alternative (Planning Basis Option). This collective dose would be associated with a very small increase (7.0×10^{-12}) in LCF in the population.

The annual radiation doses to the maximally-exposed onsite and offsite individuals and the offsite public (population with 50 miles of INTEC) from disposition of existing waste management facilities would also be very small. The highest collective dose to the population with 50 miles of INTEC (5.1×10^{-8} person-rem per year) would result from Closure to Landfill Standards of the bin sets. This collective dose would be associated with a very small increase (2.6×10^{-11})

in latent cancer fatalities in the population. Impacts from other existing facility disposition alternatives would be lower.

Because facility disposition impacts would be small in all cases, and there is no means for minority or low-income populations to be disproportionately affected, no disproportionately high and adverse impacts would be expected for minority or low-income populations.

As noted in Section 5.3.8, public health impacts from facility disposition activities are based on projected airborne releases of radioactive and nonradioactive contaminants. Because prevailing winds are out of the southwest and northeast (see Section 4.7.1), contaminants released to the atmosphere from INTEC tend to be carried to the northeast (into the interior of INEEL) or southwest (into the sparsely-populated area south and west of INEEL). Minority populations tend to be concentrated south and east of INTEC, in urban areas like Pocatello and Idaho Falls and along the Interstate 15 corridor (see Figure 4-24). The Fort Hall Indian Reservation is also some 40 miles southeast of INTEC (see Figure 4-25). This suggests that minority and low-income populations would not experience higher exposure rates than the general population and that disproportionately high and adverse human health effects for minority or low-income populations would not occur as a result of facility disposition activities at INTEC.

5.3.10 UTILITIES AND ENERGY

Upon completion of waste processing operations, DOE would disposition surplus facilities. Dispositioning activities would result in the consumption of electricity, water, and fossil fuels, and the generation of wastewater.

Table 5.3-17 presents the utility and energy requirements for dispositioning new facilities that would be built to support the waste processing alternatives. Generally, these facilities would be clean-closed in accordance with applicable permits or regulations.

Table 5.3-18 presents impacts for dispositioning the Tank Farm and bin sets by closure alternative. Dispositioning the Tank Farm and bin sets would be a long-term activity because facility closure and operation as a disposal facility could last 20 to 35 years depending on the facility, closure method, and low-level waste fraction disposal option chosen. Closure of the remaining existing HLW generation, treatment, and storage facilities is not longterm compared to the Tank Farm and bin sets.

Table 5.3-19 presents impacts for dispositioning other existing facilities associated with HLW management.

5.3.11 WASTE AND MATERIALS

Waste would be produced as a result of dispositioning new waste processing facilities. Table 5.3-20 summarizes total volumes of industrial, low-level, mixed low-level, and hazardous waste that would be generated from disposition of new facilities under each of the waste processing alternatives. As noted in Section 5.2.13.1, waste volumes have been conservatively estimated predicated on current laws and regulations. Future regulatory changes could affect predicted waste volumes and, in the worst case, some reanalysis could be required to show that predicted impacts are bounding. This analysis could be provided as an addendum to this EIS at some future date. Generation of transuranic waste is not expected under disposition of any of these facilities. These facilities would be closed in accordance with the applicable permits or regulations, and closure activities would be typically between 1 to 5 years in duration. Although the No Action Alternative includes some minor construction actions, the evaluation of impacts presented here assumes it would involve no facility disposition activities.

Table 5.3-21 shows volumes of industrial, low-level, mixed low-level, and hazardous waste that would be generated by disposition of existing HLW management facilities. As with disposition of new facilities, generation of transuranic waste is not anticipated for any of the facilities. Waste generation estimates are presented by facility (or facility grouping) and disposition alternative. Disposition of the Tank Farm and bin sets represents the more complex activities

Table 5.3-17. Utility and energy requirements for dispositioning of new facilities.

Project number	Description	Project duration (years)	Annual electricity use (megawatt-hours per year)	Annual fossil fuel use (million gallons per year)	Annual potable water use (million gallons per year)	Annual non-potable water use (million gallons per year)	Annual sanitary wastewater discharges (million gallons per year)
Continued Current Operations Alternative							
P1A	Calcine SBW including NWCF Upgrades (MACT)	3	310	0.14	0.65	0.60	0.65
P1B	NGLW and Tank Farm Heel Waste	1	180	0.07	0.59	0.20	0.59
Total			490	0.21	1.2	0.80	1.2
Full Separations Option							
P9A	Full Separations	3	160	0.23	1.3	0.60	1.3
P9B	Vitrification Plant	3	160	0.12	0.41	0.20	0.41
P9C	Class A Grout Plant	2.5	160	0.12	0.67	0.60	0.67
P18	New Analytical Lab	2	160	0.08	0.49	0.11	0.49
P24	Vitrified Product Interim Storage at INEEL	Unknown	160	0.03	0.17	0	0.17
P25A	Packaging & Loading Vitrified HLW at INTEC for Shipment to NGR	Unknown	39	0	3.0×10^{-3}	0	3.0×10^{-3}
P27	Class A Grout Disposal in New INEEL Disposal Facility	2	1	0.06	0.76	0	0.76
P35D or P35E	Class A Grout Packaging & Shipping to INEEL Disposal Facility or to Offsite Disposal	2	160	0.02	0.17	0.05	0.17
P59A	Calcine Retrieval and Transport	Unknown	160	0.11	0.90	0.20	0.90
P118	Separations Organic Incinerator	2	8	0.01	0.10	0.03	0.01
P133	Waste Treatment Pilot Plant	2	160	0.06	0.26	0.05	0.26
Total			1.3×10^{3}	0.84	5.2	1.8	5.2

Table 5.3-17. Utility and energy requirements for dispositioning of new facilities (continued).

Project number	Description	Project duration (years)	Annual electricity use (megawatt-hours per year)	Annual fossil fuel use (million gallons per year)	Annual potable water use (million gallons per year)	Annual non-potable water use (million gallons per year)	Annual sanitary wastewater discharges (million gallons per year)
Planning Basis Option							
P1A	Calcine SBW including NWCF Upgrades (MACT)	3	310	0.19	0.65	0.60	0.65
P1B	NGLW and Tank Farm Heel Waste	1	180	0.07	0.59	0.20	0.59
P23A	Full Separations	2	160	0.23	1.3	0.60	1.3
P23B	Vitrification Plant	2	160	0.12	0.44	0.60	0.44
P23C	Class A Grout Plant	2	160	0.12	0.60	0.60	0.60
P18	New Analytical Lab	2	160	0.08	0.49	0.11	0.49
P24	Vitrified Product Interim Storage at INEEL	Unknown	160	0.03	0.17	0	0.17
P25A	Packaging & Loading Vitrified HLW at INTEC for Shipment to NGR	Unknown	40	0	3.0×10^{-3}	0	3.0×10^{-3}
P35E	Class A Grout Packaging & Shipping for Offsite Disposal	2	160	0.02	0.17	0.05	0.17
P59A	Calcine Retrieval and Transport	2	160	0.11	0.90	0.20	0.90
P118	Separations Organic Incinerator	2	8	0.01	0.10	0.03	0.10
P133	Waste Treatment Pilot Plant	2	160	0.06	0.26	0.05	0.26
Total			1.8×10^{3}	1.0	5.6	3.1	5.6

Table 5.3-17. Utility and energy requirements for dispositioning of new facilities (continued).

Project number	Description	Project duration (years)	Annual electricity use (megawatt-hours per year)	Annual fossil fuel use (million gallons per year)	Annual potable water use (million gallons per year)	Annual non-potable water use (million gallons per year)	Annual sanitary wastewater discharges (million gallons per year)
			Transuranic Separations Option				
P18	New Analytical Lab	2	160	0.08	0.49	0.11	0.49
P27	Class A Grout Disposal in New INEEL Disposal Facility	2	1	0.060	0.76	0	0.76
P39A	Packaging and Loading TRU at INTEC for Shipment to the Waste Isolation Pilot Plant	1.5	140	0.05	0.04	0.04	0.04
P49A	TRU-C Separations	3	160	0.18	0.83	0.60	0.83
P49C	Class C Grout Plant	2	160	0.12	0.52	0.60	0.52
P49D	Class C Grout Packaging & Shipping to INEEL Disposal Facility	2	160	0.02	0.32	0.06	0.32
P59A	Calcine Retrieval and Transport	1	160	0.11	0.90	0.20	0.90
P118	Separations Organic Incinerator	2	8	0.01	0.10	0.03	0.10
P133	Waste Treatment Pilot Plant	2	160	0.06	0.26	0.05	0.26
Total			1.1×10^3	0.69	4.2	1.7	4.2
			Hot Isostatic Pressed Waste Option				
P1A	Calcine SBW including NWCF Upgrades (MACT)	3	310	0.19	0.65	0.60	0.65
P1B	NGLW and Tank Farm Heel Waste	1	180	0.07	0.59	0.20	0.59
P18	New Analytical Lab	2	160	0.08	0.49	0.11	0.49
P59A	Calcine Retrieval and Transport	1	160	0.11	0.90	0.20	0.90
P71	Mixing and HIPing	5	160	0.15	1.1	1.0	1.1
P72	HIP HLW Interim Storage	Unknown	160	0.07	0.86	0	0.86
P73A	Packaging and Loading HIP Waste at INTEC for Shipment to NGR	Unknown	140	0.05	0.04	0.08	0.04
P133	Waste Treatment Pilot Plant	2	160	0.06	0.26	0.05	0.26
Total			1.4×10^3	0.79	4.9	2.6	4.9

Table 5.3-17. Utility and energy requirements for dispositioning of new facilities (continued).

Project number	Description	Project duration (years)	Annual electricity use (megawatt-hours per year)	Annual fossil fuel use (million gallons per year)	Annual potable water use (million gallons per year)	Annual non-potable water use (million gallons per year)	Annual sanitary wastewater discharges (million gallons per year)
			Direct Cement Waste Option				
P1A	Calcine SBW including NWCF Upgrades (MACT)	3	310	0.19	0.65	0.60	0.65
P1B	NGLW and Tank Farm Heel Waste	1	180	0.07	0.59	0.20	0.59
P18	New Analytical Lab	2	160	0.08	0.49	0.11	0.49
P59A	Calcine Retrieval and Transport	1	160	0.11	0.90	0.20	0.90
P80	Direct Cement Process	3	160	0.14	0.92	0.60	0.92
P81	Unseparated Cementitious HLW Interim Storage	Unknown	160	0.12	1.6	0	1.6
P83A	Packaging & Loading Cementitious Waste at INTEC for Ship. to NGR	Unknown	140	0.05	0.04	0.08	0.04
P133	Waste Treatment Pilot Plant	2	160	0.06	0.26	0.05	0.26
Total			1.4×10^3	0.82	5.5	1.8	5.5
			Early Vitrification Option				
P18	New Analytical Lab	2	160	0.08	0.49	0.11	0.49
P59A	Calcine Retrieval and Transport	1	160	0.11	0.90	0.20	0.90
P61	Unseparated Vitrified HLW Interim Storage	Unknown	160	0.10	1.4	0	1.4
P62A	Packaging/Loading Vitrified HLW at INTEC for Shipment to NGR	Unknown	140	0.05	0.05	0.08	0.05
P88	Early Vitrification with MACT Upgrades	5	180	0.20	0.66	0.70	0.66
P90A	Packaging & Loading Vitrified SBW at INTEC for Shipment to the Waste Isolation Pilot Plant	1.5	140	0.05	0.04	0.04	0.04
P133	Waste Treatment Pilot Plant	2	160	0.06	0.26	0.05	0.26
Total			1.1×10^3	0.65	3.8	1.2	3.8

Table 5.3-17. Utility and energy requirements for dispositioning of new facilities (continued).

Project number	Description	Project duration (years)	Annual electricity use (megawatt-hours per year)	Annual fossil fuel use (million gallons per year)	Annual potable water use (million gallons per year)	Annual non-potable water use (million gallons per year)	Annual sanitary wastewater discharges (million gallons per year)
Minimum INEEL Processing Alternative							
P18	New Analytical Lab	2	160	0.08	0.49	0.11	0.49
P24	Vitrified Product Interim Storage at INEEL	Unknown	160	0.03	0.17	0	0.17
P25A	Packaging & Loading Vitrified HLW and INTEC for Shipment to NGR	Unknown	39	0	3.0×10^{-3}	0	3.0×10^{-3}
P27	Class A Grout Disposal in New INEEL Disposal Facility	Unknown	1	0.06	0.76	0	0.76
P59A	Calcine Retrieval and Transport	1	160	0.11	0.90	0.20	0.90
P111	SBW & NGLW Treatment with CsIX to CH TRU Grout and LLW Grout	1	180	0.07	0.59	0.20	0.59
P112A	Packaging and Loading CH TRU for Shipment to the Waste Isolation Pilot Plant	4.5	140	0.05	0.04	0.04	0.04
P117A	Packaging and Loading Calcine for Transport to Hanford Site	3	160	9.0×10^{-3}	0.29	0.80	0.29
P133	Waste Treatment Pilot Plant	2	160	0.06	0.26	0.05	0.26
Total			1.1×10^{3}	0.47	3.5	1.4	3.5

CH TRU = contact-handled transuranic waste; CsIX = cesium ion exchange; HIP = hot isostatic press; MACT = Maximum Achievable Control Technology; NGLW = newly generated liquid waste; NGR = national geologic repository; NWCF = New Waste Calcining Facility; SBW = sodium-bearing waste; TRU = transuranic waste; TRU-C = transuranic/Class C.

Table 5.3-18. Summary of annual resource impacts from dispositioning existing facilities with multiple disposition alternatives.

Facility	Units	Clean closure	Performance-based closure	Closure to landfill standards	Performance-based closure with Class A grout disposal	Performance-based closure with Class C grout disposal
Tank Farm	Years (duration)	26	17	17	22	22
Wastewater discharges	Million gallons per year	2.0	0.13	0.10	0.14	0.15
Annual potable water use	Million gallons per year	2.0	0.11	0.06	0.13	0.14
Annual process water use	Million gallons per year	0.05	0.06	0.09	0.05	0.05
Annual fossil fuel use	Million gallons per year	0.08	0.02	0.011	0.010	0.010
Annual electricity use	Megawatt-hours per year	7.3×10^{3}	4.4×10^{3}	1.2×10^{3}	4.6×10^{3}	4.6×10^{3}
Bin sets	Years (duration)	27	21	21	22	22
Wastewater discharges	Million gallons per year	0.32	0.32	0.16	0.52	0.56
Annual potable water use	Million gallons per year	0.32	0.31	0.15	0.52	0.55
Annual process water use	Million gallons per year	3.9×10^{-3}	0.01	0.011	0.03	0.03
Annual fossil fuel use	Million gallons per year	3.9×10^{-3}	6.6×10^{-3}	5.2×10^{-3}	5.2×10^{-3}	5.0×10^{-3}
Annual electricity use	Megawatt-hours per year	3.2×10^{3}	6.0×10^{3}	990	1.5×10^{3}	1.5×10^{3}
Fuel Processing Building and Related Facilities	Years (duration)	NA[a]	10	10	NA	NA
Wastewater discharges	Million gallons per year	NA	6.0×10^{-3}	4.8×10^{-3}	NA	NA
Annual potable water use	Million gallons per year	NA	6.0×10^{-3}	4.8×10^{-3}	NA	NA
Annual process water use	Million gallons per year	NA	0	0	NA	NA
Annual fossil fuel use	Million gallons per year	NA	0.26	0.26	NA	NA
Annual electricity use	Megawatt-hours per year	NA	0	0	NA	NA
New Waste Calcining Facility	Years (duration)	NA	5	5	NA	NA
Wastewater discharges	Million gallons per year	NA	0.01	0.01	NA	NA
Annual potable water use	Million gallons per year	NA	0.01	0.01	NA	NA
Annual process water use	Million gallons per year	NA	0	0	NA	NA
Annual fossil fuel use	Million gallons per year	NA	0.09	0.09	NA	NA
Annual electricity use	Megawatt-hours per year	NA	300	300	NA	NA

a. NA = not applicable.

Table 5.3-19. Summary of resource impacts from dispositioning other existing facilities associated with HLW management.

Facility Group	Duration of dispositioning activity[a] (years)	Annual wastewater discharges (million gallons per year)	Annual potable water use (million gallons per year)	Annual process water use (million gallons per year)	Annual fossil fuel use (million gallons per year)	Annual electricity use (megawatt-hours per year)
Tank Farm-Related Facilities	6	7.4×10^{-4}	7.4×10^{-4}	0	0.16	0
Bin Set-Related Facilities	6	5.0×10^{-5}	5.0×10^{-5}	0	0.13	0
Process Equipment Waste Evaporator and Related Facilities	6	0.02	0.02	0	0.17	0
Fluorinel and Storage Facility and Related Facilities	6	0.01	0.01	0	0.09	0
Remote Analytical Laboratory	5	2.1×10^{-3}	2.1×10^{-3}	0	0.06	0
Transport Lines Group	1	3.6×10^{-3}	3.6×10^{-3}	0	0.06	0

a. Duration refers to total number of calendar years during which dispositioning of facilities within the listed groups would occur.

Table 5.3-20. Summary of waste generated from the dispositioning new waste processing facilities.[a]

Number	Project description	Duration of activity (years)	Total waste generation per waste type (in cubic meters): Industrial waste	Low-level waste	Mixed low-level waste	Hazardous waste
	Continued Current Operations Alternative					
P1A	Calcine SBW including New Waste Calcining Facility Upgrades	3	1.1×10^3	620	0	200
P1B	Newly Generated Liquid Waste Management and Tank Farm Heel Waste	1	3.7×10^3	5.0×10^3	11	60
	Totals		4.8×10^3	5.6×10^3	11	260
	Full Separations Option					
P9A	Full Separations	3	2.4×10^4	3.1×10^4	350	11
P9B	Vitrification Plant	3	1.4×10^4	1.8×10^4	42	6
P9C	Class A Grout Plant	2.5	6.0×10^3	7.9×10^3	18	3
P118	Separations Organic Incinerator	2	0	0	15	0
P18	New Analytical Laboratory	2	4.6×10^3	3.1×10^3	97	0
P24	Vitrified Product Interim Storage	3	9.4×10^3	0	0	2
P25A	Packaging and Loading Vitrified HLW at INTEC for Shipment to a Geologic Repository	0.33	10	0	0	3
P59A	Calcine Retrieval and Transport	1	3.6×10^3	0	0	0
P133	Waste Treatment Pilot Plant	2	5.4×10^3	6.7×10^3	22	3
	For onsite facility disposal of grout					
P27	Class A Grout Disposal in a new Low-Activity Waste Disposal Facility	2	130	0	0	0
P35D	Class A Grout Packaging and Shipping to a new Low-Activity Waste Disposal Facility	2	670	0	0	0
	For tank farm and bin set disposal of grout					
P26	Class A Grout Disposal in Tank Farm and Bin Sets	4	3.7×10^3	0	350	20
	For offsite disposal of grout					
P35E	Class A Grout Packaging and Loading for Offsite Disposal	2	670	0	0	0
	Totals					
	Base case – New INEEL disposal of Class A grout		6.7×10^4	6.8×10^4	550	28
	Tank Farm and bin set disposal of Class A grout		7.0×10^4	6.8×10^4	900	48
	Offsite disposal of Class A grout		6.7×10^4	6.8×10^4	550	28

Table 5.3-20. Summary of waste generated from the dispositioning new waste processing facilities[a] (continued).

Number	Project description	Duration of activity (years)	Total waste generation per waste type (in cubic meters) Industrial waste	Low-level waste	Mixed low-level waste	Hazardous waste
	Planning Basis Option					
P1A	Calcine SBW including New Waste Calcining Facility Upgrades	3	1.1×10^{3}	630	0	200
P1B	Treatment of Newly Generated Liquid Waste and Tank Farm Waste Heel Waste	1	3.7×10^{3}	5.0×10^{3}	11	60
P18	New Analytical Laboratory	2	4.6×10^{3}	3.1×10^{3}	97	0
P23A	Full Separations	2	2.3×10^{4}	3.1×10^{4}	320	15
P23B	Vitrification Plant	2	1.4×10^{4}	1.8×10^{4}	8	6
P23C	Class A Grout Plant	2	6.0×10^{3}	7.9×10^{3}	12	3
P24	Vitrified Product Interim Storage	3	9.4×10^{3}	0	0	2
P25A	Packaging and Loading Vitrified HLW at INTEC for Shipment to a Geologic Repository	0.33	12	0	0	3
P59A	Calcine Retrieval and Transport	2	3.6×10^{3}	0	0	0
P118	Separations Organic Incinerator	2	0	1	15	0
P133	Waste Treatment Pilot Plant	2	5.4×10^{3}	6.7×10^{3}	22	3
P35E	Class A Grout Packaging and Loading for Offsite Disposal	2	670	0	0	0
	Totals		7.2×10^{4}	7.3×10^{4}	480	290
	Transuranic Separations Option					
P18	New Analytical Laboratory	2	4.6×10^{3}	3.1×10^{3}	97	0
P49A	Transuranic/Class C Separations	3	2.0×10^{4}	2.7×10^{4}	200	9
P49C	Class C Grout Plant	2	6.0×10^{3}	7.9×10^{3}	18	3
P118	Separations Organic Incinerator	2	0	0	15	0
P133	Waste Treatment Pilot Plant	2	5.4×10^{3}	6.7×10^{3}	22	3
P39A	Packaging and Loading Transuranic Waste at INTEC for Shipment to the Waste Isolation Pilot Plant	1.5	170	0	0	15
P59A	Calcine Retrieval and Transport	1	3.6×10^{3}	0	0	0
	For onsite facility disposal of grout					
P27	Class A Grout Disposal in a new Low-Activity Waste Disposal Facility	2	130	0	0	0
P49D	Class C Grout Packaging and Shipping to a new Low-Activity Waste Disposal Facility	2	700	0	0	0
	For tank farm and bin set disposal of grout					
P51	Class C Grout Placement in Tank Farm and Bin Sets	4	3.7×10^{3}	0	350	20
	For offsite disposal of grout					
P49E	Class C Grout Packaging and Loading for Offsite Disposal	2	1.1×10^{3}	0	0	0

Table 5.3-20. Summary of waste generated from the dispositioning new waste processing facilities[a] (continued).

Number	Project description	Duration of activity (years)	Total waste generation per waste type (in cubic meters): Industrial waste	Low-level waste	Mixed low-level waste	Hazardous waste
Hot Isostatic Pressed Waste Option						
P1A	Calcine SBW including New Waste Calcining Facility Maximum Achievable Control Technologies Upgrades	3	1.1×10^3	630	0	200
P1B	Newly Generated Liquid Waste Management (low-level waste grout) and Tank Farm Heel Waste	1	3.7×10^3	5.0×10^3	11	60
P18	New Analytical Laboratory	2	4.6×10^3	3.1×10^3	97	0
P59A	Calcine Retrieval and Transport	1	3.6×10^3	0	0	0
P71	Mixing and Hot Isostatic Pressing	5	2.6×10^4	3.5×10^4	210	12
P72	Interim Storage of Hot Isostatic Pressed Waste	3	2.3×10^4	0	0	4
P73A	Packaging and Loading of Hot Isostatic Pressed Waste at INTEC for Shipment to a Geologic Repository	2.5	580	0	0	68
P133	Waste Treatment Pilot Plant	2	5.4×10^3	6.7×10^3	22	3
Total			6.8×10^4	5.0×10^4	340	340
Direct Cement Waste Option						
P1A	Calcine SBW including New Waste Calcining Facility Upgrades	3	1.1×10^3	620	0	200
P1B	Newly Generated Liquid Waste Management and Tank Farm Heel Waste	1	3.7×10^3	5.0×10^3	11	60
P18	New Analytical Laboratory	2	4.6×10^3	3.1×10^3	97	0
P59A	Calcine Retrieval and Transport	1	3.6×10^3	0	0	0
P80	Direct Cement Process	3	2.5×10^4	3.4×10^4	220	11
P81	Unseparated Cementious HLW Interim Storage	3	5.1×10^4	0	0	24
P83	Packaging and Loading of Cementitious Waste at INTEC for Shipment to a Geologic Repository	3.5	860	0	0	110
P133	Waste Treatment Pilot Plant	2	5.4×10^3	6.7×10^3	22	3
Total			9.5×10^4	4.9×10^4	350	410
Early Vitrification Option						
P18	New Analytical Laboratory	2	4.6×10^3	3.1×10^3	97	0
P59A	Calcine Retrieval and Transport	1	3.6×10^3	0	0	0
P88	Early Vitrification with Maximum Achievable Control Technology	5	2.3×10^4	3.0×10^4	360	11
P61	Vitrified HLW Interim Storage	3	4.3×10^4	0	0	22
P62A	Packaging and Loading Vitrified HLW at INTEC for Shipment to a Geologic Repository	3	430	0	0	110
P90A	Packaging and Loading SBW at INTEC for Shipment to the Waste Isolation Pilot Plant	1.5	170	0	0	15
P133	Waste Treatment Pilot Plant	2	5.4×10^3	6.7×10^3	22	3
Total			8.0×10^4	4.1×10^4	480	160

Table 5.3-20. Summary of waste generated from the dispositioning new waste processing facilities[a] (continued).

Number	Project description	Duration of activity (years)	Total waste generation per waste type (in cubic meters): Industrial waste	Low-level waste	Mixed low-level waste	Hazardous waste
Minimum INEEL Processing Alternative						
P111	SBW and Newly Generated Liquid Waste Treatment with Cesium Ion Exchange to Contact Handled Transuranic Grout and Low-Level Waste Grout	1	3.7×10^3	5.0×10^3	15	2
P18	New Analytical Laboratory	2	4.6×10^3	3.1×10^3	97	0
P59A	Calcine Retrieval and Transport	1	3.6×10^3	0	0	0
P27	Class A Grout Disposal in New INEEL Low-Activity Waste Disposal Facility (for vitrified low-level waste fraction)	2	130	0	0	0
P24	Interim Storage of Vitrified Waste at INEEL	3	9.4×10^3	0	0	2
P25A	Packaging and Loading of Vitrified HLW at INTEC for Shipment to a Geologic Repository	0.33	12	0	0	3
P112A	Packaging and Loading Contact Handled Transuranic Waste for Transport to the Waste Isolation Pilot Plant	4.5	880	0	0	0
P117A	Calcine Packaging and Loading	3	140	110	8	46
P133	Waste Treatment Pilot Plant	2	5.4×10^3	6.7×10^3	22	3
Total			2.8×10^4	1.5×10^4	140	56

a. Source: Project Data Sheets in Appendix C.6.

Table 5.3-21. Waste generated for existing HLW facilities by facility and disposition alternative.[a]

	Duration of activity (years)	Total waste generation per waste type[b] (in cubic meters)			
		Industrial waste	Low-level waste	Mixed low-level waste	Hazardous waste
Tank Farm					
Clean Closure	26	1.6×10^5	1.1×10^3	1.1×10^4	0
Performance-Based Closure	17	1.9×10^3	0	120	79
Closure to Landfill Standards	17	1.7×10^3	0	480	0
Performance-Based Closure with Class A Grout Disposal	22	1.5×10^3	0	120	27
Performance-Based Closure with Class C Grout Disposal	22	1.5×10^3	0	120	27
Tank Farm Related Facilities	8[c]	56	100	0	1
Bin Sets					
Clean Closure	27	2.4×10^4	4.6×10^3	180	130
Performance-Based Closure	21	3.6×10^3	150	85	100
Closure to Landfill Standards	21	3.6×10^3	150	33	100
Performance-Based Closure with Class A Grout Disposal	22	1.5×10^4	0	540	28
Performance-Based Closure with Class C Grout Disposal	22	1.5×10^4	0	540	28
Bin Set Related Facilities	6	0	10	0	0.2
Process Equipment Waste Evaporator and Related Facilities[d]	6	870	2.5×10^3	0	13
Fuel Processing Building and Related Facilities	10	0	920	0	18
Fluorinel Dissolution Process and Fuel Storage and Related Facilities	6	0	1.5×10^3	0	33
Remote Analytical Laboratory	5	0	100	0	2
New Waste Calcining Facility	5	0	2.4×10^3	460	250
Transport Line Group	1	0	9	43	0

a. Unless otherwise specified, the source of the data presented is the Project Data Sheets in Appendix C.6.
b. As presented here, the quantities of waste generated during dispositioning do not include building debris and other building material buried in place.
c. Dispositioning of the Tank Farm-related facilities would occur over eight different, non-consecutive years. Most facilities would, however, be dispositioned during the 6-year period from January 2018 through December 2023.
d. Source of data for Process Waste Equipment Evaporator, CPP-604, (combined with related facilities here): Haley (1998).

and would be long-term actions, lasting upwards of 30 years, depending on the alternative. Because of these complexities, the Tank Farm and bin sets are being evaluated under each of the five disposition alternatives. Other existing waste processing facilities are generally only being considered for a single disposition alternative as shown in Table 3-4. The exception to this is the facility grouping Fuel Processing Building and related facilities and the New Waste Calcining Facility. The Fuel Processing Building and Related Facilities were considered under two disposition alternatives: Performance-Based Closure and Closure to Landfill Standards. The group is shown with a single entry in Table 5.3-21 because the quantities of waste generated would be identical under either disposition alternative. The New Waste Calcining Facility was also evaluated for the same two disposition alternatives and, again, the quantities of waste generated under either alternative were projected to be the same. Disposition of these other facilities would not be long-term actions compared to the Tank Farm and bin sets.

Disposition of new and existing waste processing facilities would produce large quantities of industrial waste. Depending on the waste processing alternative and the facility disposition alternative considered for the Tank Farm and bin sets, projected volumes of industrial waste could exceed 250,000 cubic meters. This is greater than the quantities projected for construction and operation of the waste processing alternatives as described in Section 5.2.13. However, much of these materials would be construction debris and, as discussed in Section 5.2.13, should not present a serious problem for disposal within the INEEL.

The highest combined projections of low-level waste generated from facility disposition actions would be about 85,000 cubic meters. This is a significant volume in comparison to the DOE-wide projection of 1.5 million cubic meters over a 20-year period that was described in Section 5.2.13. However, the 85,000 cubic meter quantity would be generated over even a longer period of time and, also as discussed in Section 5.2.13, DOE assumes that new facilities would be constructed if additional treatment and disposal capacity is needed.

The projected quantities of mixed low-level waste vary greatly under the various facility disposition alternatives. The largest volume shown for either new or existing facilities is for clean closure of the Tank Farm, which is estimated to produce about 10,600 cubic meters of mixed low-level waste. As discussed in Section 5.2.13, DOE assumes that new facilities would be constructed if additional mixed low-level waste treatment and disposal capacity is needed. Planning documents for clean closure of the Tank Farm identify almost 134,000 cubic meters of CERCLA waste soil that may be associated with this disposition alternative. This waste, which would likely be contaminated with both hazardous and radiological constituents, is not included in Table 5.3-21 under the assumption that it would be addressed and, as appropriate, remediated under INEEL's CERCLA program.

Quantities of hazardous waste produced under any of the facility disposition alternatives would be relatively small, particularly when spread over the number of years that it would take to implement the actions. The annual volumes would be similar to those discussed in Section 5.2.13 for construction and operation activities. Similarly, it is unlikely these additional wastes would adversely impact the ability of commercial facilities to manage hazardous waste.

5.3.12 FACILITY DISPOSITION ACCIDENTS

5.3.12.1 Introduction

Purpose

The purpose of this section is to analyze alternatives for the disposition of INTEC facilities based on their potential for facility accidents during the disposition process. Each waste processing alternative and facility disposition option requires an analysis of potential facility accidents as one of the environmental impacts, particularly to human health and safety, associated with its implementation. An accident analysis is performed to identify environmental impacts associated with accidents that would not necessarily occur but which are reasonably foreseeable and could result in significant impacts. Since the potential for accidents and their consequences varies among different facility disposition options, facility disposition accidents may provide a key discriminator among the Idaho HLW & FD EIS alternatives. Accidents are defined per the National Environmental Policy Act as undesired events that can occur during or as a result of implementing an alternative and that have the potential to result in human health impacts or indirect environmental impacts.

Potential facility disposition accidents pose health impacts to several groups of candidate receptors, including workers at nearby INEEL facilities (noninvolved workers) and the offsite public who could be exposed to hazardous materials released during some accident scenarios. Potential facility disposition impacts to human health arise from the presence of radiological, chemical, and industrial (physical) hazards such as trauma, fire, spills, and falls.

Each waste processing EIS alternative affects or includes several major INTEC facilities, such as the New Waste Calcining Facility, Tank Farm, and bin sets. Clean Closure, Performance-Based Closure, and Closure to Landfill Standards are the three major alternatives that are being considered by DOE for each HLW facility disposition. The facility disposition alternatives that are currently under active consideration by DOE are evaluated below in the respective facility accident analyses.

Approach

The approach adopted by DOE is illustrated in Figure 5.3-11. As shown, potential facility disposition impacts for noninvolved workers and members of the offsite public are analyzed differently than for involved workers. Only involved workers are subject to hazards of an industrial nature, such as trauma, fire, spills, and falls. However, all three groups could be exposed to radioactivity and/or hazardous chemicals released by a severe accident. For assessing impacts to noninvolved workers and the offsite public, the maximum plausible accident identified for disposition of each facility is compared to the maximum postulated accident during normal operation of that facility. Data sources include documented safety analyses for HLW processes at INTEC or EIS estimates for bounding facility events that are included in waste processing alternatives. The comparisons between disposition events and corresponding operations accidents use relative changes in inventories of radioactive materials and hazardous chemicals, changes in mobility of these substances, and changes in the energy available for accident initiation and propagation. These changes occur to some extent while a facility undergoes deactivation. As discussed below, the combination of inventory reductions, immobilization of residuals, and removal of energy sources produces potential disposition impacts that are less severe than those posed by acceptable hazards from current operations. This analysis indicates that a maximum plausible disposition event for a given facility has significantly less potential impact than a corresponding operations accident. Thus, an inference can be made that risks at each facility would not be increased by prospective actions taken to implement an EIS alternative.

Involved workers would be exposed to numerous industrial physical hazards during facility disposition activities, in addition to hazards from residual chemicals and radioactive materials following facility deactivation. The industrial hazards to involved workers likely would not diminish when inventories of chemicals and radioactive substances are removed or immobilized. Thus, accidents such as falls from scaffolding are assumed to be independent of the radioactive and chemical inventories, the mobility of these materials, and the energy available to

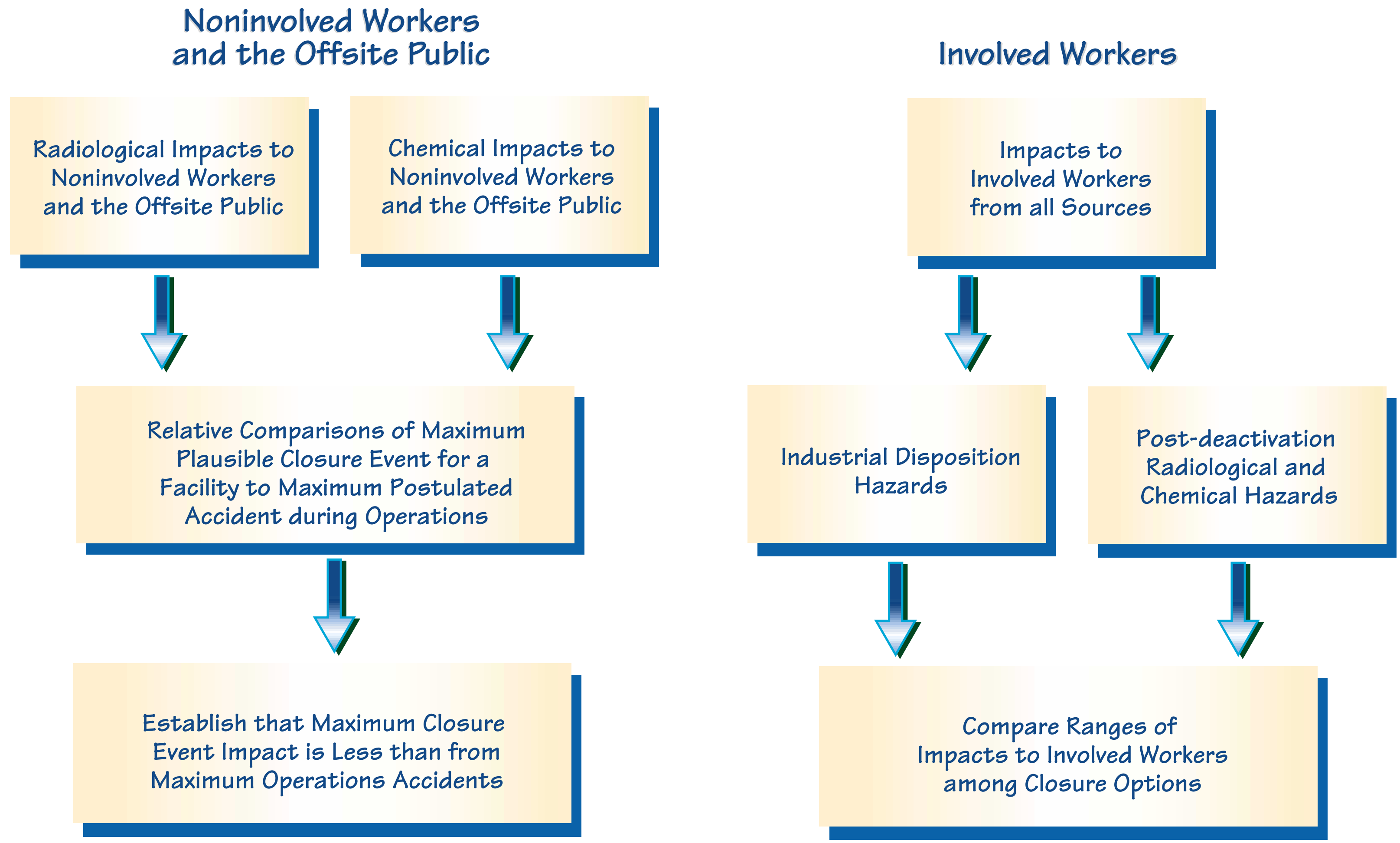


FIGURE 5.3-11.
Impact assessment methodology for hypothetical disposition accidents in INTEC facilities.

release these inventories. DOE standards indicate (DOE 1998) the likelihood of industrial accidents may increase during facility disposition, relative to facility operations, because more industrial labor is required during active phases of disposition.

There is another reason why occupational impacts to involved facility workers cannot simply be bounded by the maximum postulated accident for operations in the same manner as for potential impacts to noninvolved workers and members of the offsite public. Many facility systems that mitigate consequences of operations accidents to involved workers, such as fire protection systems, may no longer be available during disposition, especially during latter phases such as demolition. It is also possible that involved workers may encounter unforeseen radiological or chemical hazards during disposition without the benefit of adequate protective equipment. For example, process tanks or lines that are declared empty in facility documentation may still contain enough radioactivity to require shielding or remote handling for disassembly.

For these reasons the strategy for involved workers reflected in Figure 5.3-11 is to compare the potential impacts from disposition accidents with respect to the closure options under consideration. This assessment is relatively straightforward for industrial hazards, where potential impacts (injuries/illnesses and fatalities) are assumed proportional to disposition labor hours. As discussed below, a Clean Closure requires more disposition labor than a Performance-Based Closure, which requires more labor than Closure to Landfill Standards. Consequently, Clean Closure poses the largest total risk of industrial accidents to involved workers, while Closure to Landfill Standards poses the least total risk. Similarly, impacts from radiological hazards in terms of total rem exposure are calculated from the estimated duration (hours) of radiation worker labor. Facility-specific hazards from hazardous chemical residues are more difficult to quantify with available information. However, inferences can be drawn by assuming that impacts are related to amounts of disposition labor under hazardous conditions, because Clean Closure requires more disposition activity in close proximity to chemical hazards, followed by Performance-Based Closure and then Closure to Landfill Standards. Thus, potential impacts to involved workers from chemical residues should demonstrate the same trend among facility disposition alternatives as industrial and radiological accidents.

Scope

This analysis presents postulated facility disposition accidents that could occur during facility closure and have the potential to harm workers, the offsite public, and the environment. This analysis of facility disposition accidents was applied only to those existing INTEC facilities that are significant to the treatment, storage, or generation of HLW. New facilities required for the waste processing alternatives are not considered in the analysis because the design of these facilities has not been finalized and the designs would include features to facilitate decontamination and decommissioning (DOE 1989). Thus, new waste processing facilities would have minimal radioactive and hazardous material inventories remaining at the time of disposition and a low potential for significant accidents.

As described in Section 3.2.2 of this EIS, DOE used a systematic process to identify which existing INTEC facilities would be analyzed in detail for this EIS. These facilities selected for detailed analysis are assumed to have material inventories that require careful consideration of potential for accidental release into the environment at closure. The results of the DOE facility selection process are documented in Table 3-4. Table 5.3-22 is derived from Table 3-4 and forms the basis for the analysis of potential disposition impacts to involved workers in Section 5.3.12.5. This section also is applicable to inter-facility transport lines that are not directly associated with individual INTEC facilities.

Because current facility data on the type and quantities of miscellaneous hazardous materials were not available, no definitive analysis was done with respect to the chemical content and potential impact of incidental, hazardous materials at the facilities. These hazardous materials may include kerosene, gasoline, nitric acid, decontamination fluids, paints, etc. The assumption was made that closure activities would include the disposal and cleanup of these haz-

Table 5.3-22. Existing INTEC facilities with significant risk of accident impacts to noninvolved workers and to the offsite public.[a]

Tank Farm	
CPP-713	Vault containing Tanks VES-WM-187, 188, 189, and 190
CPP-780	Vault containing Tank VES-WM-180
CPP-781	Vault containing Tank VES-WM-181
CPP-782	Vault containing Tank VES-WM-182
CPP-783	Vault containing Tank VES-WM-183
CPP-784	Vault containing Tank VES-WM-184
CPP-785	Vault containing Tank VES-WM-185
CPP-786	Vault containing Tank VES-WM-186
Bin Sets	
CPP-729	Bin set 1
CPP-742	Bin set 2
CPP-746	Bin set 3
CPP-760	Bin set 4
CPP-765	Bin set 5
CPP-791	Bin set 6
CPP-795	Bin set 7
Process Equipment Waste Evaporator and Related Facilities	
CPP-604	Process Equipment Waste Evaporator
CPP-605	Blower Building
CPP-649	Atmospheric Protection Building
CPP-708	Main Exhaust Stack
CPP-756	Prefilter Vault
CPP-1618	Liquid Effluent Treatment and Disposal Facility
Fuel Processing Building and Related Facilities	
CPP-601	Fuel Processing Building
CPP-627	Remote Analytical Facility
CPP-640	Head End Process Plant
Other Facilities	
CPP-659	New Waste Calcining Facility
CPP-666/767	Fluorinel Dissolution Process and Fuel Storage Facility and Stack
CPP-684	Remote Analytical Laboratory

a. Derived from Table 3-4 and Rodriguez et al. (1997).

ardous materials to the maximum extent practicable in accordance with the current decommissioning manuals and regulations.

For occupational impacts to noninvolved workers and the offsite public, which are documented in Section C.4.2 of Appendix C.4 and summarized in Section 5.3.12.4, the facilities addressed were confined to those facilities where potential accidents could rapidly disperse radionuclides and/or hazardous chemicals beyond the immediate working area. Selection guidance was obtained from a prior study, the *Comprehensive RI/FS for the Idaho Chemical Processing Plant OU 3-13 at the INEEL Part A, RI/BRA Report (*Rodriguez et al. 1997), which identified those facilities with airborne release and direct exposure pathways. Facilities that pose short-term radiological and/or chemical hazards to uninvolved workers and the offsite public are presented in Table 5.3-22.

For purposes of this facility disposition accident analysis, HLW facilities that have only "groundwater pathways" for hazardous material releases were not assessed for potential impacts to uninvolved workers and the offsite public. Groundwater is not considered a viable short-term pathway for the following reasons. Facility disposition accident releases to the groundwater pathway are remediable and would not be expected to produce a short-term health impact to the public. Groundwater impacts are presented in potential Section 5.2.14, Facility Accidents, only when the potential consequence of an accident is so great that the cost of remediation was intractable and had to be assessed. Also, due to limitations on hazardous material inventory, accessibility, and available energy for release, the possibility of such large events can be categorically eliminated or least assumed to be bounded by the facility accidents already considered. Any long-term impacts via groundwater exposure pathways are addressed in Section 5.3.8.

During INTEC-wide operations, the bounding release scenario for hazardous chemicals with the greatest potential consequences to uninvolved workers and the offsite public is a catastrophic failure of a 3,000-gallon ammonia tank. (See Accident Analysis 15 in "Accidents with the Potential Release of Toxic Chemicals" in Appendix C.4). As discussed in Section 5.2.14, this scenario results in ammonia releases greater than ERPG-2 concentrations at 3,600 meters. Here "exposures to airborne concentrations greater than ERPG-2 values for a period greater than 1 hour results in an unacceptable likelihood that a person would experience or develop irreversible or other serious health effects or symptoms that could impact a person's ability to take protective action." This accident scenario also bounds potential chemical releases for the facility disposition analysis cases summarized in Section 5.3.12.4.

5.3.12.2 Facility Disposition Alternatives

The three facility disposition alternatives considered by DOE and included in this analysis are defined below. (Subsequent use of the Tank Farm and bin sets for disposal of the low-level waste Class A or C type grout is not included here because accidents associated with this activity were addressed in Section 5.2.14.)

Clean Closure

Hazardous wastes and radiological and chemical contaminants, including contaminated equipment, would be removed from the facility or treated so that residual radiological and chemical contamination is indistinguishable from background concentrations. Clean Closure may require total dismantlement and removal of facilities. Use of facilities (or the facility sites) after clean closure would present no risk to workers or the public from radiological or chemical hazards.

Performance-Based Closure

Closure methods would be dictated on a case-by-case basis depending on risk. For radiological and chemical hazards, performance-based closure would be in accordance with risk-based criteria. The facilities would be decontaminated such that residual waste and contaminants no longer pose any unacceptable exposure (or risk) to workers or to the public. Post-closure monitoring may be required on a case-by-case basis.

Closure to Landfill Standards

The facility would be closed in accordance with state and Federal requirements for closure of landfills. Closure to Landfill Standards is intended to protect the health and safety of the workers and the public from releases of contaminants from the facility. Depending on the type of contaminants, this could be accomplished by installing an engineered cap, establishing a groundwater monitoring system, and providing post-closure monitoring and care of the waste containment system.

5.3.12.3 Analysis Methodology for Noninvolved Workers and the Offsite Public

Risks to uninvolved workers and the public from nuclear facility accidents are evaluated as part of an ongoing safety management process during nuclear facility operations. In the DOE safety management process, documents such as safety analysis reports are used to identify risks as well as risk mitigation measures that result in an acceptable level of safety assurance for facility operations. However, facility shutdown, decontamination, and dispositioning activities could pose additional risks to uninvolved workers and the public that do not exist during facility operations (for example by removing or compromising the integrity of barriers to the release of radioactive materials). The potential for such risks is identified as part of the EIS, and could present a basis for discriminating among facility disposition alternatives. A facility disposition accident analysis was performed to identify the potential for shutdown, decontamination and dispositioning activities to pose risks that are not enveloped by the standard safety assurance process.

The disposition accident analysis team performed a systematic review of available data from applicable INTEC safety analysis reports, safety reviews, HLW facility closure studies, and EIS technical data that were generated for Section 5.2.14, Facility Accidents. The maximum plausible accident scenario selected for the HLW facilities with airborne release and direct exposure pathways is compared to a bounding accident scenario that was postulated during normal facility operations in safety analysis reports or in Section 5.2.14 of this EIS.

Facility shutdown, decontamination, and disposition activities are not well defined at this time. The methodology used to evaluate facility disposition activities is intended to provide a comparison between bounding accident scenarios that could occur during facility disposition and those that could occur during facility operation. For each facility considered in the facility disposition alternatives, a maximum plausible accident scenario was identified using a systematic qualitative review process and compared with the maximum credible accident identified for facility operations from the safety assurance documents. The specific steps in this systematic evaluation process are described below, while the results of the qualitative accident scenario comparison are give in Table 5.3-23.

Facility Description

The analysis team collected and reviewed facility descriptions that were obtained from current EIS alternative treatment studies, EIS facility closure studies, INTEC reports and studies, LMITCO feasibility studies, and previous DOE HLW studies. The facility description reviews focused on the facility's operational function; primary activities; location at INTEC; structural materials; type of equipment and process lines; shielding provisions; heating, ventilation, and air conditioning systems; material inventories; and other factors pertinent to potential facility disposition accidents. Particular attention was placed on structure design and materials that could impact the safe, efficient, and complete removal of radioactive and hazardous materials.

Facility Disposition Condition

The DOE process identified three types of facility closures appropriate for HLW facility disposition: Clean Closure, Performance-Based Closure, and Closure to Landfill Standards. For the INTEC Tank Farm and bin sets, which would contain most of the residual radioactivity, all three facility disposition alternatives are under active consideration and were evaluated accordingly. A single facility disposition alternative

Table 5.3-23. Summary of facility disposition accidents potentially impacting noninvolved workers or the offsite public.

Facility number	Facility title	Clean closure	Performance	Landfill Stds	Material at risk at closure	Contaminant mobility at closure	Energy for accident at closure	Maximum plausible accident	Bounding operations accident
CPP-713	Vault for Tanks VES-WM-187, 188, 189, and 190	●	●	●	Low levels of radioactive and hazardous material	Low mobility ensured by pipe capping and filling the tanks with LLW Class C type grout or clean fill material	Low energy sources during MTRU waste (SBW) retrieval, removal of combustible materials, and routine decontamination	Rupture or break in the transfer lines during MTRU waste (SBW) retrieval operations	Flood-induced failure of bin sets, the design basis event for calcine storage in No Action and Continued Current Operations Alternatives
CPP-780 through CPP-786	Vaults for Tanks VES-WM-180-186	●	●	●	Low levels of radioactive and hazardous material	Low mobility ensured by pipe capping and filling the tanks with LLW Class C type grout or clean fill material	Low energy sources during MTRU waste (SBW) retrieval, removal of combustible materials, and routine decontamination	Rupture or break in the transfer lines during MTRU waste (SBW) retrieval operations	Flood-induced failure of bin sets, the design basis event for calcine storage in No Action and Continued Current Operations Alternatives
CPP-729, 742, 746, 760, 765, 791, and 795	Bin sets 1 through 7	●	●	●	Low levels of radioactive and hazardous material	Low mobility ensured by pipe capping and filling the bin sets with LLW Class C type grout or clean fill material	Low energy sources during Calcine Retrieval and Transport Project, removal of combustible materials, and routine decontamination	Rupture or break in the calcine transfer lines during Calcine Retrieval and Transport operations	Flood-induced failure of bin sets, the design basis event for calcine storage in No Action and Continued Current Operations Alternatives
CPP-604	Waste Treatment Building			●	Low levels of radioactive and hazardous material residue after cease-use removal activities	Low mobility potential for contaminants affixed to surfaces or trapped in inaccessible locations	Low energy sources due to routine closure activities and removal of combustible materials	Accidental fire during demolition activities could release contaminants beyond the working area	Criticality event releasing significant radioactivity to the atmosphere
CPP-605	Blower Building			●	Low levels of radioactive and hazardous material residue after cease-use removal activities	Low mobility potential for contaminants affixed to surfaces or trapped in inaccessible locations	Low energy sources due to routine closure activities and removal of combustible materials	Accidental fire during demolition activities could release contaminants beyond the working area	Chemical release due to ammonia gas explosion in the former NO^x Pilot Plant during New Waste Calcining Facility testing
CPP-708	Main Stack			●	Low levels of radioactive and hazardous material	Low mobility potential for contaminants affixed to surfaces or trapped in inaccessible locations	Low energy sources due to gradual disassembly of stack	Accidental drop of stack segment during disassembly	Main stack toppled westward by earthquake, crushing CPP-756 prefilters and CPP-604 off-gas filter

Table 5.3-23. Summary of facility disposition accidents potentially impacting noninvolved workers or the offsite public (continued).

Facility number	Facility title	Clean closure	Performance	Landfill Stds	Material at risk at closure	Contaminant mobility at closure	Energy for accident at closure	Maximum plausible accident	Bounding operations accident
CPP-756 and 649	Prefilter Vault and Atmospheric Protection System Building			●	Low levels of radioactive and hazardous material residue after cease-use removal activities	Low mobility ensured by pipe capping and installation of a site protective cover during closure activities	Low energy sources due to routine closure activities and removal of combustible materials	Accidental fire during demolition activities could release contaminants beyond the working area	Fire that begins in prefilters and spreads to all 104 final HEPA filters, releasing radioactivity to the atmosphere
CPP-1618	Liquid Effluent Treatment & Disposal Building	●			Low levels of radioactive and hazardous material residue after cease-use removal activities	Low mobility potential for contaminants affixed to surfaces or trapped in inaccessible locations	Low energy sources due to routine closure activities and removal of combustible materials	Accidental fire during demolition activities could release contaminants beyond the working area	Explosion in fractionator releasing radioactivity to the atmosphere
CPP-601	Fuel Processing Building		●	●	Low levels of radioactive and hazardous material residue after cease-use removal activities	Low mobility potential for contaminants affixed to surfaces or trapped in inaccessible locations	Low energy sources due to routine closure activities and removal of combustible materials	Accidental fire during demolition activities could release contaminants beyond the working area	Criticality event releasing significant radioactivity to the atmosphere
CPP-627	Remote Analytical Facility		●	●	Low levels of radioactive and hazardous material residue after cease-use removal activities	Low mobility potential for contaminants affixed to surfaces or trapped in inaccessible locations	Low energy sources due to routine closure activities and removal of combustible materials	Accidental fire during demolition activities could release contaminants beyond the working area	Radionuclide spill in the CPP-627 cave; classified as an abnormal event
CPP-640	Head End Process Plant		●	●	Low levels of radioactive and hazardous material residue after cease-use removal activities	Low mobility potential for contaminants affixed to surfaces or trapped in inaccessible locations	Low energy sources due to routine closure activities and removal of combustible materials	Accidental fire during demolition activities could release contaminants beyond the working area	Transfer cask criticality initiated by addition of water moderator to 24 Rover fuel tubes
CPP-659	New Waste Calcining Facility		●	●	Low levels of radioactive and hazardous material residue after cease-use removal activities	Low mobility potential for contaminants affixed to surfaces or trapped in inaccessible locations	Low energy sources due to routine closure activities and removal of combustible materials	Crane drops or equipment malfunctions during decontamination or demolition activities	Flood-induced failure of bin sets, the design basis event for calcine storage in No Action and Continued Current Operations Alternatives

Table 5.3-23. Summary of facility disposition accidents potentially impacting noninvolved workers or the offsite public (continued).

Facility number	Facility title	Clean closure	Performance	Landfill Stds	Material at risk at closure	Contaminant mobility at closure	Energy for accident at closure	Maximum plausible accident	Bounding operations accident
CPP-666 and 767	Fluorinel and Storage Facility and Stack	●	●		Low levels of radioactive and hazardous material residue after cease-use removal activities	Low mobility potential for contaminants affixed to surfaces or trapped in inaccessible locations	Low energy sources due to routine closure activities and removal of combustible materials	Accidental fire during demolition activities could release contaminants beyond the working area	Criticality event in Spent Nuclear Fuel Storage Area
CPP-684	Remote Analytical Laboratory		●		Low levels of radioactive and hazardous material residue after cease-use removal activities	Low mobility potential for contaminants affixed to surfaces or trapped in inaccessible locations	Low energy sources due to routine closure activities and removal of combustible materials	High winds disperse residual contaminants freed during routine demolition activities	Failure of CPP-684 containment releasing entire contents of Analytical Cell

LLW = low-level waste; MTRU = mixed transuranic was considered for the remaining INTEC facilities, except for the Fuel Processing Complex (CPP-601/627/640) and the New Waste Calcining Facility where two facility disposition alternatives were evaluated. The material inventories associated with these facilities would be much less than that of the Tank Farm and bin sets. Therefore, the overall residual risk from closure of INTEC HLW facilities would not change significantly due to the contribution of a potential accident for these facilities. Also, the type of closure is considered when the analyst is estimating the critical factors bearing on a bounding accident: material at risk, energy, and mobility.

Material at Risk at Closure

The severity or eventual consequences of any potential facility disposition accident is directly proportional to the type, quantity, and potential energy of material at risk and the resultant source term. For this analysis, it is assumed that the most of the materials at risk would be removed during the facility cease-use period prior to closure activities. However, the estimated material at risk could be much greater if significant quantities of radioactive and hazardous materials were inadvertently "left behind" in areas that are assumed to be clean.

In the case of the bin sets, the Calcine Retrieval and Transport Project along with subsequent closure activities would reduce the quantities of material at risk by nearly two orders of magnitude below normal operation levels. This significant reduction in material inventory during facility closure activities is one of the primary assumptions that supports the selection of bounding accidents from operational scenarios to bound potential impacts of lesser closure accidents.

Contaminant Mobility at Closure

Contaminant mobility in the facility environment is a function of the type and construction of the facility, the location of the facility with respect to exposure pathways, the characterization and location of the contaminants, and the type of closure operations. These mobility factors and others were considered by the facility disposition accident analysis team in estimating the potential contaminant mobility for each type of HLW facility. In facilities where most of the residual contamination was left in tanks or internal bins or otherwise inaccessible places, the contaminant materials were deemed relatively unavailable for release and not susceptible to natural or external phenomena accident initiators.

Available Energy for Accident at Closure

As was the case for determining bounding accident scenarios during the treatment alternative operations (documented in Section 5.2.14), the accident "initiating events" considered for the facility disposition alternatives include fires, explosions, spills, nuclear criticality, natural phenomena, and external events. Internal initiators such as human error and equipment failures occur during operations that trigger the fires, explosions, and spills. Natural phenomena initiators include floods, tornadoes, and seismic events. External initiators include human-caused events during decommissioning, decontamination, closure, or an unrelated aircraft crash. Generally, the external initiators are the most probable initiators for bounding facility accidents that cause major structure damages and materials releases to the environment.

Maximum Plausible Accident at Closure

The maximum plausible accident is the largest credible accident during facility closure that could be hypothesized using available information. Determination of the maximum plausible accident provides an "accident benchmark" for the analyst to confirm that comparison with a "bounding operations accident for facility operations" results in greater consequences than the postulated maximum plausible facility disposition accident. Also, it is worthwhile to address any possible accident scenarios during closure because the review process may highlight the need for additional safety procedures or equipment to be considered in future safety analysis reports.

5.3.12.4 Facility Disposition Accident Summary for Noninvolved Workers and the Offsite Public

Table 5.3-23 summarizes the basis for identifying the maximum plausible accident scenarios during facility disposition and comparing them with the maximum credible accidents during facility operation. In each comparison, the potential for release is substantially smaller during facility disposition than it is during facility operation (typically several orders of magnitude smaller). The comparisons in Table 5.3-23 indicate that inventories of radioactive and chemically hazardous materials that would be available at the time facilities are turned over for disposition are typically a small percentage of those present during facility operation. In addition, materials present during facility disposition are typically not in a highly releasable form, and there are very limited energy sources such as elevated temperatures and pressures that would support release and dispersion of radioactive materials.

Conversely, normal mitigation systems (e.g. lighting, fire protection) may not be available during facility disposition activities, and there may be an increased potential for worker exposure to radiological and chemically hazardous materials (for example, during removal of piping and tanks in and around facilities). The data in Table 5.3-23 indicate that, while facility disposition activities may compromise designed safety features to control the release of radioactive materials, it is unlikely that facility disposition risks would exceed those that exist during facility operations. It can be concluded from the facilities disposition evaluation that facility disposition accidents do not pose a significant threat of health impacts to uninvolved workers or the public and do not provide a discriminator among facility disposition alternatives.

5.3.12.5 Impact of Facility Disposition Accidents on Involved Workers

During implementation of facility disposition alternatives, involved workers may incur health effects from several sources, particularly during physically intensive disposition phases, such as decontamination and demolition. Hazards to involved workers are posed by industrial accidents (e.g., falls from ladders) from increased occupational dosage as a result of accidental exposure to radiological and chemical contamination and from any radiological and chemical release accidents during disposition that impact involved workers but not uninvolved workers or the public. Specific hazards and their associated risks to involved workers will vary among facilities and the facility disposition alternatives selected for them. In general, Clean Closure requires more interaction between workers and hazards than Performance-Based Closure, while a Closure to Landfill Standards requires the least interaction.

Table 5.3-24 presents the analysis results for industrial impacts to involved workers based on facility closure alternative. The analysis methodology is detailed in Appendix C.4, but the basic assumption is that involved worker risk is directly proportional to the total worker hours for disposition of each facility. Estimated total worker hours were multiplied by average hazard incident rates from DOE and U.S. Government records described in Appendix C.4. These DOE rates are 6.2 injuries and illnesses and 0.011 fatalities per 200,000 hours; the private rates are 13.0 and 0.034 respectively. This methodology is generally in agreement with Section 5.3.8; however, this analysis distinguishes worker fatalities from injuries, rather than combining them as OSHA-recordable cases. This analysis further uses a construction injury rate that reflects historical incidents both to Management and Operating Contractor employees and to construction subcontractor employees.

Thus, to determine the total incidents by facility disposition alternative in Table 5.3-24, the average DOE-Private Industry rates of 9.6

injuries/illnesses and 0.23 fatalities per 200,000 hours were used. Note that "Other Facilities" incidents consist of the sum of the incidents for all the facilities except the Tank Farm and the bin sets, i.e. Tank Farm Related Facilities, bin set Related Facilities, Process Equipment Waste Evaporator and Related Facilities, Fuel Processing Building. and Related Facilities, FAST/FAST Stack, New Waste Calcining Facility, and Remote Analytical Laboratory. Since data for all three facility disposition alternatives were not available for all the Other Facilities, the total man-hours were assumed to be the same for all three facility disposition alternatives in the table. This assumption, that the incident data will be the same order of magnitude for all facility disposition alternatives, is considered conservative and will have no significant impact on the trend of the "Total Incidents" and the conclusion that Clean Closure has the most incidents.

Table 5.3-24 reveals significant differences among closure options for the Tank Farm and bin sets. (Labor estimates are not consistently available for all options being considered for the other facilities.) Clean Closure has by far the greatest number of injuries/illnesses and fatalities, while the Performance-Based Closure Alternative has fewer incidents, and the Closure to Landfill Standards Alternative has the least estimated incidents.

Appendix C.4 calculates exposure to involved workers using estimated radiation worker labor and exposure rates in facility closure studies and engineering design files. Results indicate that the greatest negative impacts to involved workers are predicted for Clean Closure, followed by Performance-Based Clean Closure, and then by Closure to Landfill Standards. As with industrial accidents, Clean Closure is estimated to result in significantly higher impacts than the other two disposition impacts. Appendix C.4 does not provide quantitative estimates of involved worker risk from chemical hazards, but it suggests that chemical impacts likely will follow the same trend as found for industrial and radiological hazards.

Table 5.3-24. Industrial hazards impacts during disposition of existing HLW facility groups using "average DOE-private industry incident rates (per 200,000 hours)."

	Clean Closure		Performance-Based Closure		Closure to Landfill Standards	
Facility groups	Injuries/ illnesses	Fatalities	Injuries/ illnesses	Fatalities	Injuries/ illnesses	Fatalities
Tank Farm	750	1.8	30	0.07	16	0.04
Bin sets	130	0.32	100	0.24	48	0.11
Other facilities	150	0.33	150	0.33	150	0.33
Total incidents	1000	2.4	280	0.64	210	0.48

5.4 Cumulative Impacts

Cumulative impacts result "from the incremental impact of an action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or nonfederal) or person undertakes such actions. Cumulative impacts can result from individually minor, but collectively significant actions taking place over a period of time" (40 CFR 1508.7). These actions include on- or off-site projects conducted by government agencies, businesses, or individuals that are within the spatial and temporal boundaries (project impact zone) of the actions considered in this EIS.

5.4.1 METHODOLOGY

Unless otherwise noted, this analysis considers impacts that could occur over the defined EIS timeframe (2000-2095). This timeframe includes the period required for completion of activities evaluated in this EIS, along with an assumed period of institutional control of lands and resources. The methodology used to analyze the potential for impacts from alternatives evaluated in this EIS that could contribute to a cumulative impact on a regional resource involved the following process:

1. An appropriate Region of Influence for impacts associated with projects analyzed in this EIS was defined.

2. The affected environment or baseline conditions were identified.

3. Past, present, and reasonably foreseeable actions and the effects of those actions were identified.

4. Aggregate effects of these past, present, and reasonably foreseeable actions were assessed (totaled, etc.).

The Idaho HLW & FD EIS is tiered from the SNF & INEL EIS. Volume 2, Part A of the SNF & INEL EIS was concerned with the selection of facilities and technologies for the management of spent nuclear fuel and radioactive wastes at INEEL, including the mixed transuranic waste (SBW) and HLW that are the focus of this EIS. Anticipated future INEEL projects, including remediation of contaminated sites at INEEL, were derived from, and previously analyzed in the SNF & INEL EIS (DOE 1995). The Record of Decision for that EIS provided the scope and timetable for spent nuclear fuel management and environmental restoration activities to be included in the cumulative impact analysis of this EIS. Additional actions that have been undertaken or proposed subsequent to the issuance of that Record of Decision were identified and included in the cumulative impact analysis of this EIS.

Modeling data were extracted from the SNF & INEL EIS via the INEL Spent Nuclear Fuel and Waste Engineering Systems comprehensive model (Hendrickson 1995). This systems model included all spent nuclear fuel, HLW, transuranic waste, low-level waste, mixed low-level waste, hazardous waste, and industrial waste activities. The model was based on planned treatment, storage, and disposal activities at the INEEL, EIS project summaries, and operating parameters of existing facilities. The start dates, construction period, operating periods, treatment rates, storage capacities, environmental effects, waste generation rates, and waste treatment, storage, and disposal activities for applicable EIS projects were based on data from the SNF & INEL EIS. Treatment, storage, and disposal activities, treatment rates, storage capacities, and waste generation rates of the existing facilities were based on the operating data of the individual facilities as supplied by DOE and the facility operators. This model was updated to reflect projects that were included in the SNF & INEL EIS Record of Decision and other projects that occurred subsequent to the EIS (Jason 1998). In this analysis, data extracted from the updated model were used to project a baseline for impacts to air resources and generation of low-level waste, mixed low-level waste, hazardous waste, and industrial waste over a timeframe encompassing the time required for completion of the alternatives analyzed in this EIS. Anticipated projects that were included in the baseline are identified in Table 5.4-1. The contribution of each Idaho HLW & FD EIS alternative and option to these INEEL waste streams was obtained from project data sheets. Anticipated quantities of these waste streams from the INEEL baseline and Idaho HLW & FD EIS were combined and depicted graphically to provide a visual representation of cumulative waste quantities over time (see Section 5.4.3.10).

Section 5.4.2 identifies past, present, and reasonably foreseeable actions that were included in the cumulative impact analysis. Other actions that were not included in the analysis because of the speculative nature of the action are also identified in Section 5.4.2. Subsequent sections present cumulative impact analysis by resource.

5.4.2 IDENTIFICATION OF PAST, PRESENT, AND REASONABLY FORESEEABLE ACTIONS

The project impact zones of past, present, and reasonably foreseeable on- and off-site actions that could result in a cumulative impact were identified by reviewing DOE proposed and anticipated future actions on the INEEL and by contacting other Federal and state agencies. Actions that were determined to have environmental impacts that would overlap in time and space with potential impacts from the actions evaluated in this EIS were included in the analysis. The City of Idaho Falls, the State of Idaho Department of Environmental Quality, and the Bureau of Land Management were contacted for information regarding anticipated future activities that could contribute to a cumulative impact on a particular resource within the Region of

Table 5.4-1. Projects included in the environmental baseline for analyses of cumulative impacts.

Borrow Source Silt Clay	Non Incinerable Mixed Waste Treatment
Calcine Transfer Project	Partnership Natural Disaster Reduction Test Station
Central Liquid Waste Processing Facility D&D	Pit 9 Retrieval
Dry Fuels Storage Facility	Private Sector Alpha-MLLW Treatment
EA Determination for CPP-627	Radioactive Scrap/Waste Facility
EBR-II Blanket Treatment	Remediation of Groundwater Facilities
EBR-II Plant Closure	Remote Mixed Waste Treatment Facility
ECF Dry Cell Project	RESL Replacement
Engineering Test Reactor D&D	RWMC Modifications for Private Sector Treatment of Alpha-MLLW
Fuel Processing Complex (CPP-601) D&D	Sodium Processing Plant
Fuel Receiving, Canning, Characterization & Shipping	TAN Pool Fuel Transfer
Gravel Pit Expansions (New Borrow Source)	Tank Farm Heel Removal Project
GTCC Dedicated Storage	Treatment of Alpha-MLLW
Headend Processing Plant (CPP-640) D&D	TSA Enclosure and Storage Project
Health Physics Instrument Lab	Vadose Zone Remediation
High Level Tank Farm Replacement (upgrade phase)	Waste Calcine Facility (CPP-633) D&D
Increased Rack Capacity for CPP-666	Waste Characterization Facility
Industrial/Commercial Landfill Expansion	Waste Handling Facility
Material Test Reactor D&D	Waste Immobilization Facility
Mixed/LLW Disposal Facility	WERF Incineration

Influence. Past, present, and reasonably foreseeable on- and off-site actions that were identified and included in the cumulative impact analysis are presented in Table 5.4-2.

Onsite actions that could potentially have overlapping or connected impacts with waste processing activities include the Advanced Mixed Waste Treatment Project, remedial activities at INTEC Waste Area Group 3 (WAG 3), excavation of silt/clay borrow sources, deactivation of obsolete nuclear facilities, and replacement of INTEC percolation ponds. Impacts associated with Advanced Mixed Waste Treatment Project have been analyzed in detail and are presented in the *U.S. Department of Energy Idaho National Engineering and Environmental Laboratory Advanced Mixed Waste Treatment Project Draft Environmental Impact Statement* (AMWTP EIS) (DOE 1999a). The SNF & INEL EIS analyzed potential environmental impacts associated with remediation of contaminated sites at INEEL, including INTEC, which are included in the analysis of this EIS. Excavation of silt/clay materials for use in INEEL operations and remedial activities was evaluated in this EIS because these materials may be required to support facility disposition activities at INTEC, including the disposition of obsolete nuclear facilities. Furthermore, residual contamination left in place from WAG 3 activities would contribute to the source for long-term risks associated with INTEC. DOE has chosen to remediate contaminated perched water at WAG 3 using institutional controls with aquifer recharge control (DOE 1999b). This will entail (1) restricting future use of contaminated perched water and future recharge to contaminated perched water and (2) taking the existing INTEC percolation ponds out of service and replacing them with new ponds built outside of the zone influencing perched water contaminant transport. As a consequence, development of new percolation ponds is included in this cumulative impact assessment.

The only identified offsite activity that is reasonably foreseeable within the timeframe of the actions evaluated in this EIS involves a proposed quartzite mine. If implemented, this mine could contribute to a cumulative impact to land resources on the INEEL. Retail development in the communities surrounding INEEL will con-

Table 5.4-2. Onsite and offsite actions included in the assessment of cumulative impacts.

Project	Description
Onsite	
SNF & INEL EIS	The SNF & INEL EIS provided the scope and timetable for spent nuclear fuel and environmental restoration activities to be included in the cumulative impact analysis of this EIS.
Advanced Mixed Waste Treatment Project[a]	Retrieve, sort, characterize, and treat mixed low-level waste and approximately 65,000 cubic meters of alpha-contaminated mixed low-level waste and transuranic waste currently stored at the INEEL Radioactive Waste Management Complex. Package the treated waste for shipment offsite for disposal.
WAG 3 Remediation[a]	Ongoing activities addressing remediation of past releases of contaminants at INTEC.
New silt/clay source development and use at the INEEL.	INEEL activities require silt/clay for construction of soil caps over contaminated sites, research sites, and landfills; replacement of radioactivity contaminated soil with topsoil for revegetation and backfill; sealing of sewage lagoons; and other uses. Silt/clay will be mined from three onsite sources (ryegrass flats, spreading area A, and WRRTF) (DOE 1997a).
Closure of various INTEC facilities unrelated to Idaho HLW&FD EIS Alternatives	Reduce the risk of radioactive exposure and release of hazardous constituents and eliminate the need for extensive long-term surveillance and maintenance for obsolete facilities at INTEC. Facilities included in the cumulative impact analysis are identified in Table 5.4-4.
Percolation Pond Replacement	DOE intends to replace the existing percolation ponds at the INTEC with replacement ponds located approximately 10,200 feet southwest of the existing percolation ponds (DOE 1999b).
Draft EIS for the Treatment and Management of Sodium-Bonded Spent Nuclear Fuel (DOE/EIS-0306D)	This Draft EIS analyzes alternatives for the treatment and management of sodium bonded spent nuclear fuel at Argonne National Laboratory-West (ANL-W) located on the INEEL. Under some alternatives the sodium bonded SNF would be treated at ANL-W using an electrometallurgical process. This process was addressed in the SNF & INEL EIS (Experimental Breeder Reactor-II Blanket Treatment at Appendix C-4.1.7, and Electrometallurgical Process Demonstration at Appendix C-4.1.8). These actions are included in the projects that make up the environmental baseline for this EIS.
Offsite	
System Integration Corporation Arco Hills Quartzite Mine	Quartzite mining and ore processing operation near Arco Hills on 56 acres (47 acres on BLM lands and 9 acres on INEEL land). Fourteen acres would be disturbed by the quarry operation and a small waste ore dump; 22 acres would be disturbed by the construction of a haul road; 11 acres would be disturbed by the ore crushing facilities; and 9 acres would be disturbed by the loading facilities on the INEEL. The project would employ 40 workers.

a. Included in the baseline conditions identified in the SNF & INEL EIS.

tinue to expand and could contribute to regional socioeconomic impacts. Expansion or reduction of regional retail trade would be controlled by market conditions unrelated to the actions evaluated in this EIS. Furthermore, DOE is likely to continue pursuing new missions and actions on INEEL. Environmental impacts from any new missions will be considered in subsequent NEPA reviews specific to those actions.

Other future projects that were identified but not considered in the cumulative impact analysis because of the speculative nature of the projects or lack of sufficient detail on potential environmental impacts include:

1. DOE, in conjunction with the Federal Emergency Management Administration, may pursue an environmental test facility to evaluate the effects of wind on structures. Bench scale tests are in progress at the INEEL and appropriate NEPA review will be conducted if a full-scale facility were proposed for construction at the INEEL. This action was considered speculative, and potential environmental impacts were not included in this analysis.

2. A site for a spaceport has been proposed for development on 44 square miles (approximately 28,000 acres) within the boundaries of INEEL. Much of the land reserved for the spaceport would consist of an undeveloped buffer zone around the launch pads and runway. As proposed, the Idaho Spaceport would utilize current utilities and services at required levels with the exception of natural gas, which would be supplied by rail. Water usage required for spaceport operations would increase the total INEEL withdrawal by less than 135,000 gallons per day, an increase of 3 percent. This spaceport is expected to require a workforce of 2,000 following initial spaceport construction. Potential environmental impacts from the project will be evaluated in an EIS prepared by the Federal Aviation Administration (lead agency) in support of issuance of a launch license. DOE will be a cooperating agency on the EIS.

3. A proposal to develop a hog-farming operation involving up to 250,000 sows is being considered by Sawtooth Farms. This operation could use up to 4,700 acres of land at a site adjacent to the INEEL. If implemented, this hog-raising operation would employ as many as 1,000 individuals. A formal proposal has not been issued and several prospective sites are being considered; therefore, this project was not included in the cumulative impact analysis.

4. DOE has announced (FR 64 FR 50064, September 15, 1999) its intent to prepare a programmatic environmental impact statement that will examine the enhancement of the nation's nuclear research and technology infrastructure to ensure a reliable supply of radioisotopes for medicine, industry, research, and space exploration. One of the alternatives under consideration would involve use of the Advanced Test Reactor at the INEEL to irradiate targets fabricated from neptunium-237 to produce up to 5 kilograms per year of plutonium-238. The radioactive waste by-product from processing the neptunium-237 targets would probably be managed as transuranic waste but could be managed as HLW. The Advanced Test Reactor is an operating test reactor with a primary programmatic mission to support the Naval Reactor Fuels Program. Because data on potential impacts are very preliminary, this project was not included in the cumulative impact analysis.

Table 5.4-3 presents waste processing impacts from each Idaho HLW & FD EIS alternative. The maximum impact from the Idaho HLW & FD EIS waste processing and facilities disposition alternatives, and other past, present, and reasonably foreseeable projects evaluated in this EIS are presented in Table 5.4-4. Table 5.4-5 lists INTEC facilities unrelated to Idaho HLW alternatives that are planned for closure over approximately the same timeframe as the waste processing and facility disposition activities evaluated in this EIS. The impacts from these unrelated facility closures are included in the cumulative evaluation in Table 5.4-4.

Table 5.4-3. Waste processing impacts from each Idaho HLW & FD EIS alternative.

Resource area	No Action Alternative	Continued Current Operations	Separations Alternative: Full Separations Option	Separations Alternative: Planning Basis Option	Separations Alternative: Transuranic Separations Options	Non-Separations Alternative: Hot Isostatic Pressed Waste Option	Non-Separations Alternative: Direct Cement Waste Option	Non-Separations Alternative: Early Vitrification Option	Minimal INEEL Processing at INEEL
Land resources	None	None	Conversion of 22 acres to industrial use	None	Conversion of 22 acres to industrial use	None	None	None	Conversion of 22 acres to industrial use
Cultural resources	None	None	Minimal visual degradation through 2035	Minimal visual degradation through 2035	Minimal visual degradation through 2035	Temporary visual degradation	Temporary visual degradation	Temporary visual degradation	Temporary visual degradation
Air resources	Consumption of up to 39 percent of increment	Consumption of up to 43 percent of increment	Consumption of up to 47 percent of increment	Consumption of up to 53 percent of increment	Consumption of up to 44 percent of increment	Consumption of up to 44 percent of increment	Consumption of up to 44 percent of increment	Consumption of up to 40 percent of increment	Consumption of up to 39 percent of increment
Water resources[a]									
Construction	0.2	0.9	6.7	7.2	4.9	3.3	3.7	2.8	3.2
Operations	15.4	64.7	9.0	74.8	55.8	93.2	66.8	9.2	9.1
Ecological resources	None	None	Loss of 22 acres of habitat	None	Loss of 22 acres of habitat	None	None	None	Loss of 22 acres of habitat
Waste management[b]									
Industrial									
Construction	1,400	6,800	55,000	59,700	39,100	25,800	29,900	23,100	26,100
Operations	13,900	19,200	52,700	52,300	43,200	43,200	50,400	41,700	34,700
Hazardous									
Construction	0	30	790	880	280	790	560	640	340
Operations	0	0	1,600	1,200	960	4	4	4	40
Mixed low-level waste									
Construction	220	240	1,100	1,100	1,100	1,100	1,100	1,100	1,100
Operations	1,300	3,200	5,900	7,900	5,300	6,400	8,600	6,000	5,700
Low-level waste									
Construction	0	20	330	210	210	260	340	310	110
Operations	190	9,500	1,200	10,200	960	10,000	10,000	750	700
Socioeconomics[c]									
Construction									
Direct	20	90	850	870	680	360	400	330	200
Indirect	20	90	880	900	700	370	420	340	210
Year of peak	2005	2008	2013	2013	2012	2008	2008	2008	2008
Operations									
Direct	130	280	440	480	320	460	530	330	330
Indirect	230	500	790	860	570	820	930	590	590
Year of peak	2015	2015	2018	2015	2015	2015	2015	2015	2018

a. Million gallons per year.
b. Total waste volumes in cubic meters.
c. Peak employment.

Table 5.4-4. Maximum impact from Idaho HLW & FD EIS alternatives and other past, present, and reasonably foreseeable projects evaluated in this EIS. (Health & Safety and Transportation impacts are addressed in applicable sections.)

Resource area	Idaho HLW & FD EIS: Waste Processing	Idaho HLW & FD EIS: Facility Disposition	SNF & INEL EIS (inclusive of WAG 3 and AMWTP) (DOE 1995)	New silt/clay source development and use at the INEEL	Disposition of unrelated INTEC facilities	Percolation pond replacement	Systems Integration Corp. Arco Hills Quartzite Mine
Land resources/acres disturbed	22 acres[a]	None	1,346 acres[b]	21 acres and 24 acres per year[c]	None	10-15 acres	56 acres[d]
Socioeconomics	Direct employment of 870 during construction and 530 during operations	Direct employment of 914	Overall decrease in employment	None/use of existing workforce	Small numbers of workers drawn from existing labor pool	None/use of existing workforce	Increase of 40 jobs
Air resources	Consumption of up to 53 percent of PSD increment/no health based standards exceeded	No health based standards exceeded	Below applicable standards	Short-term elevated levels of fugitive dust and exhaust emissions	Emissions of fugitive dust/ vehicle exhaust during demolition activities	Temporary emissions of fugitive dust and vehicular exhaust during construction activities	Negligible
Water resources groundwater withdrawal and contamination	93.2 million gallons per year negligible	Increase of 12.4 million gallons per year/cancer risk of 2.5×10^{-5} from facility disposition.	Increase of 83.2 million gallons per year[e]/cancer risk of 5×10^{-5}	Negligible	Within existing water use/cancer risk of 2×10^{-6} from closure of CPP-633	Relocation of ponds reduces potential for contaminant migration	2,000 gallons per day - 200 work days per year/ negligible
Ecological resources/ acreage loss	22 acres[a]	None	1,346 acres[b]	21 acres and 24 acres per year[c]	None	10-15 acres	56 acres[d]
Geology and soils	Negligible (use of existing onsite sources)	Negligible (use of existing onsite sources)	1,772,000 m^3	4,600,000 m^3 as a silt/clay source	Materials obtained from existing INEEL sources	Soil disturbance on up to 15 acres	Soils disturbed on up to 56 acres/ extraction of mineral resources
Cultural resources	Negligible	Potential for loss of historic data on nuclear facilities	70 structures and 23 sites impacted[f]	No significant resources identified in surveys of 40-acre plots at each onsite location	Potential for loss of historic data on nuclear facilities	Surveys will be conducted/resources avoided	Surveyed/no significant resources revealed

a. 22 acres of previously disturbed land adjacent to INTEC.
b. SNF & INEL EIS involves 1,339 acres, plus 7 acres impacted as a result of AMWTP.
c. Represents temporary disturbance; rehabilitation of disturbed acres will occur annually.
d. 47 acres on BLM lands and 9 acres on INEEL land.
e. SNF & INEL EIS activities use 79 million gallons per year and AMWTP involves use of 4.2 million gallons per year.
f. SNF & INEL EIS impacts plus 1 additional site impacted from AMWTP.

Table 5.4-5. List of INTEC facilities subject to closure and anticipated closure action and time of closure activity.

Building	Name	Closure Action	Deactivation Activity Period	Demolition Activity Period
	Service Waste Group A			
CPP-709	Service Waste Monitoring System (Completed)	Closure to Landfill Standards	1999	1999-2000
CPP-734	Service Waste Monitoring Station for West Side (Completed)	Closure to Landfill Standards	1999	1999-2000
CPP-750	Service Waste Diversion Pump Station	Clean Closure	2035-2037	2038-2043
CPP-796	West Side Service Waste Building	Clean Closure	2035-2037	2038-2043
CPP-797	East Side Service Waste Building	Clean Closure	2035-2037	2038-2043
CPP-631	RALA Process "L" Off-Gas Blower Room (Completed)	Closure to Landfill Standards	1998-1999	2000
	Service Waste Group B			
CPP-642	Hot Waste Pump House and Pit	Clean Closure	1999	1999-2000
CPP-648	Basin Sludge Tank Control House	Clean Closure	1999-2000	2000-2002
CPP-740	Settling Basin and Dry Well (Near CPP-603)	Clean Closure	2035-2037	2038-2043
CPP-751	Service Waste Monitoring Station for CPP-601	Clean Closure	2035-2037	2038-2043
CPP-752	Service Waste Diversion Station for CPP-601	Clean Closure	2035-2037	2038-2043
CPP-753	Service Waste Monitoring Station for CPP-633	Clean Closure	2035-2037	2038-2043
CPP-754	Service Waste Diversion Station for CPP-633	Clean Closure	2035-2037	2038-2043
CPP-763	Waste Diversion Tank Vault	Clean Closure	2030-2032	2033-2037
CPP-764	SFE Hold Tank Vault	Performance-Based	1999	1999-2000
	Laboratory and Office Buildings			
CPP-602	Laboratory and Office Building	Closure to Landfill Standards	2010-2012	2015-2025
CPP-608	Storage-Butler Building (Contains Rover ash under concrete)	Clean Closure	2014-2015	2015-2025
CPP-620	Chemical Engineering High Bay Facility & HCWHNF	Clean Closure	2010-2012	2015-2025
CPP-630	Safety and Spectrometry Building	Clean Closure	2014-2015	2015-2025
CPP-663	Maintenance Building	Clean Closure	2038	2043
CPP-637	Process Improvement Facilities	Clean Closure	2038	2043
	Ponds and Service Waste Lines			
NA	Service Waste Lines (Low-Level Liquid Waste)	Clean Closure	2035-2037	2038-2043
	Miscellaneous			
NA	Overhead Pneumatic Transfer Lines	Clean Closure		
CPP-1776	Utility Tunnel System throughout Chem Plant	Clean Closure		
CPP-618	Measurement and Control Building/Tank Farm	Clean Closure	2030-2034	2034-2035
	Waste Storage Building			
CPP-1617	Waste Staging Building	Clean Closure	2037	2038-2043
CPP-1619	Hazardous Chemical/Radioactive Waste Facility	Clean Closure	2037	2038-2043
	Waste Calcining Facility			
CPP-633	Waste Calcining Facility	Closure to Landfill Standards		
	CPP 603			
CPP-603	Fuel Receiving and Storage Building	Performance-Based		

Additional INTEC facilities have been determined through the CERCLA process to require "no action" (no contaminant source) or "no further action" (no exposure route for a potential source under current site conditions). A list of these facilities is provided in the Record of Decision for Waste Area Group 3 (DOE 1999b). As a result, these facilities were not included in the cumulative impact analysis.

Impacts associated with the Hanford alternative are discussed in Appendix C.8. Actions at the Hanford Site that could result in cumulative impacts with the Minimum INEEL Processing Alternative include the Hanford Site waste management and environmental restoration programs, operation of the Environmental Restoration and Disposal Facility, the management of spent nuclear fuel, and activities at the U.S. Ecology Site. The level of activity associated with many of the Hanford Site cleanup functions would be declining by the time treatment of the INEEL waste would begin. Among the cumulative impacts that would occur are impacts to land use and biological resources, human health, transportation, and socioeconomics.

5.4.3 RESOURCE CATEGORIES INCLUDED IN THE CUMULATIVE IMPACT ANALYSIS

Analysis indicates that implementation of alternatives evaluated in this EIS would contribute incrementally to cumulative impacts on land resources, socioeconomics, air resources, water resources, ecological resources, geologic resources and soils, cultural resources, traffic and transportation, health and safety, long-term health risk, and waste management. No cumulative impacts were identified that would affect noise, aesthetic and scenic resources, or environmental justice.

5.4.3.1 Land Resources

Existing industrial development at INEEL occupies approximately 11,400 acres of the total INEEL area (569,600 acres) (DOE 1995). Advanced Mixed Waste Treatment Project activities could involve approximately 7 acres within the developed portion of INEEL Radioactive Waste Management Complex but would not require development on any undisturbed land outside of the primary facility area (DOE 1999a).

Reasonably foreseeable activities associated with remediation of INEEL contaminated sites and future projects included in the baseline (DOE 1995) would result in converting up to 1,339 acres of INEEL land to industrial use (see Table 5.4-4). This baseline estimate of land use impacts includes impacts from existing and anticipated future INEEL projects, including environmental restoration activities at the time of the analysis. Due to cancellation or modification of some projects, this baseline may overestimate the actual amount of land that would be converted to industrial use in support of the activities considered in the SNF & INEL EIS (DOE 1995).

Although impacts from development of borrow areas for gravel were considered in the SNF & INEL EIS, potential environmental impacts from excavation of fine materials were not; those impacts were evaluated in an environmental assessment issued subsequent to the SNF & INEL EIS (DOE 1997a). Excavation of silt/clay materials would lead to permanent disturbance of 21 acres for upgrading and extending existing roads. Excavation of silt/clay could lead to a temporary disturbance of 24 acres per year for a 10-year period; rehabilitation of this disturbance would occur annually. Although reclamation of these lands is anticipated, certain land uses may no longer be feasible after removal of the soil.

Replacement of the existing percolation ponds at INTEC could lead to conversion of up to 15 acres of presently undisturbed land to industrial use. DOE intends to replace the existing percolation ponds at INTEC with percolation ponds located approximately 10,200 feet southwest of the existing percolation pond (DOE 1999c). Lands associated with new percolation ponds could be reclaimed in the future and converted to other uses.

If implemented, the Systems Integration Corporation Quartzite Mine would lead to a disturbance of 56 acres on and adjacent to INEEL.

The Low Activity Waste Disposal Facility evaluated in this EIS could result in the development of approximately 22 acres of previously undisturbed land adjacent to INTEC.

Land disturbance associated with facility disposition, including facilities associated with the Idaho HLW & FD EIS alternatives and facilities identified in Table 5.4-5 would occur within the previously disturbed industrial area of the INTEC. Although disposition of these facilities would not involve development of new facilities outside of the secure perimeter fence, certain land uses within the existing industrial area would be precluded in the future.

Cumulatively, implementation of all activities would lead to converting approximately 1,400 acres of land to industrial use (primarily for waste management purposes), increasing the total disturbance to approximately 13,000 acres, which is less than 3 percent of the total INEEL land area.

A majority of the potential land disturbance (approximately 1,400 acres) would be associated with environmental restoration activities identified in the SNF & INEL EIS (DOE 1995). This disturbance would be associated with remediation of contaminated areas and would largely involve areas that have been previously disturbed, or that are contiguous with or adjacent to existing industrial facilities. Furthermore, these lands are not well suited for non-industrial (agricultural, recreational, or commercial) uses. Potential impacts to INEEL land resources from Idaho HLW & FD EIS activities would account for less than 2 percent of the total potential new development of INEEL land. Therefore, the contribution of the alternatives evaluated in this EIS to land use impacts would be small.

5.4.3.2 Socioeconomics

Table 5.4-4 presents employment impacts for each project evaluated in this EIS. Over the Idaho HLW & FD EIS timeframe, waste processing activities would sustain a maximum of 870 direct jobs during the peak year (2013) of the construction phase and a maximum of 530 direct jobs during the peak year (2015) of the operations phase. However, the timing of peak employment and the number of workers, both direct and indirect, is highly variable across all alternatives. Idaho HLW & FD EIS facility disposition activities would require direct employment of up to 914 workers. DOE anticipates that these workers would be drawn from the existing workforce through retraining and reassignment. DOE anticipates that total employment would decline and the net change in jobs associated with Idaho HLW & FD EIS alternatives would represent a continuation of current site employment that may otherwise cease. Considering that direct employment at the INEEL was approximately 11,000 workers in 1990 (DOE 1995) and that 1998 INEEL employment was approximately 8,100 workers (see Section 4.3.2), future changes in employment as a result of activities described in this EIS would be within normal INEEL workforce fluctuations.

The number of workers required for disposition of INTEC facilities that are not related to Idaho HLW & FD EIS alternatives is small, and the activities would not all occur concurrently. DOE anticipates that the work force associated with deactivation and decontamination and decommissioning of these facilities would be drawn from existing INEEL personnel and local subcontractors as necessary. Therefore, employment levels would remain within the normal short-term fluctuation in employment at the INEEL.

5.4.3.3 Air Resources

Cumulative impacts of radiological and nonradiological air emissions have been assessed for each alternative in this EIS. Radiological emission impacts at on- and off-site locations are well below applicable standards (see Table 5.4-6). The highest dose to an offsite individual from waste processing activities would be about 0.002 millirem per year (under the Continued Current Operations Alternative, Planning Basis Option, Hot Isostatic Pressed Waste Option, and Direct Cement Waste Option). The cumulative dose to the maximally exposed offsite individual would be about 0.16 millirem per year, including the dose from waste processing and the maximum baseline dose of 0.16 millirem per year. The total dose of approximately 0.16 millirem per year would be less than 2 percent of the 10 millirem per year dose limit specified in the National Emissions Standards for Hazardous Air Pollutants (40 CFR 61.92) and is a small addition to the 360 millirem dose received from natural background "sources". Approximately 1 percent of the total dose to the offsite maximally exposed individual could be attributed to the waste processing alternatives.

Summing maximum impacts from sources located in different areas (e.g., Radioactive Waste Management Complex, INTEC) and with different release parameters (e.g., stack heights) is inherently conservative since the maximum impacts from each source are likely to occur at different offsite locations.

Cumulative nonradiological air quality impacts are expressed in terms of concentrations of criteria and toxic air pollutants in ambient air and general deterioration of current air quality. Table 5.4-7 presents a comparison of recent criteria pollutant emission estimates. Analyses of SNF & INEL EIS maximum baseline concentrations are presented in Table 5.7-5 of the SNF & INEL EIS and are well within the National Ambient Air Quality Standards (DOE 1995). The highest predicted concentrations of criteria pollutants from Idaho HLW & FD EIS activities remain well below the SNF & INEL EIS maximum baseline case. Since maximum baseline concentrations are much greater than actual sitewide emissions and the total emissions from other activities evaluated in this EIS remain substantially lower, these results likely overstate the consequences that would actually occur.

Toxic air pollutants were assumed to be emitted at the maximum levels allowed under the maximum achievable control technology rule. The incremental impacts at onsite locations are well below occupational standards in all cases. The highest offsite impact from any alternative evaluated in this EIS would be for dioxins and furans, which could reach about 29 percent of the standard at, or just beyond, the INEEL boundary if emitted at levels allowed under the maximum achievable control technology rule, which is significantly less than the maximum allowable levels. Nickel concentrations are projected to reach 21 percent of the standard for that carcinogen.

The maximum consumption of Prevention of Significant Deterioration increment would occur under the Planning Basis Option. The combined effects of baseline sources, waste processing alternatives, and other planned future projects would consume 53 percent of increment at Craters of the Moon (Class I area) and 29 percent of increment at the INEEL boundary (Class II area) for sulfur dioxide, averaged over 24 hours. All other waste processing options would result in a smaller cumulative consumption of Prevention of Significant Deterioration increment (see Table 5.2-9).

5.4.3.4 Water Resources

Potential impacts to water resources would include withdrawal of water from the aquifer in support of INEEL activities and potential long-term impacts on water quality from migration of residual contaminants to the aquifer.

Water Use - Current INEEL activities use an average of 1.6 billion gallons of water from the aquifer each year (DOE 1997b). Total water consumption from reasonably foreseeable activities, including waste processing activities evaluated in this EIS, could account for an additional 188.8 million gallons per year, of which 105.6 million gallons would be associated with activities from the Idaho HLW & FD EIS (see Table 5.4-4). This anticipated use represents an increase of 12 percent of water withdrawn from the aquifer, which exhibits a small increase in

Table 5.4-6. Summary of radiation dose impacts associated with airborne radionuclide emissions.

	Maximally exposed offsite individual (millirem per year)	Noninvolved worker (millirem per year)	Population (person-rem per year)
Baseline conditions[a]	0.16	0.29	0.92
Idaho HLW & FD EIS[b]	0.002	0.0001[c]	0.10
Total	0.16	0.29	1.0
Standard	10[d]	5,000	NA[e]

a. Includes contributions from foreseeable sources including AMWTP (see Table C.2-8).
b. Maximum dose for any alternative (see Section 5.2.6.3).
c. Location of highest onsite dose is Central Facilities Area.
d. EPA dose limit specified in 40 CFR 61.92; applies to effective dose equivalent from air releases only.
e. NA = Not available. No standard has been established.

water consumption over current INEEL use. If DOE elects to recycle process wastewater at INTEC, water withdrawal in support of waste processing options would be smaller.

Water use in support of all INEEL operations, including the proposed action and reasonably foreseeable actions, would have a small effect on the quantity of water in the aquifer. Given that 470 billion gallons of water pass under the INEEL annually (Robertson et al. 1974), the maximum cumulative water use (including water withdrawn for current activities and the maximum additional withdrawal) represents less than 1 percent of the volume of water passing under INEEL.

Groundwater Contamination - Past waste disposal practices have resulted in some impacts to water resources, primarily in isolated areas within the INEEL site boundaries, including the groundwater underlying INTEC. Tritium, strontium-90, iodine-129, americium-241, cesium-137, chloride, chromium, cobalt-60, nitrate, sodium, and plutonium isotopes have been detected in the aquifer near INTEC. Some contaminant plumes, most notably tritium, strontium-90, and iodine-129, have concentrations in excess of EPA drinking water standards. Previous groundwater computer modeling of the vadose zone and saturated contaminant transport predicted that no contaminants would migrate past the present

Table 5.4-7. Comparison of recent criteria pollutant emissions estimates with the levels assessed under the maximum emissions case in the SNF & INEL EIS.

Pollutant	SNF & INEL EIS maximum baseline case (kilograms per year)[a]	Advanced Mixed Waste Treatment Project (kilograms per year)[b]	Idaho HLW&FD EIS (kilograms per year)	Actual sitewide emissions (1996) (kilograms per year)[c]	Total (kilograms per year)	Percent of baseline case
Carbon monoxide	2,200,000	2,100	26,000	155,000	183,100	8
Nitrogen dioxide	3,000,000	25,000	93,000	220,000	338,000	11
Particulate matter[d]	900,000	290	6,000	180,000	186,000	21
Sulfur dioxide	1,700,000	700	260,000	120,000	380,700	21
Lead components	68	1.9×10^{-5}	4.1	1.5	5.6	8
VOCs	not specified	480	2,900	16,000	19,000	-

a. Source: DOE (1995).
b. Source: DOE (1999a).
c. Source: DOE (1997c).
d. Particle size of particulate matter emissions is assumed to be in the respirable range (less than 10 microns).
VOCs = volatile organic compounds.

INEEL site boundaries in concentrations exceeding maximum contaminant levels (DOE 1995). A more recent study (Rodriguez et al. 1997) predicts that without remediation, mercury, tritium, iodine-129, neptunium-237, and strontium-90 have already or will reach or exceed drinking water standards beneath INTEC before the year 2095. Iodine-129 was predicted to migrate to the INEEL southern border at a concentration near the drinking water standard (Rodriquez et al. 1997).

Relocation of the percolation ponds that are used for disposal of service waste to a location 10,200 feet southwest of INTEC would provide a beneficial impact to water quality. This action would serve to enhance water quality and help DOE to achieve the goal of meeting drinking water standards at the aquifer by 2095. This action moves the region of influence of the ponds far enough from the INTEC that infiltration of water discharged to the ponds (which in the past has exceeded drinking water standards) will not hydrologically interact with contaminated perched water bodies beneath INTEC.

Plumes of contaminants are known to occur in perched water zones and the Snake River Plain aquifer in areas underlying and downgradient from other INEEL facilities. The potential for interaction between plumes has not been well studied at this time. However, the concentration of contaminants is greatest close to the INEEL facilities that are the source of the plume.

Closure of facilities and residual contamination left in place after remediation of INTEC facilities could contribute to the concentration of contaminants in the aquifer over the long term. A discussion of long-term cumulative impacts from exposure to contaminants in groundwater can be found in Section 5.4.3.9.

5.4.3.5 Ecological Resources

The INEEL occupies 569,600 acres of land, of which 11,400 acres have been dedicated to industrial use for more than 40 years (DOE 1995). Most natural vegetation has been removed from developed areas, reducing the

value of wildlife habitat. Reasonably foreseeable activities, including remediation of contaminated sites (which would account for the majority of the disturbance) at the INEEL could involve converting approximately 1,400 acres of habitat to industrial use (see Table 5.4-4). If all of the reasonably foreseeable activities were implemented, the total loss of habitat on the INEEL would involve less than 3 percent of the total available habitat.

As stated in Section 5.4.3.1, the excavation of silt and clay could lead to the excavation of 24 acres each year for a 10-year period. This land would be recontoured and reseeded with native plants but would likely not return to its pre-disturbance condition as habitat (DOE 1997a).

Activities evaluated in this EIS could account for 22 acres of this total anticipated disturbance but would involve land adjacent to INTEC, which though undisturbed exhibits marginal value as wildlife habitat.

Development of new percolation ponds for disposal of service wastewater from INTEC operations would eliminate vegetation and wildlife habitat from up to 15 acres of undisturbed land. The location of these new ponds (10,200 feet southwest of existing percolation ponds), if built, would be near, but not adjacent to, the INTEC industrial area. Impacts to biodiversity and habitat fragmentation from development of the new percolation ponds would be minimal, but vegetation associated with up to 15 acres would be lost during the operating life of the ponds and small animals displaced if the new percolation ponds with associated holding ponds were constructed.

Although a majority of the 1,400 acres that may be developed has been previously disturbed, is contiguous with, or is adjacent to existing industrial facilities, some reduction in plant productivity, localized loss of biodiversity, displacement of animals, and direct mortality of less-mobile species is expected.

No state- or Federally-listed species is known to occur in the area; therefore, habitat losses would not be expected to affect any threatened or endangered species. Therefore, the cumulative impact to ecological resources from habitat loss as a result of any alternative evaluated in this EIS would be small.

Radionuclides released from treatment operations could be deposited on vegetation surrounding INTEC. Radionuclide exposure of plant and animal species in areas adjacent to INTEC could increase slightly due to waste processing operations. Residual radionuclides in soils surrounding INTEC, not related to the proposed action, would still potentially be absorbed by plants and consumed by animals. Although exposure to these materials may result in injury to individual animals or plants, measurable impacts to populations on or off the INEEL have not occurred and are not expected as a result of the incremental increase in exposure that could result from treatment operations associated with any of the alternatives. Additional deposition as a result of Idaho HLW & FD EIS alternatives is not anticipated to lead to levels of contaminants that would exceed the historically reported range of concentrations or ecologically-based screening levels (See Section 5.2.8). Therefore, DOE does not anticipate cumulative impacts on plant and animal populations as a result of any Idaho HLW & FD EIS alternative.

If, subsequent to completion of all activities at INTEC, DOE were to reclaim and revegetate the entire area, as well as other developed areas at the INEEL, local increases in some wildlife populations would be likely; however, the percentage increase in these populations would probably not be measurable over the INEEL.

5.4.3.6 Geology and Soils

Disposition of facilities and remediation of contaminated sites at INTEC and other INEEL facility areas would require the use of geologic materials (e.g., gravel and soils). Anticipated requirements for geologic materials in support of remediation of contaminated sites at the INEEL were identified in the SNF & INEL EIS (DOE 1995) and in an environmental assessment addressing impacts of developing new sources of fine soils (silt/clay) to support INEEL operations (DOE 1997a).

Fine soils (silt/clay) would be used for construction of soil caps to remediate contaminated soils, research sites, and landfills; replace radioactively contaminated soils with topsoil for revegetation and backfill; seal sewage lagoons; and in other activities. An environmental assessment prepared in 1997 evaluated a need for 2,300,000 cubic yards of silt/clay material over a period of 10 years (DOE 1997a). To account for compaction, reject material not suitable for construction, and other uncertainties associated with construction activities, the assumed need for material was doubled to 4,600,000 cubic yards (DOE 1997a). Silt/clay required for construction activities associated with waste processing alternatives and facilities disposition at INTEC, as well as material for all other INEEL activities, including ongoing operations and remediation of contaminated sites, would be obtained from these sources.

Sources of, and requirements for, other geologic materials (sand, gravel, pumice, aggregate, etc.) in support of remedial activities and INEEL operations were evaluated in the SNF & INEL EIS. The maximum estimated need for gravel and borrow materials is 1,772,000 cubic yards (DOE 1995). The environmental impacts associated with development or expansion of existing material sources within the boundaries of the INEEL were evaluated in the SNF & INEL EIS. DOE will consider additional National Environmental Policy Act review if additional borrow sites are required to support INEEL activities.

Geologic materials required in support of any of the waste processing alternatives and for facility disposition would be obtained from these existing sources onsite sources. Therefore, cumulative impacts to geologic materials are anticipated to be small.

5.4.3.7 Cultural Resources

The majority of reasonably foreseeable INEEL actions, including the Advanced Mixed Waste Treatment Project, remediation of contaminated sites, and waste processing activities would occur within previously disturbed areas contained within or adjacent to INEEL facility areas. The potential for these areas to harbor cultural resources is small. Nevertheless, there is always the potential to unearth cultural resources during excavation. Mitigation measures to avoid or minimize the impacts to cultural resources discovered during site development are in place.

Reasonably foreseeable activities that could be undertaken in undisturbed areas include development of new percolation ponds for management of service wastewater, and expansion of borrow sites to obtain material required for construction and restoration activities. Cultural resource surveys would be conducted prior to construction or surface disturbance outside of the INTEC fence and appropriate mitigation measures, such as avoidance or scientific documentation and tribal consultation, would be implemented prior to development of the site. Implementation of these measures would minimize the potential for impacts, including cumulative impacts, to cultural resources on the INEEL. The Systems Integration Corporation quartzite mining area was surveyed and no significant archaeological site or archaeological values that need to be protected were identified.

The types of cumulative impacts on historic resources are the same for all alternatives considered in this EIS. All undertakings within developed facility areas on the INEEL have the potential to impact properties that are eligible for nomination to the National Register of Historic Places. Appropriate mitigation measures, including archival documentation of historic structures and their histories, will be implemented in accordance with an agreement with the State Historic Preservation Officer. Contribution of activities evaluated in this EIS to cumulative impacts on cultural and historic resources on the INEEL or in southeastern Idaho would be small.

5.4.3.8 Traffic and Transportation

Transportation impacts analyzed in the SNF & INEL EIS are summarized in this section as well as cumulative impacts from the AMWTP EIS and WAG 3 remediation activities.

Traffic Volume - As noted in Section 5.2.9, DOE does not expect any change in the Level-of-Service on U.S. Highway 20 as a result of anticipated future activities at the INEEL, including the proposed action.

Transportation Radiological Impacts - Radiological collective doses to workers and the general population were used to quantify cumulative transportation impacts. The analysis of cumulative transportation impacts focuses on offsite transportation because this method yields a larger dose to the general population in comparison to onsite transportation or occupational dose. Due to the difficulty in identifying a maximally exposed individual for historical and anticipated shipments that would occur all over the U.S. over an extended period of time (i.e., from 1953 through completion of transportation related activities evaluated in this EIS), this measure of impact was evaluated by estimating cancer fatalities using cancer risk coefficients. The collective dose for waste shipments associated with all alternatives in this EIS are summarized in Section 5.2.9, Traffic and Transportation, of this EIS. Total collective occupational and general population doses from past, present, and reasonably foreseeable actions are summarized in Table 5.4-8.

There are also general transportation activities that are unrelated to alternatives evaluated in the SNF & INEL EIS, this EIS, or to reasonably foreseeable actions. Examples of these activities are shipments of radiopharmaceuticals to nuclear medicine laboratories and shipment 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 by the Nuclear Regulatory Commission included limited quantity shipments, medical, industrial, fuel cycle, and waste. The Nuclear Regulatory Commission estimated that the annual collective worker dose for these shipments was 5,600 person-rem, which would result in 2.2 cancer fatalities. The annual collective general population dose for these shipments was estimated to be 4,200 person-rem, which would result in 2.1 cancer fatalities. Because comprehensive transportation doses were not available, these collective dose estimates were used to estimate transportation collective doses for 1953 through 1982 (30 years). These dose estimates included shipments of spent nuclear fuel and radioactive waste shipments.

Weiner et al. (1991a,b) estimated doses to workers and the general public from land (truck) and air shipments of radioactive material and estimated that the annual collective radiation dose to workers and the general population was 1,690 and 1,850 person-rem per year, respectively. Assuming similar exposure rates over the 1983 to 2037 period, the total collective doses to workers and the general public would be 96,000 person-rem and 103,000 person-rem, respectively.

The total number of cancer fatalities resulting from shipments of radioactive materials from 1953 through 2037 was estimated to be 255. Based on 300,000 cancer deaths/year (NRC 1977) over this same period (84 years), approximately 24,000,000 people will die from cancer. The transportation-related cancer deaths are less than 0.001 percent of this total. The maximum number of transportation related cancer deaths that would occur as a result of the projects analyzed in this EIS would be less than 1 percent of the total number of cancer deaths resulting from transportation of radioactive materials and less than 0.00001 percent of the conservatively estimated total number of fatal cancers from all causes.

Like the historical transportation dose assessments, the estimates of collective doses due to general transportation exhibit considerable uncertainty. For example, data from 1975 were applied to all general transportation activities from 1953 through 1982. This approach may have overestimated doses because the amount of radioactive material transported and the number of shipments in the 1950s and 1960s was less than the amount that was shipped in the 1970s.

Comprehensive data that would enable a more accurate transportation dose assessment are not available so the dose estimates developed by the Nuclear Regulatory Commission were used. In addition, the collective doses identified in Weiner et al. (1991a,b) were assumed to be representative of the dose that would occur over the life of the project and are likely to understate the health effects that would occur as a result of unrelated shipments of radioactive material.

The estimate of the total number of fatal cancers from all causes that would occur over the life of the project is conservative, which tends to overstate the impacts of the project relative to the

Table 5.4-8. Cumulative transportation-related radiological collective doses and cancer fatalities.

Category	Collective occupational dose (person-rem)	Latent cancer fatalities[a]	Collective general population dose (person-rem)	Latent cancer fatalities[a]
Historical				
Waste (1954 - 1995)	47	0.02	28	0.01
DOE Spent Nuclear Fuel (1953 – 1995)	56	0.02	30	0.02
Naval Spent Nuclear Fuel (1957 – 1995)	6.2	3.0×10^{-3}	1.6	8.0×10^{-4}
Alternative B (10-year plan)[b]				
Waste shipments				
Truck (100 percent)	870	0.35	460	0.23
Train (100 percent)	20	0.01	29	0.02
Maximum Waste Processing Alternative				
Direct Cement Waste Option (Truck)	530	0.21	2.9×10^{3}	1.4
Reasonably Foreseeable Actions				
Geological Repository				
Truck	8.6×10^{3}	3.4	4.8×10^{4}	24
Train	750	0.3	740	0.37
Waste Isolation Pilot Plant				
Test Phase	110	0.043	48	0.03
Disposal Phase				
Truck	1.9×10^{3}	0.76	1,500	0.75
Train	180	0.07	990	0.5
General Transportation				
Truck				
1953 – 1982	1.7×10^{5}	68	1.3×10^{5}	65
1983 – 2037	9.6×10^{4}	38	1.0×10^{5}	52
Summary				
Historical	109	0.043	60	0.030
Alternatives B (10-year plan)[b]				
Truck (100 percent)	870	0.35	460	0.23
Train (100 percent)	20	0.008	29	0.02
Maximum Waste Processing Alternative	530	0.21	2.9×10^{3}	1.4
Reasonably Foreseeable Actions				
Truck (100 percent)	1.1×10^{4}	4.16	5.0×10^{4}	24.78
Train (100 percent)	1.0×10^{3}	0.37	1.8×10^{3}	0.87
General Transportation (1953-2037)	2.7×10^{5}	106	2.3×10^{5}	117
Total collective dose[c]	2.8×10^{5}	111	2.9×10^{5}	144
Percent of total collective dose from Maximum Waste Processing Alternative	0.002	0.002	0.01	0.01

a. Dose conversion factors were 4.0×10^{-4} latent cancer fatality per person-rem for workers and 5.0×10^{-4} latent cancer fatality per person-rem for the general population.
b. Dose reported in SNF & INEL EIS (DOE 1995); includes Advanced Mixed Waste Treatment Project.
c. Assumes truck transport.

number of cancers that would occur from all causes. The number of cancer fatalities over time is influenced by numerous factors, including the population size and the age structure of the population. Although the estimate of 300,000 fatal cancers per year is probably too high for the 1950s and 1960s, the estimate is also too low for the 1980s and 1990s. For example, there were more than 535,000 cancer fatalities in 1992 (American Cancer Society 1996).

Vehicular Accident Impacts - Facilities that involve the shipment of radioactive materials were surveyed for 1971 through 1993 using accident data from the U.S. Department of Transportation, the Nuclear Regulatory Commission, DOE and state radiation control offices. During this period, there were 21 vehicular accidents involving 36 fatalities. These fatalities resulted from the 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. For the Transuranic Separations Option, it is estimated that there would be approximately 13 vehicular accidents, which would be expected to result in approximately one (0.99) fatality over the shipment campaign. All other alternatives would involve fewer vehicular accidents and fatalities. During 1997, approximately 42,000 people were killed in all vehicle accidents (DOT 1997).

5.4.3.9 Health and Safety

Although there are a number of pathways through which radioactive materials at INTEC and INEEL operations could affect onsite workers or an offsite member of the public, the airborne pathway is the principal exposure pathway. Radiation doses to public receptors in the vicinity of the INEEL site due to atmospheric releases have been analyzed in the SNF & INEL EIS and in Sections 5.2.6 and 5.2.10 of this EIS. Actual emissions of radionuclides are continuously monitored and the potential radiation dose to offsite members of the public is reported in INEEL annual site environmental reports (ESRF 1996, 1997).

The potential health effects from radiation exposure are presented as the estimated number of fatal cancers in the affected population. The potential health effects resulting from exposure to chemical carcinogens are presented as the number of lifetime cancers in the affected population. For exposure to noncarcinogenic chemicals, health effects are presented as estimated fatalities.

Historic radiation releases and subsequent offsite doses associated with INEEL operations have been evaluated and summarized in the SNF & INEL EIS (DOE 1995) and the Idaho National Engineering Laboratory Historical Dose Evaluation (DOE 1991). Airborne releases over the operating history of INEEL have always been within the radiation protection standards applicable at the time and the doses from those releases have been small in comparison to doses from sources of natural background radiation in the vicinity of INEEL (DOE 1991). Liquid-borne radioactive effluents from the INEEL have not, to this time, produced measurable exposure to offsite members of the public. Some potential biotic pathways (animals and vegetation) also exist, such as game animals that assimilate radioactivity on the INEEL and are subsequently harvested. DOE has estimated that the potential radiation dose to individuals through ingestion of game animals, although unlikely, could be as high as 10 millirem per hunting season (DOE 1991). More recent analyses (ESRF 1998) of duck sampling data indicate the potential dose to be approximately 1 millirem.

Public exposure to residual radioactive materials left in place at INTEC after the completion of all remedial activities and implementation of a waste processing alternative would be small because of institutional controls assumed to be in place throughout the time frame of this analysis (2000-2095). Materials left in place would potentially provide a source of contamination that could migrate to the Snake River Plain aquifer. Public exposure to these contaminants could occur if the plumes of the materials within the aquifer migrated off the INEEL or to a point outside the institutionally controlled area (See Section 5.4.3.9 for a discussion of potential long-term cumulative impacts associated with groundwater).

Occupational Health - The activities to be performed by workers under each of the alternatives identified in this EIS are similar to activities that are currently performed at INTEC. Therefore, the potential hazards encountered in the workplace would be similar to existing hazards. 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. The airborne pathway, through which materials released on the INEEL could affect workers, was modeled in the SNF & INEL EIS and was found to add negligible amounts to actual measured data.

As used in the SNF & INEL EIS (DOE 1995), the average reportable radiation dose to an INEEL worker (including both INTEC and non-INTEC workers) was about 27 millirem per year. The value was based on 1991 occupational radiation monitoring results, but was projected to be representative over the 10-year period of the SNF & INEL EIS analysis. In addition, there is a potential for a small additional radiation dose due to atmospheric releases from INEEL facilities. The occupational dose received by the entire INEEL workforce would result in about one fatal cancer for ten years of operations (DOE 1995). For comparison, the natural lifetime incidence of fatal cancers in the same population from all other causes would be about 2000. The greatest increase in the collective worker dose would occur under the Direct Cement Waste Option. This option would have a total campaign collective worker dose of 1,600 person-rem. The combined additional radiation dose to workers from this option would result in less than one (0.64) additional latent cancer fatality over the life of the project. All other options would result in a lower contribution to the cumulative collective worker dose.

For the evaluation of occupational health effects from chemical emissions, the modeled chemical concentrations were compared with applicable occupational standards (see Sections 5.2.6 and 5.2.10). Modeled concentrations below occupational standards were considered acceptable. Based on the analysis, no adverse health effects for onsite workers are projected to occur as a result of normal chemical emissions under any alternative.

Routine workplace safety hazards can result in injury or fatality. Projected injury rates were calculated based on INEEL historic injury rates for construction workers and for INEEL operations. The number of additional recordable cases and lost workdays that would be anticipated for each alternative are reported in Section 5.2.10.4.

Facility disposition at INTEC would also result in worker exposure to radiation. Clean Closure of the Tank Farm and bin sets would result in the greatest dose to workers at 3.38 latent cancer fatalities. Disposition of other facilities and remedial activities undertaken at INTEC would also lead to worker exposure, but those doses were calculated to be much lower than for Clean Closure of the Tank Farm.

These analyses indicate that the cumulative radiological health effects, nonradiological health effects, and workplace safety hazards to the INEEL workforce would be small. The combined occupational risks are less than those encountered by the average worker in private industry.

Public Health - The airborne pathway is the principal pathway through which radioactive materials released on INEEL can reach offsite members of the public. The project-specific analysis of the potential radiation dose to the public in the vicinity of INEEL indicates that the potential radiation dose (to the maximally exposed individual and collectively) would be highest under the Continued Current Operations Alternative, Planning Basis Option, Hot Isostatic Pressed Waste Option, or Direct Cement Waste Option. These options would result in a potential annual radiological dose to the maximally exposed individual of approximately 0.002 millirem. This potential dose would be in addition to the dose from existing and proposed INEEL operations. Monitoring of existing operations indicated that the maximally exposed individual received a dose of 0.018 millirem and 0.031 millirem in 1995 and 1996, respectively (ESRF 1996, 1997). For comparison, the radiation dose to individuals residing in the vicinity of INEEL from natural background radiation averages approximately 360 millirem per year (ESRF 1997).

Waste processing options would add a maximum of 0.1 person-rem per year to the collective radiation dose received by the affected population. The collective radiological dose to the population within 50 miles of the INEEL in 1996 was 0.2 person-rem. Using the standard risk factors for estimating fatal concerns from a given calculated exposure, a value of 0.0005 fatal cancers would be obtained as a result of the cumulative radiation dose received by the population within 50 miles of INEEL from existing INEEL operations, treatment of HLW, and other reasonable foreseeable actions at INEEL. In essence, no fatalities would be expected. The natural lifetime incidence of cancer in the same population from all other causes would be about 24,000 cancers in a population of about 120,000 people (DOE 1995).

Other regional sources of atmospheric radioactivity have the potential to contribute to the radiation dose received by the public near INEEL. The primary non-INEEL source of airborne radioactivity is emissions from phosphate processing operations in Pocatello, Idaho. EPA evaluated health effects in the exposed population from these emissions (EPA 1989). The number of fatal cancers in the population within 50 miles of Pocatello would be about one over a ten-year period. INEEL and the Pocatello phosphate plants are separated by a large enough distance that the population evaluated by EPA does not completely overlap the population evaluated 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. No emissions of toxic air pollutants would exceed applicable standards for any alternative, although emissions of dioxins and furans at the Maximum Achievable Control Technology limit (which is much higher than actual emissions are likely to be) could potentially reach 29 percent of the standard. Nevertheless, INEEL operations are not anticipated to exceed any applicable standards when emissions from the alternatives analyzed in this EIS are considered in conjunction with existing and anticipated emissions. The highest risks calculated for any alternative imply less than one fatal cancer in the exposed population. Therefore, no health effects are anticipated from releases of chemical carcinogens. No basis for use in evaluating risks from chemical exposure due to other regional commercial, industrial, and agricultural sources, such as combustion of diesel or gasoline fuels and agricultural use of pesticides, herbicides, and fertilizers, is available. Therefore, the number of potential health effects in the general population from INEEL activities combined with other sources of chemical exposure cannot be reliably estimated.

The volume of surface water that flows from the INEEL to offsite areas is negligible and there are no liquid discharges from operations to the intermittent streams on the INEEL. In the unlikely event that storm water runoff from the INTEC were to reach the Big Lost River channel, the flow would not leave INEEL. Therefore, INEEL operations, including existing and proposed activities at INTEC, have a negligible contribution to cumulative impacts on public health resulting from the surface water pathway.

At present there are no contaminant plumes in the groundwater that leave the INEEL. Consequently, contaminants in the groundwater do not contribute to cumulative impacts on public health. However, there is a potential for exposure of the public to these contaminants in the future because of downgradient migration of the contaminants or changes in the INEEL site boundary (which could change the location of the nearest human receptor). The potential for long-term cumulative impacts is discussed in Section 5.3.8.2. In addition, Section 5.2.14.6 provides a discussion of potential impacts to the groundwater from a postulated failure of five underground storage tanks full of mixed transuranic waste/SBW.

Long-term impacts from exposure to residual contamination - Long-term impacts to public health could potentially occur as a result of contaminants left in place after completion of closure activities and Waste Area Group 3 remedial action. Over time, these contaminants could migrate to the groundwater and ultimately be ingested by humans residing near the location of the INTEC and using the Snake River Plain aquifer as a drinking water source.

Table 5.4-9 shows the results of the baseline risk assessment for Waste Area Group 3 and the

Table 5.4-9. Comparison of impacts due to groundwater ingestion from the WAG 3 Baseline Risk Assessment and this EIS.

Evaluation Document	Total individual dose[a] over evaluation period (millirem)	Excess latent cancer fatality risk due to total individual dose	Annual individual dose due to drinking water during evaluation period [b] (millirem per year)	Time of evaluation (year)
Waste Area Group 3 Baseline Risk Assessment[c]	56[d] (beta/gamma-emitting radionuclides)	5.0×10^{-5}[e]	1.9 (beta/gamma-emitting radionuclides)	2095
	250[d] (total radiation dose)		8.33 (total radiation dose)	
Idaho High-Level Waste and Facilities Disposition EIS	51	2.5×10^{-5}[f]	2.1	3000

a. The total radiation dose is presented for the duration reported in the respective documents. For Waste Area Group 3 the duration is 30 years, while this EIS uses 70 years as the duration for evaluation.
b. The annual dose was estimated by dividing the total dose by the evaluation period duration.
c. Source: Rodriguez et al. (1997)
d. The radiation dose for this receptor was calculated by using the groundwater concentrations reported by Rodriguez et al. (1997) and applying DOE dose conversion factors (DOE 1988).
e. The risk for this evaluation was calculated based on EPA methodology for risk assessment.
f. The risk for this evaluation was calculated based on NCRP and DOE guidance on risk assessment.

results from the analyses in this EIS. For each evaluation, the dose is presented, along with the corresponding risks reported in the respective documents. Also included in the table are estimates of the annual dose to the maximally exposed individual and the time periods at which the presented doses and risks are applicable.

As shown in Table 5.4-9, the risk and dose from the Waste Area Group 3 risk assessment are both low but are not expected to overlap in time to any great extent with the doses and risks calculated for this EIS. The table presents the highest radiation dose for the maximally exposed resident farmer for facilities disposition alternatives in this EIS, including the No Action Alternative. The table also contains estimates of annual doses due to groundwater consumption. The values in the table are below the drinking water standard of 4 millirem for beta/gamma-emitting radionuclides. Groundwater concentration limits for all the radionuclides are also not exceeded.

In addition to the activities listed in Table 5.4-9, the total estimated cancer risk due to groundwater ingestion from closure in place of building CPP-633 would be 2.0×10^{-6} (DOE 1996). This value is small compared to the Waste Area Group 3 risk assessment and the impacts calculated in this EIS and therefore is not included in Table 5.4-9.

Additional health risk could occur as a result of nonradiological contaminants that would be available via groundwater and fugitive dust pathways. However, in the cases assessed here, cancer risk results only from inhalation of cadmium entrained in fugitive dust, as discussed in Appendix C.9. For all receptors and exposure scenarios, cancer risk from cadmium would be less than 1×10^{-9} and would not contribute substantially to the cumulative risk. Noncancer risk would be higher than for some receptors and scenarios, most notably those cases involving fluoride releases from onsite disposal of low-level

Class A or C type grout. The effect of concern for fluoride intake is objectionable dental fluorosis, which is considered more of a cosmetic effect than an adverse health effect.

5.4.3.10 Waste Management

Table 5.4-3 presents, by waste stream for each alternative, the total volumes of waste that would be generated under each alternative. Existing disposal of waste stored or buried on the INEEL includes approximately 145,000 cubic meters of low-level waste and about 62,000 cubic meters of transuranic waste. Although the volume of INEEL industrial waste previously deposited in the INEEL Landfill Complex is unknown, it is estimated that the Landfill Complex would provide adequate capacity for the next 30 to 50 years, which would accommodate wastes generated over the life of the projects evaluated in this EIS. Furthermore, the Landfill Complex may provide adequate capacity for a longer period of time as a result of an active recycling program at INEEL.

A series of figures depicting the cumulative volume of specific waste streams that may be generated by INEEL activities over the projected life of the Idaho HLW & FD EIS alternatives have been developed using the INEEL baseline (Jason 1998) and LMITCO Project Data Sheets. Figures 5.4-1, 5.4-2, 5.4-3, and 5.4-4 project cumulative INEEL generation of low-level waste, mixed low-level waste, hazardous waste, and industrial waste, respectively.

Actual waste volumes that are generated may be smaller than estimated because waste minimization and recycling efforts that are ongoing at the INEEL could reduce the quantity of waste. However, the efficiency or applicability of recycling to each particular waste stream cannot be predicted with any degree of reliability based on the information available at this time.

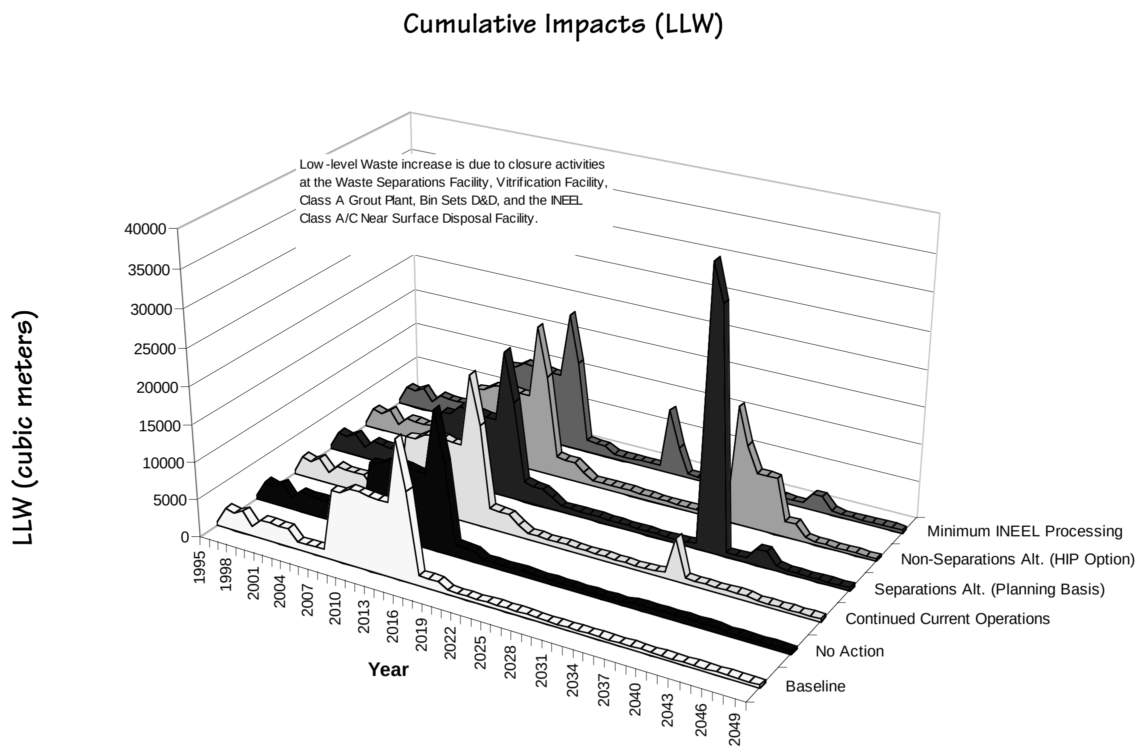


Figure. 5.4-1. Cumulative generation of low-level waste at INEEL, 1995-2050.

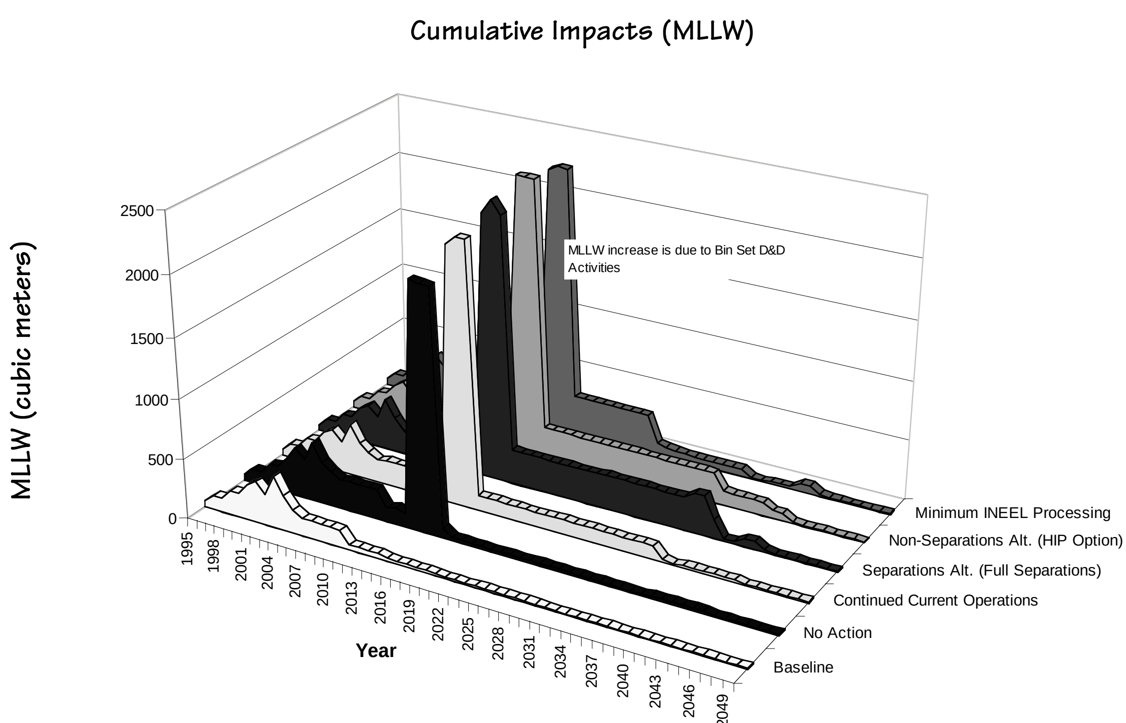


Figure. 5.4-2. Cumulative generation of mixed low-level waste at INEEL, 1995-2050.

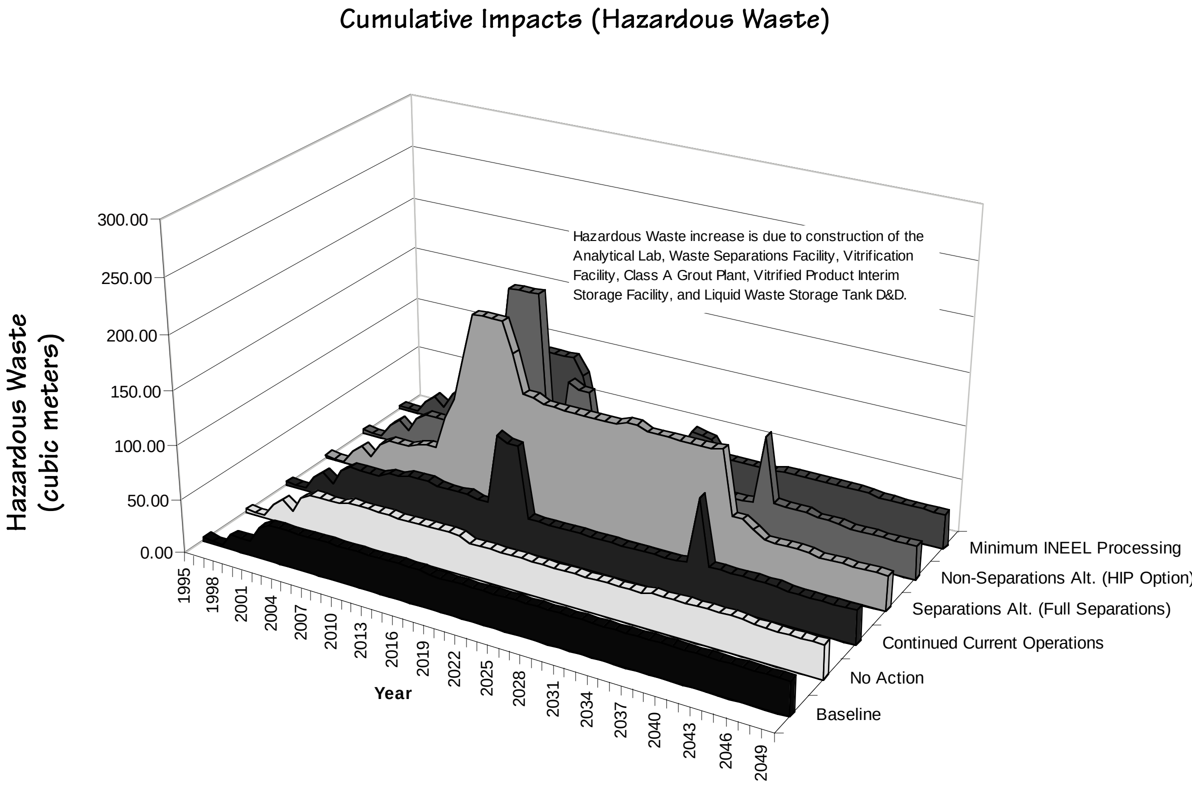


Figure. 5.4-3. Cumulative generation of hazardous waste at INEEL, 1995-2050.

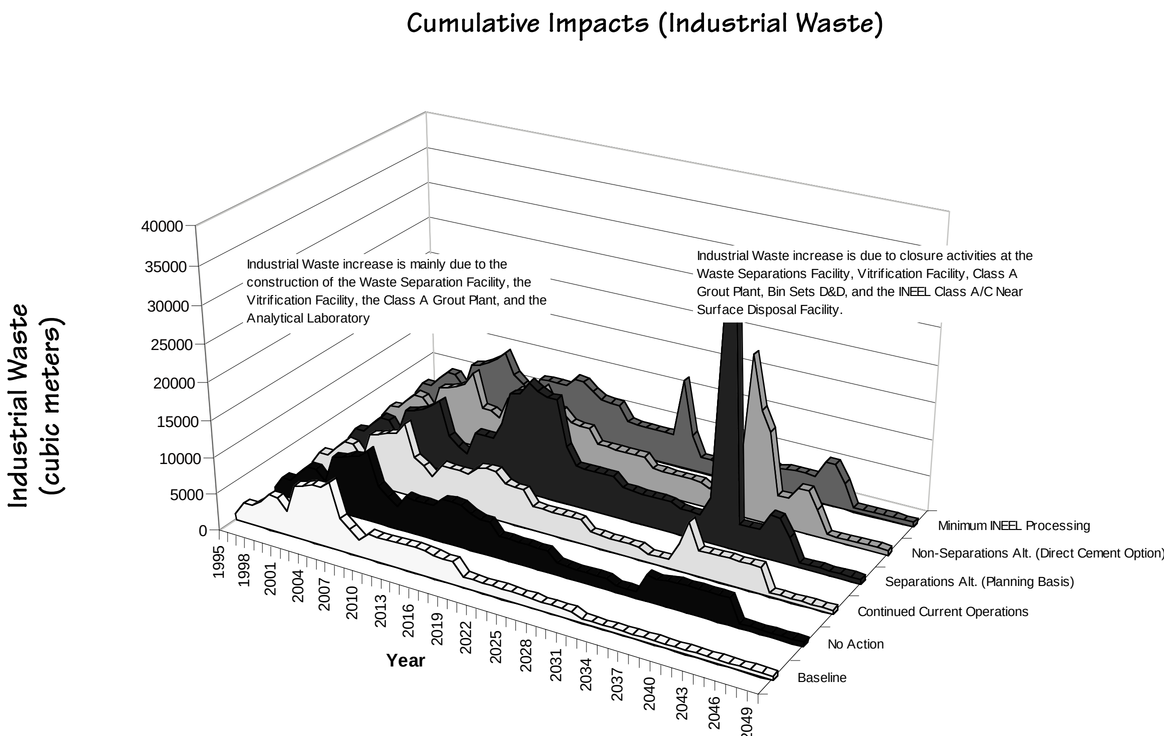


Figure. 5.4-4. Cumulative generation of industrial waste at INEEL, 1995-2050.

5.5 Mitigation Measures

As required by the Council on Environmental Quality, this section considers mitigation measures that could reduce or offset the potential environmental consequences of waste management activities and that are not integral to the alternatives analyzed in this EIS. Based on the potential environmental effects described in this chapter for each alternative, DOE would consider establishing additional programs to reduce environmental impacts. Section C.8 discusses mitigation measures that could reduce or offset potential impacts at Hanford under the Minimum INEEL Processing Alternative.

5.5.1 GENERAL MITIGATION MEASURES

For the most part, DOE has not identified specific measures other than management controls and standard engineering practices that would reduce impacts beyond the actions that are part of each alternative. If future activities were likely to lead to impacts beyond those described in Chapter 5 of this EIS, mitigation action planning would begin concurrent with consideration of the need for appropriate National Environmental Policy Act documentation.

Mitigation measures have been implemented as a result of past or current activities related to HLW management. Current mitigation measures include administrative or management controls and engineered systems (e.g., backup systems, failsafe designs) that have been required by environmental regulations or DOE Orders and implemented through operating procedures. Chapter 6 describes the laws and regulations that affect HLW management. These activities would continue under each alternative described in Chapter 3.

Management controls include erosion and sedimentation control plans instituted through stormwater pollution prevention plans and their permits; spill prevention control and countermeasures plans; and best management plans. These plans and others are referenced throughout Chapters 4 and 5.

5.5.2 SPECIFIC MITIGATION MEASURES

For the Idaho HLW & FD EIS, DOE lists below mitigation measures that may be of particular importance to stakeholders. Although none of the alternatives would result in major impacts to the environment, DOE, in seeking to eliminate, avoid, or reduce even small impacts, proposes the following actions. These actions appear in this EIS in the appropriate environmental sections. Socioeconomic resources including environmental justice issues; utility and energy resources; traffic and transportation issues; facility accident considerations; and decontamination and decommissioning do not have specific mitigation measures listed in this EIS. However, impact reduction and minimization is inherent in planning for and carrying out these aspects of HLW management. The following are examples of such inherent measures.

Land Use

Depending on which waste processing alternative is chosen, DOE may build a Low-Activity Waste Disposal Facility. Once filled to capacity, the Low-Activity Waste Disposal Facility would be equipped with an engineered cap sloping from centerline to ground level with a 4-percent grade. If a soil cap is used it would be revegetated with selected native plants to prevent erosion, improve the appearance of the closed facility, and blend in with the surrounding vegetation. DOE would revegetate with species indigenous to the area to restore the natural landscape to as near its original condition as possible. Post-closure monitoring would be conducted in accordance with regulatory requirements. DOE is studying the re-establishment of vegetation in areas previously burned.

Socioeconomics

For the proposed processing alternatives and facility disposition activities, different skill mixes and the number of skilled workers may change relative to current INEEL missions. In order to mitigate any impacts to the overall work force at the INEEL, DOE will retrain and reassign workers to the extent practical once the alternative has been selected. Generally, with adequate retraining, no significant reduction in the work force is necessary. If a reduction in force becomes necessary, site contractors generally provide outplacement aid to displaced workers who choose to seek employment offsite.

Cultural and Aesthetic Resources

Potential cultural resource areas on the INEEL are considered to be eligible for nomination to the National Register of Historic Places until they have been formally evaluated; therefore, these sites would not be disturbed without formal evaluation. DOE has standing "Stop Work" stipulations in the event that cultural resources or human remains are discovered during any part of project implementation. If these resources or remains are found, DOE would stop project construction or operation and consult the State Historic Preservation Officer and the Shoshone-Bannock Tribes in accordance with the National Historic Preservation Act and Native American Graves Protection and Repatriation Act. Before any facility disposition occurs, DOE would execute a Memorandum of Agreement with the State Historic Preservation Officer to ensure that potential adverse impacts from alteration or demolition would be mitigated.

DOE would avoid any construction activities and ground disturbances associated with an alternative that could result in a visual impact that is incompatible with the general setting and the Bureau of Land Management Visual Resource Management Class designation for the area. DOE will consult with the Shoshone-Bannock Tribes before it implements projects that could have impacts to resources of importance to the tribes.

Fugitive Dust

Major construction activities often produce relatively high levels of fugitive dust in the vicinity of the activity and short-term, localized levels of particulate matter, which, if not mitigated, could exceed applicable standards. As specified in Sections 650 and 651 of Rules for the Control of Air Pollution in Idaho, all reasonable precautions would be taken to prevent the generation of fugitive dust. Dust generation would be mitigated by the application of water, use of soil additives, and possibly administrative controls (such as halting construction during high-wind conditions). These mitigation measures would also be implemented in the event that dust or erosion were to impact visual resources.

Flood Hazards

Based on information provided in Section 4.8.1.3 and 5.2.7.3, it is expected that some form of flooding mitigation will be required to protect INTEC facilities from the hazards associated with 100- to 500-year return period floods. Since mitigation can affect other INEEL facilities as well as INTEC, proposed mitigation activities at the INEEL would be based on technical concurrence of the flood hazard for various return periods and review of proposed mitigation actions by the INEEL Natural Phenomena Committee and facility managers. The final Mitigation Action Plan (see 10 CFR 1021.331) will be referenced in the Record of Decision and formalized after the Record of Decision is signed. Potential flood mitigation may include rebuilding or modifying the INEEL diversion dam, the Lincoln Boulevard Bridge, or other infrastructures that could exacerbate flooding along the Big Lost River on the Site. The specific actions delineated in the Mitigation Action Plan will be determined by selection of the preferred waste processing alternative, the decisions made in the Record of Decision, and any additional site-specific requirements generated by the incorporation of design requirements into the INEEL architectural and engineering standards to mitigate Big Lost River hazards. As this process evolves, a more detailed description of proposed mitigation activities will be made available to the public. Proposed flood mitigation actions may require additional National Environmental Policy Act review.

Radiation Safety

DOE relies on a program to keep worker exposures to radiation and radioactive material as low as reasonable achievable (ALARA). An effective ALARA program must balance minimizing individual worker doses from external and internal sources with the goal to minimize the collective dose of all workers in a given group. ALARA evaluations must consider individual and collective doses to ensure the minimization of both. Using many workers to perform extremely small portions of a task would reduce the individual worker dose to very low levels. However, the frequent worker changes would make the work inefficient, with the result that the total dose received by all the workers would be significantly higher than if fewer workers received slightly higher individual doses. INEEL worker doses have typically been well below DOE worker exposure limits, and DOE will continue to use the ALARA program to maintain this level of safety.

Institutional Controls

Regardless of the facility disposition option chosen, DOE would maintain adequate institutional controls (e.g., fences or warning signs) to limit access to areas that pose a significant health or safety risk to workers until at least 2095, when DOE is assumed to relinquish institutional control of the site. Areas formerly occupied by waste management facilities would not, as long as DOE maintains institutional control, be open to the public for recreational uses or added to the acreage leased to local ranchers for grazing.

Waste Minimization

The INEEL has programs and policies in place that require projects to include physical or engineered processes to reduce or eliminate waste generation, and reduce the hazard, toxicity, and quantity of waste generated. These programs, which are discussed in more detail in Section 4.14, also specify that waste be recycled to the extent possible before storage or disposal. It is reasonable to assume that these same policies and requirements will be implemented under the proposed action and will effectively minimize the quantities of all types of waste that will require treatment, storage, and/or disposal.

5.6 Unavoidable Adverse Environmental Impacts

This section summarizes potential unavoidable adverse environmental impacts associated with the alternatives analyzed in this EIS. Unavoidable impacts are impacts that would occur after implementation of all feasible mitigation measures. Section C.8 contains a discussion of potential unavoidable adverse impacts at Hanford associated with the Minimum INEEL Processing Alternative.

5.6.1 CULTURAL RESOURCES

Construction activities would be undertaken within the INTEC under all alternatives. Impacts to cultural resources from these activities would be negligible because the construction would occur in previously disturbed areas; however, the potential for subsurface discoveries of cultural resources is possible. Ground disturbance has the potential to affect archaeological, traditional, and paleontological sites located on the surface or buried beneath recent sediments. Alteration of the setting associated with a traditional, archaeological, or historic resource through the introduction of additional noise, pollution, contamination, or lighting may adversely affect those resources located both inside and outside of the INTEC fence.

Under the Separations Alternative, approximately 22 acres of open land outside of the INTEC fence could be developed for a Low-Activity Waste Disposal Facility. Although this facility would be located in a previously disturbed area, surface or subsurface cultural resources could be discovered at the site and the potential for adverse impacts would be unavoidable. Mitigation measures, such as creation of a scientific record, would minimize, but not completely eliminate, impacts to cultural resources discovered during development of a disposal facility.

The unchecked deterioration of historical structures at the INTEC could have a long-term adverse impact on historic resources. Some potentially adverse impacts could be avoided by preserving the historic value of structures through appropriate research and documentation or by conducting limited rehabilitation of historic structures. Adverse impacts to potentially significant historic structures could occur under all alternatives. These potential impacts could be minimized, but not completely eliminated, through scientific study and documentation. Memoranda of Agreement with the State Historic Preservation Officer are in place or would be negotiated to ensure that adverse impacts from alteration or demolition of INTEC facilities would be mitigated using the process described in Section 4.4.5. Adverse impacts may also occur to archaeological sites of importance to Native Americans and to areas or resources of traditional or religious importance.

Temporary visual degradation of the cultural setting of the INEEL and adjacent lands would occur as a result of air emissions under all alternatives except the No Action Alternative. Processing operations are anticipated to be complete by 2035, and visual degradation of INEEL cultural resources from stack emissions would cease at that time.

5.6.2 AESTHETIC AND SCENIC RESOURCES

Construction of new facilities and removal of other facilities would result in a change in the visual setting at the INTEC. The INTEC is an industrial facility distantly removed from points along U.S. Highways 20 and 26 where the facility is visible to the public. Changes in the specific configuration of facilities within the INTEC would change the viewscape to some degree, but those changes would be unlikely to be noticeable to the casual observer.

Soil erosion could occur during construction or demolition activities, and the release of fugitive dust particles might temporarily affect visibility in localized areas. Dust control measures, such as watering, would minimize, but not completely eliminate, these transient impacts to the viewscape.

Emissions of fine particulate matter and nitrogen dioxide can result in an impairment of visual resources. Emission rates for these pollutants under the waste processing alternatives are not expected to exceed levels currently or previously experienced by INEEL sources; therefore, the "visual impact" of these alternatives is already reflected in existing baseline conditions. Nevertheless, conservative visibility screening analysis has been performed to evaluate the relative potential for visibility impacts between alternatives. This analysis included a quantitative assessment of contrast and color shift parameters and comparison of results against numerical criteria which define potential objectionable impacts. The views analyzed were at Craters of the Moon Wilderness Area and Fort Hall Indian Reservation. The results of the visibility analysis indicate that emissions from each of the waste processing alternatives would not result in deleterious impacts on scenic views at Craters of the Moon Wilderness Area or Fort Hall Indian Reservation (including the view to Middle Butte, an important cultural resource to the Shoshone-Bannock Tribes). The highest results were obtained for the Hot Isostatic Pressed Waste and Planning Basis Options. For color shift, the highest calculated value at Craters of the Moon was about 0.5, compared to an acceptability criterion of 2.0. For contrast, the highest calculated value was 0.004, compared to an acceptability criterion of 0.05. Values at Fort Hall were about one-half the Craters of the Moon values. The calculated values conservatively assume that no abatement systems are present on the fossil fuel-burning equipment used to generate steam; if air pollution control systems are employed (which is a reasonable assumption), these values would decrease in rough proportion to the removal efficiency of the control equipment.

Generators and night lighting associated with facilities at INTEC would increase the visible and audible intrusion to the aesthetic environment in the vicinity of the INTEC but would have little or no impact at the nearest points of public access along public highways.

5.6.3 AIR RESOURCES

Construction or demolition activities would result in short-term increases of particulate emissions in localized areas. Emissions of criteria pollutants, toxic air pollutants, and radionuclides may result in some degradation of air quality under all alternatives.

Emissions of criteria pollutants would be greatest under the Separations Alternative. State of Idaho significance thresholds would be exceeded for emissions of at least one criteria pollutant under all waste processing alternatives and options except the No Action Alternative and Minimum INEEL Processing Alternative. Increases in net emissions would be considered "major" and subject to additional analysis. Each applicable project would be subject to a permit defining air pollution control requirements.

Options that involve the greatest amount of fossil fuel combustion (most notably those under the Separations Alternative) would produce the highest emissions of toxic air pollutants as described in Section 5.2.6. Conservatively calculated air concentrations of these pollutants at the INEEL boundary would not exceed applicable standards for either carcinogenic or noncarcinogenic substances (see Section 5.2.6).

The highest radiological dose to an offsite individual would occur under the Continued Current Operations Alternative, Planning Basis Option, Hot Isostatic Pressed Waste Option, and Direct Cement Waste Option. The calculated dose to the maximally exposed offsite individual would be about 0.002 millirem per year, while the noninvolved worker would receive 1.0×10^{-4} millirem per year (see Section 5.2.6). The offsite dose would be well below the National Emissions Standards for Hazardous Air Pollutants limit of 10 millirem per year. The maximum collective dose (the sum of all individual doses) to the entire population residing within 50 miles would be about 0.1 person-rem per year and would occur under the same four alternatives and options listed earlier in the paragraph. Doses for the Early Vitrification Option and Minimum INEEL Processing Alternative would be approximately 0.05 person-rem per year, and other options would be lower.

5.6.4 WATER RESOURCES

Water consumption would increase as a result of construction activities, operational activities, facility disposition, and the increased workforce at INTEC. The highest total water withdrawal during construction would occur under the Planning Basis Option (7.2 million gallons per year) and would represent a small increase over the baseline INEEL water usage (see Section 5.2.12). The highest operating phase water use would occur under the Hot Isostatic Pressed Waste Option (93 million gallons per year). INEEL water use would be well below the consumptive use water rights of 11.4 billion gallons per year (Teel 1993). The No Action Alternative would have the lowest requirement for consumptive use of water and generation of wastewater.

An unavoidable adverse impact of all alternatives would be the risk of migration of contaminants from contaminated media and areas at INTEC to the Snake River Plain aquifer. Based on the quantity of untreated material that would be left in place (approximately 800,000 gallons of mixed transuranic waste/SBW and 4,200 cubic meters of mixed HLW calcine), the greatest potential for migration of contaminants would occur under the No Action Alternative.

5.6.5 ECOLOGICAL RESOURCES

Activities described in this EIS would lead to disturbances within INTEC. The entire area has been previously disturbed; moreover, little or no wildlife cover or food exists. The disturbance of this marginal habitat within the boundary of INTEC would have a negligible impact on INEEL biodiversity and wildlife habitat.

Under the Separations Alternative and Minimum INEEL Processing Alternative, a new onsite Low-Activity Waste Disposal Facility for low-level Class A or Class C type grout could be developed. This facility would occupy approximately 22 acres and would be developed in a previously undisturbed area adjacent to INTEC. Some individual animals, including small mammals and reptiles, could be adversely impacted through displacement or mortality during development of the facility. Birds would likely move away from areas where active construction was ongoing.

Radionuclides released from waste processing operations could be deposited on vegetation surrounding INTEC. Radionuclide exposure of plant and animal species in the areas adjacent to INTEC could increase slightly due to these operations. Residual radionuclides in soils surrounding INTEC, not related to the proposed action, would still potentially be absorbed by plants and consumed by animals. Although exposure to these materials could theoretically result in injury to individual animals or plants, measurable impacts to populations on or off the INEEL have not occurred and are not expected to occur as a result of the small increase in exposure resulting from treatment operations.

5.6.6 HEALTH AND SAFETY

Exposure of the workforce to radionuclides would be highest under the Direct Cement Waste Option of the Non-Separations Alternative. This exposure could potentially lead to less than 1 (0.64) latent cancer fatality within the exposed workforce. The highest collective worker dose during disposition of new facilities associated with the waste processing alternatives would result in less than one (0.10) latent cancer fatality. The highest collective worker dose from disposition of existing facilities associated with high-level waste management would occur as a result of Clean Closure of the Tank Farm and would result in an estimated 3.0 latent cancer fatalities. All other Tank Farm closure options, disposition of the bin sets and related facilities, and other facilities would result in less than 1 latent cancer fatality.

The highest total collective dose to the offsite population from any alternative described in this EIS would occur under the Early Vitrification Option and would lead to less than one (8.5×10^{-4}) latent cancer fatality within the population residing within 50 miles of the INTEC.

As described in Section 5.2.6, DOE does not expect exposure to non-carcinogenic and carcinogenic toxic air pollutants to result in health impacts.

5.7 Short-term Use Versus Long-term Productivity of the Environment

Implementation of any of the alternatives would cause some adverse impacts to the environment and would permanently commit certain resources. Under most alternatives, adverse impacts to the environment would be of short duration and would be offset by long-term enhancements to the productivity of the region. This section compares potential short-term influences of each alternative on the environment and the associated effects on the maintenance and enhancement of long-term productivity of the environment. Section C.8 contains a discussion of the relationship between short-term uses of the environment and long-term productivity at Hanford under the Minimum INEEL Processing Alternative.

5.7.1 WASTE PROCESSING ALTERNATIVES

5.7.1.1 No Action Alternative

- **General -** Short-term uses of resources would have little or no impact on long-term environmental productivity. Under this alternative, wastes would remain untreated and newly generated wastes would continue to be processed; however, maintenance activities necessary to protect human health and the environment would continue. Under this alternative, a potential would exist for future contamination of water resources underlying INTEC.

- **Land Use -** This alternative would involve little or no additional disturbance of land. Activities would be undertaken within the developed industrial area at INTEC. No effect on long-term environmental productivity would be expected.

- **Cultural Resources -** Little or no short-term impacts to cultural resources would occur under this alternative. Continued degradation and modification of historic structures at INTEC could lead to long-term loss of data on these structures.

- **Air Quality -** Airborne emissions of criteria pollutants, toxic air pollutants, and radionuclides would be minimal and would be lower than current emissions of these pollutants. Current operational impacts have been evaluated and are within applicable standards. Therefore, impacts to air quality from the No Action Alternative would represent a short-term commitment of resources. There would be no long-term commitment of air resources under this alternative.

- **Ecology -** Little or no additional wildlife habitat would be converted to industrial uses; however, there would be a long-term loss of productivity associated with continued exposure of ecological receptors to existing contamination.

- **Waste Management -** This alternative includes only continued maintenance operations to protect human health and the environment and does not provide for long-term disposition and enhanced management of waste as required by the Federal Facility Compliance Act, INEEL Site Treatment Plan and Consent Order, and the Settlement Agreement/Consent Order between DOE and the State of Idaho. Maintenance activities conducted under the No Action Alternative would provide little or no enhancement of the environment in the long term.

5.7.1.2 Continued Current Operations Alternative

- **General -** Short-term uses of resources would have little or no impact on long-term environmental productivity. Under this alternative, existing waste management facilities and processes would continue to operate. Maintenance activities necessary to protect human health and the environment would continue and no impacts on long-term environmental productivity outside of the INTEC facility boundary would be expected.

- **Land Use -** This alternative would involve little or no additional disturbance of land. Activities would be undertaken within the developed industrial area at INTEC. No effect on long-term environmental productivity would be expected.

- **Cultural Resources -** Little or no short-term impacts to cultural resources would occur under this alternative because new development activities would occur in previously disturbed areas. Degradation and modification of historic structures at INTEC, in support of continued operation, could lead to long term loss of data on these structures.

- **Air Quality -** Short-term commitment of air resources would continue at current levels under this alternative. These operational impacts have been evaluated and are within applicable standards. Therefore, impacts to air quality from continuing current operations would represent a short-term commitment of resources. There would be no long-term commitment of air resources under this alternative because the impacts would cease upon completion of waste processing operations.

- **Ecology -** No additional wildlife habitat would be converted to industrial use. Land contained within the INTEC facility boundary would remain an industrial area unavailable to wildlife in the long-term. Ecological receptors in the vicinity of INTEC would continue to be exposed to existing contamination.

- **Waste Management -** This Continued Current Operations Alternative would not meet the long-term disposition and enhanced management of waste as required by the Federal Facility Compliance Act, INEEL Site Treatment Plan/Consent Order, and the Settlement Agreement/Consent Order between the DOE and the State of Idaho.

5.7.1.3 Separations Alternative

The Separations Alternative includes three options: the Full Separations Option, the Planning Basis Option, and the Transuranic Separations Option. The relationship between short-term use and long-term productivity of the environment would be similar under each of these options.

- **General -** Short-term uses of resources would have little or no impact on long-term environmental productivity. Although approximately 22 acres of previously undisturbed land adjacent to INTEC would be developed and used for long-term disposal of low-level waste Class A (Full Separations Option) or low-level waste Class C (Transuranic Separations Option) type grout, long-term environmental productivity would generally be enhanced because of the final waste forms and disposition of the waste.

- **Land Use -** This alternative would involve disturbance of 22 acres of previously undisturbed land adjacent to INTEC for development of a Low-Activity Waste Disposal Facility for Class A (Full Separations Option) or Class C (Transuranic Separations Option) type grout. This disposal facility would be located in close proximity to the existing developed area at INTEC. Other activities, including construction and operation of waste processing facilities, would be undertaken within the existing developed industrial area at INTEC. Although this alternative would require a nominal change in long-term land use of 22 acres, no effect on long-term environmental productivity would be expected because the change would occur on acreage adjacent to the INTEC industrial area.

- **Cultural Resources -** Minor short-term impacts to traditional Native American cultural resources could occur as a result of land disturbance activities through development of the Low-Activity Waste Disposal Facility. Alteration of the environmental setting would result through the introduction of additional noise and lighting during construction activities and from air pollutant emissions during waste processing. Furthermore, long-term impacts would remain as a result of the alteration of the property's setting that is of importance to areas or resources of traditional or religious importance. Demolition, modification, or deterioration of historic structures could also lead to long-term loss of historic data.

- **Air Quality -** Construction of facilities for treatment of HLW and disposal of low-level waste grout would result in short-term elevated levels of airborne emissions of particulate matter and combustion products from INTEC. Treatment processes would result in airborne emissions of criteria pollutants, toxic air pollutants, and radionuclides. DOE has assessed these emissions and predicts them to be within applicable standards. Therefore, impacts to air quality from the Separations Alternative would represent a short-term commitment of resources. There would be a potential for visual impacts that would be defined in the permit for each facility. Impacts to air quality as described in Section 5.2.6 would occur during project construction and operation and would not result in long-term commitment of air resources beyond the life of the project.

- **Ecology -** Approximately 22 acres of open space that is presently available for use by wildlife could be converted to industrial use. The long-term loss of productivity associated with conversion of this land would be small because the land has limited value as wildlife habitat because it is located adjacent to the INTEC industrial area. Land within the INTEC facility boundary would remain an industrial area that does not provide important wildlife habitat. Although a low-level Class A or Class C type grout disposal facility would be constructed using 22 acres of previously undeveloped land, this alternative would enhance long-term productivity of the INTEC environment by decreasing the risk of exposure on surrounding biota to toxic and radioactive substances.

- **Waste Management -** This alternative would provide for long-term disposition and enhanced management of waste as required by the Federal Facility Compliance Act, INEEL Site Treatment Plan/Consent Order, and the Settlement Agreement/Consent Order between DOE and the State of Idaho.

5.7.1.4 Non-Separations Alternative

The Non-Separations Alternative includes the Hot Isostatic Pressed Waste, Direct Cement Waste, and Early Vitrification Options. Although specific details would differ slightly, the relationship between short-term use and long-term productivity of the environment would be similar under all of these options.

- **General -** Short-term uses of resources would have little or no impact on long-term environmental productivity. Impacts would result in enhanced long-term environmental productivity as compared to the No Action or Continued Current Operations Alternatives because of the final waste forms and disposition of the waste.

- **Land Use -** This alternative would involve little or no additional disturbance of land. Activities would be undertaken within the developed industrial area at INTEC. No effect on long-term environmental productivity would be expected to land resources.

- **Cultural Resources -** Short-term impacts to cultural resources under this alternative would consist of alteration of the built environment surrounding historic structures at INTEC. Modification of historic structures and alteration of the environment containing those structures at INTEC could lead to long term loss of data on these structures.

- **Air Quality -** Construction and upgrading of facilities would result in short-term elevated levels of airborne emissions of particulate matter and combustion products from INTEC. Waste processing would result in airborne emissions of criteria pollutants, toxic air pollutants, and radionuclides. Specific quantities of these pollutants that would be released to the environment differ slightly under each option as described in Section 5.2.6. DOE has assessed atmospheric emissions of pollutants and expects them to be within applicable standards for all options. Therefore, impacts to air quality from the Non-Separations Alternative would represent an acceptable short-term commitment of resources. There would be a potential for visual impacts that would be defined in the permit for each new or upgraded facility. Impacts to air quality as described in Section 5.2.6 would occur during project construction and operation and would not result in long-term commitment of air resources beyond the life of the project.

- **Ecology -** Little or no additional wildlife habitat would be converted to industrial uses.

- **Waste Management -** Although the details of treatment processes would differ under each option, the Non-Separations Alternative would provide for long-term disposition and enhanced management of waste as required by the Federal Facility Compliance Act, INEEL Site Treatment Plan and Consent Order, and the Settlement Agreement/Consent Order between DOE and the State of Idaho.

5.7.1.5 Minimum INEEL Processing Alternative

- **General -** Short-term uses of resources would have little or no impact on long-term environmental productivity. Maintenance activities that protect human health and the environment would continue during packaging and shipping operations and no impacts on long-term environmental productivity would be expected.

- **Land Use -** This alternative could involve disturbance of 22 acres of previously undisturbed land adjacent to INTEC for development of a Low-Activity Waste Disposal facility for the vitrified low-level waste fraction. Although this alternative could involve a nominal change in long-term land use, no effect on long-term environmental productivity would be expected.

- **Cultural Resources -** Minor short-term impacts to cultural resources could occur as a result of land disturbance activities. Modification of historic structures or buildings at INTEC could lead to long term loss of data on these structures.

- **Air Quality -** Construction of new facilities for packaging of mixed HLW calcine would result in short-term elevated levels of airborne emissions of particulate matter and combustion products. Treatment of liquid waste would result in airborne emissions of criteria pollutants, toxic air pollutants, and radionuclides. These emissions have been assessed and would be within applicable standards (see Section 5.2.6). Therefore, impacts to air quality from the Minimum INEEL Processing Alternative would represent a short-term commitment of resources. There would be a potential for visual impacts that would be defined in the permit for each facility. Impacts to air quality as described in Section 5.2.6 would occur during project construction and operation and would not result in long-term commitment of air resources beyond the life of the project.

- **Ecology -** Approximately 22 acres of undeveloped land that is presently available for use by wildlife could be converted to industrial use. The long-term loss of productivity associated with conversion of this land would be small because the land has limited value as wildlife habitat because it is located adjacent to the INTEC industrial area. Land within the INTEC facility boundary would remain an industrial area unavailable to wildlife in the long term.

- **Waste Management -** This alternative would provide for long-term disposition and enhanced management of waste as required by the Federal Facility Compliance Act, INEEL Site Treatment Plan and Consent Order, and the Settlement Agreement/Consent Order between DOE and the State of Idaho. This alternative would enhance the long-term productivity of the INTEC environment by decreasing the risk of exposure of onsite workers and surrounding biota to toxic and radioactive substances in the long term.

5.7.2 FACILITY DISPOSITION

- **General -** Facility disposition would have little or no impact on long-term environmental productivity.

- **Land Use -** Facility disposition would involve little or no additional disturbance of land. Activities would be undertaken within the developed industrial area at INTEC. No effect on long-term environmental productivity would be expected.

- **Cultural Resources -** Demolition or modification of historic structures at INTEC could lead to a long-term loss of historic data. Loss of this information could be minimized through documentation of historic structures prior to disposition.

- **Air Quality -** Demolition of facilities would result in short-term elevated levels of airborne emissions of particulate matter and combustion products. Impacts to air quality from facility disposition would be temporary and represent a short-term commitment of resources. There would be a potential for visual impacts during demolition and removal of structures, but this short-term impact would abate upon completion of individual projects. There would be no long-term commitment of air resources as a result of facility disposition.

- **Ecology -** Little or no additional wildlife habitat would be converted to industrial uses and there would be no long-term loss of productivity.

5.8 Irreversible and Irretrievable Commitments of Resources

Irreversible and irretrievable resource commitments are related to use of resources and the effects that consumption or permanent loss or commitment of those resources would have on future generations. Irreversible commitments occur as a result of use or destruction of a resource (e.g., fossil fuels) that cannot be replaced. Irretrievable resource commitments involve the loss in value of an affected resource.

Irreversible and irretrievable commitments of resources would potentially include land, groundwater, construction materials, and energy resources. Some other resources and materials that would be used under each alternative could be recycled and do not represent an irreversible and irretrievable commitment (e.g., structural and stainless steel used in facility construction could be recovered and recycled after the completion of project related activities). These resource commitments would be a result of construction and operation of new treatment, storage or disposal facilities; use in treatment related processes; and in disposal of existing or treated radioactive or hazardous wastes.

Under the Separations Alternative, approximately 22 acres of previously undisturbed land outside of the INTEC facility boundary would be committed to disposal of low-level waste Class A (Full Separations Option) or Class C (Transuranic Separations Option) type grout. In the absence of reclamation, some marginal wildlife habitat associated with this area would be lost.

Activities at the INEEL 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. These plumes occur in localized areas within the INEEL site boundaries. Services lost from these commitments include limits on the location of certain types of wells, such as drinking water wells or the volume of water pumped from the aquifer by DOE for activities on the INEEL site. All potable water wells on the INEEL site are routinely monitored to ensure that water withdrawn from the aquifer is utilized appropriately, as specified under Federal and state regulations. Risk of future contamination of groundwater underlying the INTEC, and hence commitment of the groundwater resource, is highest under the No Action Alternative.

The construction materials (sand, gravel, pumice, and landscaping cinders) extracted on INEEL would be irreversibly and irretrievably committed in support of activities associated with waste processing and facility disposition. Aggregate would also be used during construction for concrete production, foundation preparation, and road construction and maintenance. Some materials used for facility construction, such as structural steel, could ultimately be recycled depending on market conditions. All of these materials are plentiful in supply. Material consumption for this purpose would not lead to shortages in the availability of these materials.

Material requirements for treatment of wastes would vary with alternative and treatment option as described in Section 5.2.13. The maximum quantities of each material (in cubic meters) that could be consumed under any alternative are as follows: argon gas (1,200); blast furnace slag (6,400); cement (5,800); clay (8,500); fly ash (6,100); glass frit (7,800); silica (2,300); sodium hydroxide (500); titanium (or aluminum) powder (240). Not all types of materials would be required under all treatment options, and only the maximum amounts required under any option are listed. For example, argon gas, silica, and titanium (or aluminum) powder would be the only materials required for the Hot Isostatic Pressed Waste Option of the Non-Separations Alternative, and these materials would not be required in any quantity by any other option.

Consumption of fossil fuel during the construction phase would be highest under the Full Separations Option, which would require 480,000 gallons of fuel per year. The peak annual fossil fuel usage for operations is also highest under the Full Separations Option at 4.5 million gallons per year. All other alternatives would consume substantially less fossil fuel during both construction and operations phases.

The Planning Basis Option has the highest requirement for electrical energy during the construction phase. This option would require up to 6,500 megawatt hours per year during construction. All other alternatives have lower requirements for electrical energy. The Planning Basis Option also has the highest operations-phase energy requirement, 50,000 megawatt hours per year. All other alternatives have would lower requirements for electrical energy.

Annual energy requirements for facility disposition, including decontamination and decommissioning of new waste processing facilities and closure of existing facilities, would be much lower than peak energy demands identified for waste processing.

6.0 Statutes, Regulations, Consultations, and Other Requirements

This chapter discusses the consultations and coordination the U.S. Department of Energy (DOE) has had with various agencies during the preparation of this EIS. This chapter also analyzes the complex regulatory issues that arise when considering the various alternatives discussed previously.

When reviewing this chapter, it is important to remember the following: in the Purpose and Need discussion in Chapter 2 of this EIS, DOE has described the challenges it faces with its HLW at INEEL and its additional challenge with facilities associated with mixed HLW management. It also described the decisions it intends to make; however, some of the issues collateral to the DOE decisions cannot be made by DOE alone. Instead, those collateral matters must be subject to negotiation with and agreement by the State of Idaho and/or other regulators. For example, DOE expects to make a decision in the present EIS process about which method of treatment will be used on the mixed HLW at INEEL; however, with respect to any decision on how the waste tanks at INTEC will be closed, that approach cannot be decided by DOE alone. Instead, the tank closure decision must be negotiated with the State in a separate series of activities in the future.

6.1 Consultations and Coordination

This section highlights the consultation and coordination DOE conducted in preparing this EIS. DOE informed the public and consulted Federal agencies that have jurisdiction by law or special expertise and State agencies that are authorized to develop and enforce environmental standards. DOE also consulted with the Shoshone-Bannock Tribes because of the proximity of the Fort Hall Indian Reservation and the Tribes' vested interest in the cultural and natural values and use of the lands comprising and surrounding the INEEL. DOE has provided in this section the associated correspondence in the order that they are discussed.

Synopsis and Chronology of Consultation – In litigation that started in 1991, the State of Idaho argued that DOE had violated the National Environmental Policy Act, claiming that the environmental impacts from the transportation and storage of spent nuclear fuel at INEEL had not been fully analyzed. In response, DOE prepared the SNF & INEL EIS (DOE 1995), which was completed in April of 1995. The lawsuit was settled between DOE, the Department of the Navy, and the State of Idaho on October 17, 1995. The Federal District Court then imposed upon the parties a Consent Order (USDC 1995) that incorporated as requirements all of the terms and conditions of the Settlement Agreement. One element of the Settlement Agreement (E.6.) requires that by December 31, 1999, DOE shall commence negotiating a plan and schedule with the State of Idaho for calcined waste treatment. DOE decided to prepare this EIS and to involve the State as a cooperating agency in order to negotiate the plan and schedule from an informed position that integrates the requirements of the INEEL Site Treatment Plan and takes into account the feasibility and environmental consequences of a reasonable range of treatment alternatives.

In anticipation that an EIS would be required to analyze the possible environmental impacts of managing mixed HLW, DOE met with the Shoshone-Bannock Tribes on June 2, 1997 at Fort Hall, Idaho to discuss the Tribes' role in the consultation process. On June 5, 1997 the DOE Idaho Operations Office sent a letter (Figure 6-1) to the Chairman of the Fort Hall Business Council to request an opportunity to brief the Business Council on the anticipated EIS and its scope.

On June 9, 1997, the Manager of the DOE Idaho Operations Office signed a determination that an EIS is required to analyze alternatives and assist in deciding a course of action for the management and treatment of INEEL mixed HLW and the ultimate disposition of HLW facilities. On September 15, 1997, the DOE Principal Deputy Assistant Secretary for Environment, Safety and Health signed a Notice of Intent stating that the Idaho HLW & FD EIS would be prepared; this Notice of Intent was published in the Federal Register on September 19, 1997 (62 FR 49209).

The Notice of Intent announced that public scoping on this EIS would run from September 19, 1997 to November 24, 1997, a period of sixty-six days. During this period, public scoping activities included open houses; booths and displays at shopping malls throughout southern Idaho; talks to schools and civic groups; individual briefings and interviews with key stakeholders such as government and tribal officials, interest groups, INEEL employees, and the INEEL Citizens Advisory Board. One formal public scoping meeting was held in Boise and another in Idaho Falls, Idaho. At the meetings, DOE officials and the State's Coordinator-Manager of the INEEL Oversight Program presented overviews of the EIS from their

Department of Energy
Idaho Operations Office
850 Energy Drive
Idaho Falls, Idaho 83401-1563

June 5, 1997

The Honorable Keith Tinno, Chairman
Fort Hall Business Council
Shoshone-Bannock Tribes
P.O. Box 306
Fort Hall, Idaho 83203-0306

SUBJECT: Meeting with Shoshone Bannock Tribes (OPE-SFP-97-188)

Dear Mr. Chairman:

The Department of Energy (DOE) will be publishing a Notice of Intent to prepare an Environmental Impact Statement (EIS) in the Federal Register at the end of July, 1997. This EIS will make important decisions on disposition of the 1.7 million gallons of liquid high level waste and 3800 cubic meters of calcined high level waste stored at the Idaho Chemical Processing Plant. The program is challenged by flat budgets and the uncertainties regarding the opening of the geologic repository.

The Idaho Operations Office and our Contractor staff appreciated the opportunity to meet with members of your staff at Fort Hall, on June 2, 1997, to discuss the High Level Waste program and the upcoming EIS. The issue of "consultation" was raised by your staff. Department of Energy Idaho Operation Office(DOE-ID) is very interested in consulting with the Tribes during preparation of the EIS. To help us meet our mutual objectives, we must thoroughly understand what adequate consultation means to you for this Project. I respectfully request that you convey your expectations in writing to Chuck Ljungberg, DOE-ID Tribal Liaison Officer. I would like to
have this issue resolved before the Federal Register announcement in July.

Thank you for the opportunity to meet with your staff and explain the challenges facing the High Level Waste program and the schedule for completing the *Environmental Impact Statement*. We would also like to brief the Tribal Business Council on the EIS before the end of July. Please contact Chuck Ljungberg at (208) 526-0198 if you have any questions.

The Honorable Keith Tinno -2- June 5, 1997

We look forward to working with you on this important issue.

Sincerely

Tom Wichmann

Tom Wichmann, High Level Waste
Program manager

cc: J. H. Valentine, LMITCO, M.S-3211
B.F. Bugger, DOE-ID, M.S-1214

Figure 6-1. Consultation letter to the Shoshone-Bannock Tribes.

respective points of view. During the scoping period, DOE received more than 900 comments representing 49 issue categories. Table 6-1 shows scoping activities for this EIS, and Table 6-2 lists the number of comments received in each issue category. DOE prepared a Scoping Activity Report that describes the process and shows how scoping input was categorized and used in preparing the EIS (DOE 1998).

In a letter dated November 25, 1997, DOE-ID requested a species list from the Snake River Basin Office, Columbia River Basin Ecoregion of the U.S. Fish and Wildlife Service. Figure 6-2 presents this letter. This request is part of the informal consultation process under Section 7 of the Endangered Species Act. The purpose of the request is to assist DOE in identifying any threatened or endangered species or critical habitat that may be affected by the actions analyzed in the EIS. In a letter dated December 16, 1997, which is shown in Figure 6-3, the U.S. Fish and Wildlife Service replied that given the general nature of the proposal, it was their preliminary determination that the proposed action would be unlikely to impact any species listed under the Endangered Species Act.

On January 26, 1998, members of the Idaho HLW & FD EIS project staff met with the Shoshone-Bannock Tribes Cultural Committee. The meeting was to provide some educational background to EIS Project Staff and other DOE specialists on the Tribal concept of cultural resources to assist in the development of a better EIS. On April 6, 1998, EIS project staff met with the Fort Hall Business Council to discuss the purpose of this EIS and the involvement and role of the Tribes in preparing the EIS.

In early 1998, DOE commissioned the National Academy of Sciences' National Research Council to conduct an independent assessment of INEEL's HLW management program and alternative treatment technologies being considered. The Council held two public meetings in Idaho Falls. The purpose and theme of the first meeting, held August 17 to 19, 1998, was for the Council and interested public to gain an understanding of the history of HLW management and the known problems and treatment options. The purpose of the second meeting, held October 1 and 2, 1998, was to concentrate on the technical details of the treatment options presented in the August meeting. The Council is preparing a report that evaluates the treatment options represented by the alternatives analyzed in this EIS. The report is scheduled for release in December 1999.

During DOE's initial activities preparing the EIS, it became apparent that the State of Idaho had special expertise and perspectives that could assist DOE in its data gathering and analysis activities. From the perspective of DOE it was advantageous to obtain input from the State on the regulatory implications of implementing the various alternatives considered in this EIS as early as possible in the process. From the State's perspective, early consideration of the regulatory implications and consideration of the technical aspects of the alternatives by State experts would improve this EIS and facilitate DOE's progress toward meeting the legal requirements of the Idaho Settlement Agreement/Consent Order. To formalize the role of the State of Idaho in providing this assistance, the State entered into a Memorandum of Understanding with DOE on September 24, 1998 to serve as a cooperating agency in the preparation of this EIS.

On January 28, 1999, DOE sent a second letter, shown in Figure 6-4, to the U.S. Fish and Wildlife Service to ask if any conditions with regard to endangered or threatened species or critical habitat had changed in the year since the U.S. Fish and Wildlife Service response of December 16, 1997. In a letter dated February 11, 1999 the U.S. Fish and Wildlife Service again replied that it was their preliminary determination that, given the general nature of the proposal, the project would be unlikely to adversely impact any species listed under the Endangered Species Act. Figure 6-5 shows the U.S. Fish and Wildlife Service response.

In a February 4, 1999 letter, shown in Figure 6-6, to the Chairman of the Shoshone-Bannock Tribal Business Council, DOE asked the Tribes to review the most recent internal draft version of the Affected Environment section of this EIS. The purpose of the request was to assure that the Tribe's input to date had been accurately and completely incorporated and that the Tribe's

Table 6-1. HLW&FD EIS scoping activities.

Activity	Date	Location	Number of stakeholders
Prescoping (prior to September 19, 1997)			
CAB briefing	November 19-20, 1996	Idaho Falls	20
CAB briefing	January 21-22, 1997	Idaho Falls	31
CAB briefing	May 20-21, 1997	Sun Valley	28
HLW&FD EIS open house	April 16, 1997	Idaho Falls, Ameritel	125
2006 open house	July 8, 1997	Idaho Falls, Shilo	95
2006 video conference	July 24, 1997	Idaho Falls	NA[a]
League of Women Voters forum	September 9-10, 1997	Boise	92
Grand Teton Mall	September 12-13, 1997	Idaho Falls	250
Estimated Total			641
Scoping (September 19, 1997 through November 24, 1997)			
Press release	September 19, 1997	NA	NA
Toll-free telephone line	September 19, 1997 through November 24, 1997	NA	23
24-hour fax line	September 19, 1997 through November 24, 1997	NA	
Towne Square Mall	September 19-20, 1997	Boise	250
Chamber presentation: Wichmann	September 23, 197	Idaho Falls, Westbank	45
Pine Ridge Mall	September 26-27, 1997	Pocatello	250
Dear Citizen Letter (to stakeholders/employees)	October 1, 1997	NA	9,000
ICPP open house	October 1, 1997	ICPP	(a)
Idaho Falls Rotary: Bugger	October 1997	Idaho Falls, North's Blackfoot	50
Blackfoot Kiwanis: Bugger	October 1997	Blackfoot	20
Magic Valley Mall	October 10-11, 1997	Twin Falls	250
University of Idaho presentation: Wichmann	October 14, 1997	Idaho Falls, University Place	10
American Nuclear Society presentation: Wichmann	October 14, 1997	Idaho Falls, Westbank	30
Workshop display advertising	October 13-22, 1997	Idaho Falls, Twin Falls, Pocatello, Boise	NA
Workshop radio ads and public service announcements	October 13-23, 1997	Idaho Falls, Boise, Pocatello	NA
Media advisory, Idaho Falls workshop	October 15, 1997	NA	NA
Scoping workshop, Idaho Falls	October 16, 1997	Idaho Falls, Shilo Inn	110
Media advisory, Boise workshop	October 22, 1997	NA	NA
KIDO Radio interview: Wichmann	October 23, 1997	Boise	NA
Scoping workshop, Boise	October 23, 1997	Boise, Centre on the Grove	12
INEEL Committee talk: Wichmann	November 14, 1997	Idaho Falls, Westbank	19

Table 6-1. (continued).

Activity	Date	Location	Number of stakeholders
Key stakeholder interviews: • Shoshone-Bannock Tribes • Snake River Alliance • Seimer • DEQ • INEEL Oversight • Broscious (EDI) • Pierre (EPA) • Rice (CAB) • Dakins (CAB) • ICPP employees • Maynard • Detonancour • Congressional staff (3) • St of Nevada (Loux) • Milam (Idaho Falls mayor) • P Harrington (YMP) • County commissioners (19) • Area farmers/ranchers • Coalition 21 (Freund)	September 25, 1997 through November 24, 1997	Various	20 interviews 19 mailings
Estimated total			10,108

a. Not available.

Table 6-2. Idaho HLW&FD EIS issue categories and total comments per category.

Issue category	Number of comments	Issue category	Number of comments
1. Aquifer	14	26. Cost and Funding of Alternatives	47
2. Emission/Discharges from Treatment	11	27. New Alternatives/Completeness of Alternatives	97
3. Storage Effects – HLW & LLW	20	28. Effluent HLW Management	13
4. Environmental Justice	6	29. No Action Alternative	46
5. Human Health and Safety Risks	31	30. Non-Separations Alternative	39
6. Air/Soil/Water/Biota Effects	17	31. Proposed Action	88
7. Cultural/Historical Resources	6	32. Hazardous Components of HLW (delisting)	9
8. Pollution Prevention	0	33. Jobs/Economic Impacts	7
9. External Oversight/Regulation	8	34. Alternative Selection/Decisionmaking	16
10. Privatization	7	35. Definitions of Waste	8
11. Future use of Constituents/Nonproliferation	13	36. Out of Scope	23
12. Regulatory Compliance	24	37. Knowledge Level of Situation Addressed by EIS	30
13. Settlement Agreement	24	38. Identification/Completeness of EIS issues	102
14. Cumulative Impacts	11	39. Trust in DOE	3
15. Land and Resource Use	15	40. Get the Work Done	40
16. Impacts form Tank Farm Closure/Onsite Disposal	4	41. Security/Terrorism	2
17. Reprocessing	3	42. Tribal Sovereignty/Consultations	12
18. Involvement with Other States	4	43. Seismic Analysis	8
19. Final Disposition (methods/sites)	65	44. Emotional Stress	1
20. Schedule/Deadlines	5	45. Mitigation Plans	4
21. Transportation	16	46. Performance Criteria for Storage/Disposal	4
22. Technical Viability of Alternatives	27	47. EIS vs. WAG 3	5
23. NEPA Process/Tiering	14	48. Facilities Disposition	6
24. Public Participation/Scoping	53	49. Waste Characterization and History	10
25. Involving Other DOE Sites in the Process	5	50. No Issue Addressed	39

EIS PROJECT - AR PF
Serial = 359

Department of Energy
Idaho Operations Office
850 Energy Drive
Idaho Falls, Idaho 83401-1563
November 25, 1997

Alison Beck Haas
Snake River Basin Office
Columbia River Basin Ecoregion
1387 South Vinnell Way, Room 368
Boise, Idaho 83709

SUBJECT: Request For Species List (ARM-PA-97-103)

Dear Ms Beck Haas:

This is to request a species list to assist the Department of Energy (DOE) in the preparation of an Environmental Impact Statement (EIS). DOE is preparing a draft EIS for High Level Waste and Facilities Disposition at the Idaho National Engineering and Environmental Laboratory (INEEL). The Notice Of Intent (NOI) to prepare this EIS was published in the Federal Register September 19, 1997, (62 FR 49029). The NOI provides background information, gives the purpose and need, and describes the proposed action and agency identified alternatives. Our schedule is to issue the Draft EIS in February 1999, and to issue the Final EIS in July of the same year. DOE's proposed action and agency identified alternatives would take place on the INEEL which is a 569,295 acre DOE reservation that occupies lands withdrawn from the public domain in south-east Idaho on the eastern Snake River Plain. All actions analyzed in the EIS would take place within or near the Idaho Chemical Processing Plant (ICPP). The ICPP is located in the south central portion of the INEEL in Township 3N, Range 30E, and occupies about 265 acres of the south-west portion of Section 19. The location and geographic relationship of these areas are shown on the attachment.

This EIS will analyze the environmental impacts of the demolition of several existing facilities at the ICPP, as well as actions necessary to treat and prepare high level waste for transport from the INEEL to a repository. This may include the construction of new facilities. The environmental impacts of transportation and construction and operation of a repository are being addressed in a the EIS for a Geologic Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain.

Please provide a list of threatened, endangered and candidate species and species proposed to be listed under the Endangered Species Act that may occur on the INEEL, and particularly in the vicinity of the ICPP. Also please identify any designated or proposed critical habitat near the INEEL, and any supplementary information you think may be used in our analyses. If you have any questions concerning this request or if you need further information concerning this EIS or other actions on the INEEL, please call me at (208) 526-0776.

Sincerely,

Roger Twitchell

Roger Twitchell
National Environmental Policy Act
Compliance Officer

Attachment

Figure 6-2. Consultation letter to the U.S. Fish and Wildlife Service.

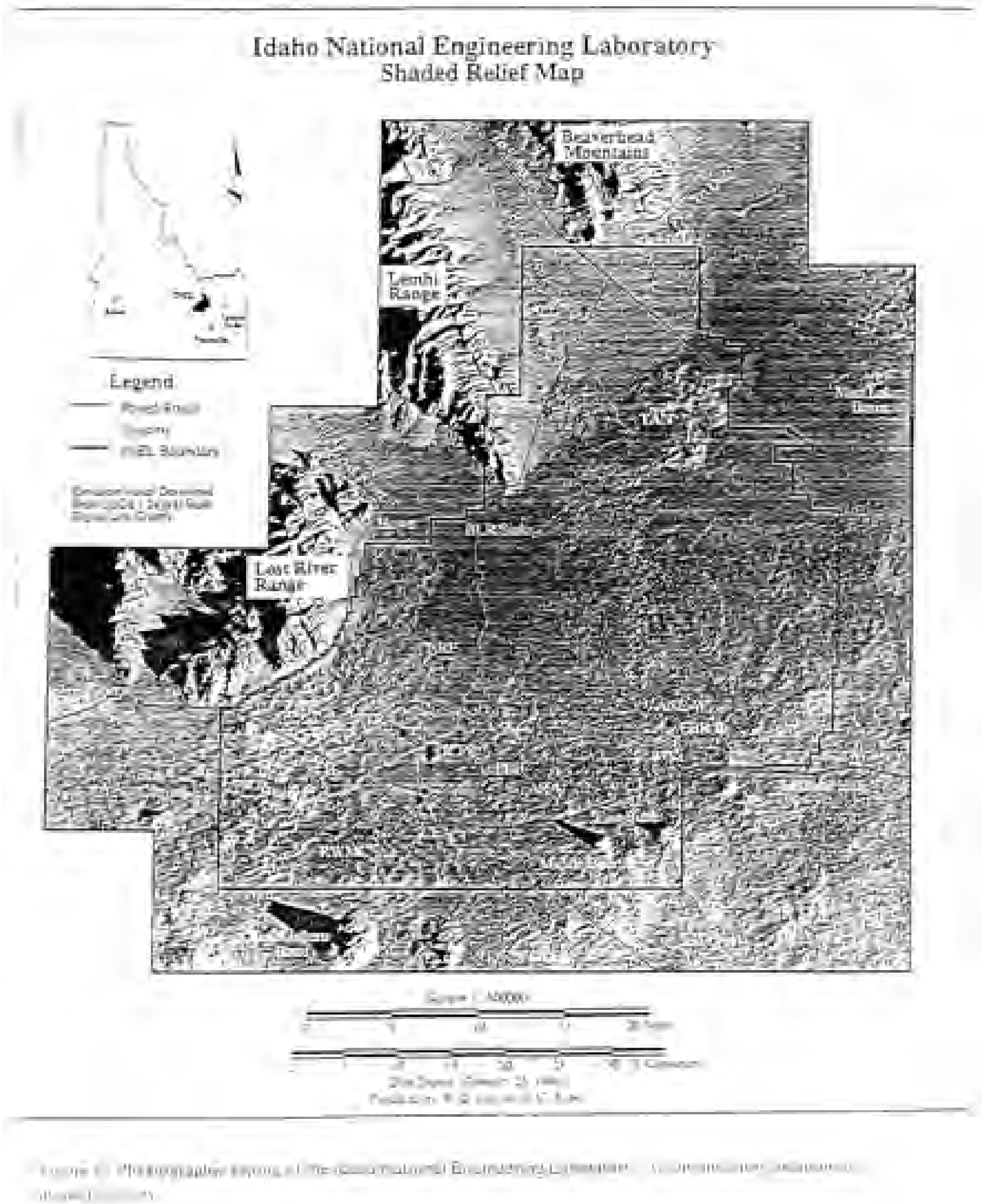


Figure 6-2. (Continued).

United States Department of the Interior

FISH AND WILDLIFE SERVICE

Snake River Basin Office, Columbia River Basin Ecoregion
1387 South Vinnell Way, Room 368
Boise, Idaho 83709

December 16, 1997

Roger Twitchell
Department of Energy
Idaho Operations Office
850 Energy Drive
Idaho Falls, Idaho 83401-1563

Subject: High Level Waste and Facilities Disposition Species List
SP #1-4-98-SP-44 File #506.0000

Dear Mr. Cramer:

The U.S. Fish and Wildlife Service is writing in response to your request for information about potential impacts to endangered species from the proposed High Level Waste and Facilities Disposition project. It is our preliminary determination that, given the general nature of the proposal the project is unlikely to adversely impact any species listed under the Endangered Species Act of 1973, as amended. If you determine otherwise or require further assistance, please contact Alison Beck Haas of this office at (208) 378-5384. Thank you for your interest in endangered species conservation.

Sincerely,

Acting Supervisor, Snake River Basin Office

cc: IDFG, Idaho Falls

Figure 6-3. Response letter from U.S. Fish and Wildlife Service.

Department of Energy
Idaho Operations Office
850 Energy Drive
Idaho Falls, Idaho 83401-1563
January 28, 1999

Mr. Robert Ruesink, Supervisor
Snake River Basin Office
Columbia River Basin Ecoregion
1387 South Vinnell Way, Room 368
Boise, Idaho 83709

SUBJECT: Request For Species List (ARM-PA-99-007)

Dear: Mr. Ruesink

This is to follow-up on my letter to Allison Beck Haas of November 25,1997, by which I requested a species list for use in preparing the Idaho High Level Waste and Facility Disposition Environmental Impact Statement (EIS). Your agency's response of December 16, 1997 (File#506.0000) stated "It is our preliminary determination that, given the general nature of the proposal the project is unlikely to adversely impact any species listed under the Endangered Species Act of 1973, as amended." This EIS analyzes alternatives for the treatment and management of high level waste, liquid sodium bearing waste, and the disposition (closure, decontamination and disposal) of associated treatment and storage facilities. Under the alternatives being analyzed, except for transportation, all actions that take place in Idaho would occur within or near of the Idaho Nuclear Technology Engineering Center (INTEC), within the boundaries of the Idaho National Engineering and Environmental Laboratory (INEEL). By way of reference, the INEEL is a 569,295 acre DOE reservation that occupies lands withdrawn from the public domain in southeast Idaho on the eastern Snake River Plain. INTEC, formerly known as the Idaho Chemical Processing Plant, is located in the south central portion of the INEEL in Township 3N, Range 30E, and occupies about 265 acres of the south-west portion of Section 19. The Bureau of Land Management 30X60 minute series "Circular Butte, Idaho" topograhpic map and shaded relief map provided with my November 25, 1997 species list request show the location of INTEC, the INEEL, and surrounding region.

This EIS is currently in preliminary draft form and is being reviewed internally. We plan to issue the Draft EIS in April 1999 and make it available to your agency for review and comment in accordance with Department of Interior protocol. Please advise me if any conditions with regard to listed endangered or threatened species, or species proposed to be listed, or designated or proposed critical habitat, have changed since your agency's response of December 16, 1997. If you have any questions concerning this request or if your need further information concerning this EIS or other actions on the INEEL, please call me at (208) 526-0776.

Roger Twitchell

National Environmental Policy Act
Compliance Officer

Figure 6-4. Consultation letter to U.S. Fish and Wildlife Service.

United States Department of the Interior

FISH AND WILDLIFE SERVICE

Snake River Basin Office, Columbia River Basin Ecoregion
1387 South Vinnell Way, Room 368
Boise, Idaho 83709

February 11, 1999

Roger Twitchell
National Environmental Policy Act Compliance Officer
Department of Energy, Idaho Operations Office
850 Energy Drive
Idaho Fall, Idaho 83401-1563

Subject: Idaho High Level Waste and Facility Disposition Project Species List
SP #1-4-99-SP-105 File #506.0000

Dear Mr. Twitchell:

The U.S. Fish and Wildlife Service is writing in response to your request for information about potential impacts to endangered species from the proposed Idaho High Level Waste and Facility Disposition project. It is our preliminary determination that, given the general nature of the proposal, the project is unlikely to adversely impact any species listed under the Endangered Species Act of 1973, as amended. If you determine otherwise or require further assistance, please contact Mike Donahoo of our Pocatello office at (208) 233-8550. Thank you for your interest in endangered species conservation.

Sincerely,

Susan B. Martin

Acting Supervisor, Snake River Basin Office

cc: FWS-ES, Pocatello (Donahoo) w/incoming
IDFG, Idaho Falls

Figure 6-5. Response letter from U.S. Fish and Wildlife Service.

Department of Energy
Idaho Operations Office
850 Energy Drive
Idaho Falls, Idaho 83401-1563
February 4, 1999

The Honorable Keith Tinno, Chairman
Shoshone-Bannock Tribal Business Council
P.O. Box 306
Fort Hall, ID 83203-0306

SUBJECT: Request for Additional Information Specific to the Existing Environment and Cultural Resources Sections of the Idaho High Level Waste and Facility Disposition Environmental Impact Statement (HLW EIS) (ARM-PA-099-010)

Dear Chairman Tinno:

The subject EIS analyzes alternatives for the treatment and management of high level waste, liquid sodium bearing waste, and the disposition (closure, decontamination and disposal) of associated treatment and storage facilities. Under the alternatives being analyzed, except for transportation, all actions that take place in Idaho would occur within or near the Idaho Nuclear Technology Engineering Center, formerly known as the Idaho Chemical Processing Plant, within the boundaries of the Idaho National Engineering and Environmental Laboratory (INEEL). This EIS is currently in preliminary draft form and is being reviewed internally.

Our schedule is to issue the Draft EIS for public review and comment by April 30, 1999. To date, the Shoshone-Bannock Tribes have been involved in providing input and review of the sections of the EIS identified above. In order to assure accuracy and completeness in this document, I am requesting that the Tribes review our incorporation of the comments and work they have provided and our use of other work that has been done to date in the preparation of this EIS. It is also requested that the Tribes identify any additional information or documents we may need to incorporate or reference in the EIS or enter into the Administrative Record. Our intent is that the EIS accurately reflect the interests, concerns and intentions of the Shoshone-Bannock Tribes. The Tribes' comments and contributions are important. With this in mind we are providing the internal review version of the existing environment section for your review. To the extent practicable, we will incorporate your comments and any new information into the Draft EIS before it is made available for public review. The Tribes will have additional opportunity for review, to comment, and to provide input during the public comment period on the Draft EIS. Information or comments submitted on the Draft EIS during the public comment period will be incorporated or responses will be prepared and published in the Final EIS. Additions, corrections or inclusions, that are necessary, should be provided to me by March 5, 1999. If you have any questions, or require any additional information, please contact Bob Pence, our DOE-Idaho American Indian Program Manager at (208) 526-6518 or myself at (208) 526-0776.

Sincerely,

Roger Twitchell

Roger Twitchell
National Environmental Policy Act
Compliance Officer

enclosure

cc: Robert Bobo, Tribal/DOE Director
Diana Yupe, Heritage Tribal Office

Figure 6-6. Consultation letter to the Shoshone-Bannock Tribes.

interests, concerns, and intentions were accurately reflected. On April 22, 1999, the Director of the Tribes' DOE Office indicated in a phone message that neither he nor the Heritage Tribal Office had any comments.

In a letter dated March 1, 1999, shown in Figure 6-7, DOE-ID notified the State Historic Preservation Officer that DOE would be issuing this draft EIS. The letter stated that prior to the initiation of any activities that might affect cultural resources, DOE intended to consult under Section 106 of the National Historic Preservation Act.

6.2 Pertinent Federal and State Statutes, Regulations, and Restrictions

This section identifies and summarizes the major statutes (both state and Federal), regulations, executive orders, and DOE Orders that may apply to the proposed action and alternatives at INEEL. This section also provides information concerning DOE's compliance with these requirements.

Department of Energy
Idaho Operations Office
850 Energy Drive
Idaho Falls, Idaho 83401-1563

March 1, 1999

Dr. Robert M. Yohe II
State Historic Preservation Officer
State Historic Preservation Office
210 Main Street
Boise, ID 83702

SUBJECT: Draft Idaho High Level Waste and Facilities Disposition Environmental Impact Statement (OPE-EP&SA-99-042)

Dear Dr. Yohe:

The Department of Energy Idaho Operations Office (DOE-ID), is planning to issue for public review and comment a draft Environmental Impact Statement (EIS) for high-level waste management activities. The title of the document is the "Idaho High Level Waste and Facilities Disposition EIS". This EIS is based on five waste processing alternatives with activities ranging from new construction, building and infrastructure modification, to closure and demolition.

Most of the activities proposed under the five alternatives would take place within the perimeter security fence at the Idaho Nuclear Technology and Engineering Center (INTEC), formerly the Idaho Chemical Processing Plant (ICPP). This area has been highly altered by development and dedicated to industrial use for nearly 50 years. Though no previously undisturbed land would be developed, DOE-ID has assessed potential direct and indirect impacts to INEEL cultural resources under each of the alternatives.

Prior to initiation of any activities that may have an impact on cultural resources, DOE-ID intends to consult with your office as required by Section 106 of the National Historic Preservation Act. In the event such impacts will be adverse, a Memoranda of Agreement that contains stipulations to mitigate such impacts will be drafted in consultation with your office.

This letter is to notify you of the impending draft EIS, DOE-ID's intent to consult with your office as necessary, and to request your written acknowledgement of this intent.

Please contact me at (208) 526-1122 if you have any questions or concerns.

Sincerely,

Robert A. Starck
Cultural Resources Coordinator

cc: Diana Yupe, Shoshone-Bannock Tribes, HeTO

Figure 6-7. Consultation letter to the State Historic Preservation Office.

View of the Tetons from the State of Idaho.

6.2.1 PLANNING AND CONSULTATION REQUIREMENTS

National Environmental Policy Act of 1969, as amended (42 USC 4321 et seq.), – The National Environmental Policy Act requires agencies of the Federal Government to prepare EISs on potential impacts of proposed major Federal actions that may significantly affect the quality of the human environment.

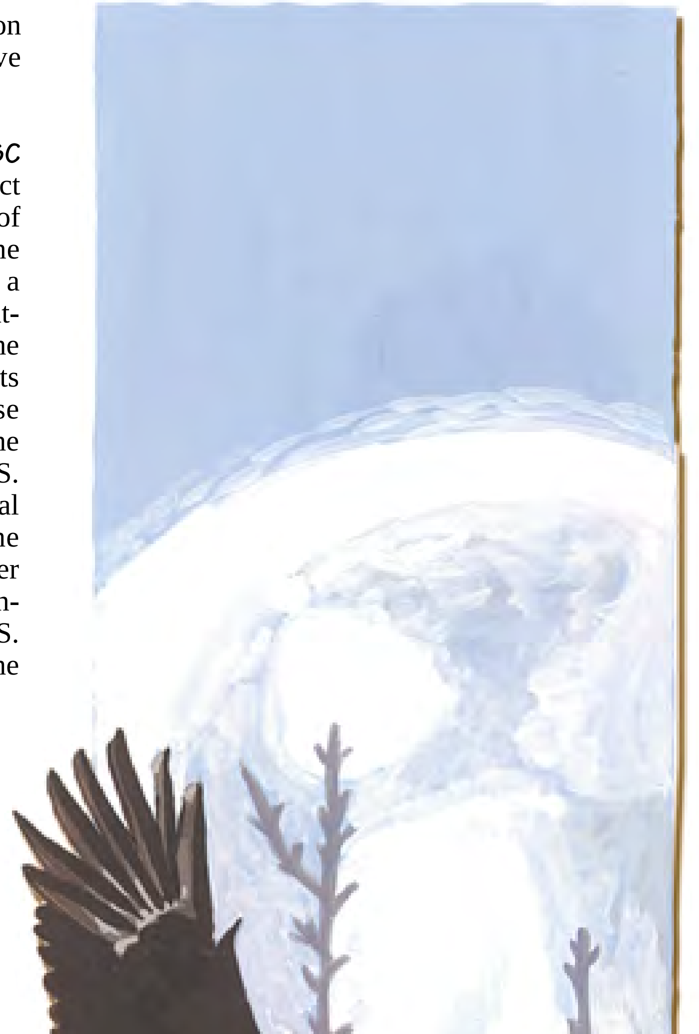
DOE has prepared this EIS in accordance with the requirements of the National Environmental Policy Act as implemented by Council on Environmental Quality regulations (40 CFR Parts 1500 through 1508) and DOE National Environmental Policy Act regulations (10 CFR Part 1021).

Executive Order 11514, National Environmental Policy Act, Protection and Enhancement of Environmental Quality – This Order directs Federal agencies to monitor and control their activities continually to protect and enhance the quality of the environment. The Order also requires the development of procedures both to ensure the fullest practicable provision of timely public information and understanding of Federal plans and programs with environmental impacts, and to obtain the views of interested parties.

American Indian Religious Freedom Act of 1978 (42 USC 1996) – The American Indian Religious Freedom Act reaffirms Native American religious freedom under the First Amendment and establishes policy to protect and preserve the inherent and constitutional right of Native Americans to believe, express and exercise their traditional religions. This law ensures the protection of sacred locations and access of Native Americans to those sacred locations and traditional resources that are integral to the practice of their religions. Further, it establishes requirements that would apply to Native American sacred locations, traditional religious practices potentially affected by the construction and operation of any alternatives analyzed in this EIS.

Native American Graves Protection and Repatriation Act of 1990 (25 USC 3001) – The Native American Graves Protection and Repatriation Act directs the Secretary of the Interior to guide the repatriation of Federal archaeological collections and collections that are culturally affiliated with Native American tribes and held by museums that receive Federal funding. Major actions to be taken under this law include (1) the establishment of a review committee with monitoring and policymaking responsibilities, (2) the development of regulations for repatriation, including procedures for identifying lineal descent or cultural affiliation needed for claims, (3) the oversight of museum programs designed to meet the inventory requirements and deadlines of this law, and (4) the development of procedures to handle unexpected discoveries of graves or grave goods during activities on Federal or tribal land. The provisions of the Act would be invoked if any excavations associated with the selected action led to unexpected discoveries of Native American graves or grave artifacts.

Endangered Species Act, as amended (16 USC 1531 *et seq.*) – The Endangered Species Act provides a program for the conservation of threatened and endangered species and the ecosystems on which those species rely. If a proposed action could adversely affect threatened or endangered species or their habitat, the Federal agency must assess the potential impacts and develop measures to minimize those impacts. The agency then must consult with the U.S. Fish and Wildlife Service (part of the U.S. Department of the Interior) and the National Marine Fisheries Service (part of the Department of Commerce), as required under Section 7 of the Act. The outcome of this consultation may be a biological opinion by the U.S. Fish and Wildlife Service or the National Marine Fisheries Service that states whether the proposed action would jeopardize the continued existence of the species under consideration. If there is non-jeopardy opinion, but if some individuals might be killed incidentally as a result of the proposed action, the Services can determine that such losses are not prohibited as long as measures outlined by the Services are followed. Regulations implementing the Endangered Species Act are codified at 50 CFR Part 15 and 402. For this EIS, DOE consulted with the U.S. Fish and Wildlife Service regarding impacts on any species listed under the Endangered Species Act. The outcome of this consultation was the U.S. Fish and Wildlife Service's determination that the project was unlikely to adversely impact any listed species (see Figures 6-3 and 6-5).



National Historic Preservation Act, as amended (16 USC 470 *et seq.*) – The National Historic Preservation Act provides for the placement of sites with significant national historic value on the *National Register of Historic Places*. It requires no permits or certifications. DOE would evaluate activities associated with the selected action to determine if they would affect historic resources. If required after this evaluation, the Department would consult with the Advisory Council on Historic Preservation and the Idaho State Historic Preservation

Officer. Such consultations generally result in the development of an agreement that includes stipulations to be followed to minimize or mitigate potential adverse impacts to a historic resource. DOE has notified the State Historic Preservation Office of its intent to consult on this project. Executive Order 11593 provides further guidance to Federal agencies on implementing this Act.

Archaeological Resources Protection Act, as amended (16 USC 470aa *et seq.*) – The Archaeological Resources Protection Act requires a permit for excavation or removal of archaeological resources from publicly held or Native American lands. Excavations must further archaeological knowledge in the public interest, and the resources removed are to remain the property of the United States. Requirements of the Archaeological Resources Protection Act would apply to any excavation activities that resulted in identification of archaeological resources.

Executive and DOE Orders – Executive Orders and DOE Orders to be considered in planning a Federal action include the following:

- **Executive Order 12088 [Federal Compliance with Pollution Control Standards (October 13, 1978), as amended by Executive Order 12580 (January 23, 1987)] –** This Order generally directs federal agencies 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, and Resource Conservation and Recovery Act. Compliance with these orders, as applicable, would be required for a range of DOE activities associated with the proposed action and alternatives.

- **Executive Order 12898 (Environmental Justice) –** This Order directs Federal agencies, to the extent practicable, to make the achievement of environmental justice part of their mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of their programs, policies, and activities on minority and low-income populations in the United States and its territories and possessions. The order provides that the Federal agency responsibilities it establishes are to apply equally to Native American programs.

- **Executive Order 13045 (Protection of Children from Environmental Health Risks and Safety Risks) –** Because of the growing body of scientific knowledge that demonstrate that children may suffer disproportionately from environmental health and safety risks, Executive Order 13045 directs each Federal agency to make it a high priority to identify and assess environmental health and safety risks that may disproportionately affect children.

- **Executive Order 12699 (Seismic Safety) –** This Order requires Federal agencies to reduce risks to the lives of occupants of buildings owned, leased, or purchased by the Federal Government or buildings constructed with Federal assistance and to persons who would be affected by failures of Federal buildings in earthquakes, to improve the capability of existing Federal buildings to function during or after an earthquake, and to reduce earthquake losses of public buildings, all in a cost-effective manner. Each Federal agency responsible for the design and construction of a Federal building shall ensure that the building is designed and constructed in accordance with appropriate seismic design and construction standards.

- **DOE Order 5400.1 (General Environmental Protection Program) –** This Order establishes environmental protection program requirements, authorities, and responsibilities for DOE operations for ensuring compliance with applicable Federal, state, and local environmental protection laws and regulations as well as internal DOE policies.

Future Coordination and Consultation Activities. Activities proposed in this EIS might result in the unlikely situation where unexpected cultural resources are found and could be impacted adversely. Should that occur, additional consultation and coordination would take place prior to any actions being carried out. Likewise, there are actions analyzed in this EIS that require ongoing coordination between DOE, the State of Idaho, and EPA with regard to environmental restoration and facility disposition at INTEC. Where applicable, in accordance with the 1994 Secretarial Policy on the National Environmental Policy Act, documentation prepared for CERCLA activities at INTEC will incorporate the National Environmental Policy Act values as practical. The combined impacts of facility disposition under the alternatives analyzed in this EIS and the residual impacts of the CERCLA remedial actions at INTEC are analyzed in the Cumulative Impacts Section (Section 5.4) of this EIS.

6.2.2 RADIOACTIVE MATERIALS AND REPOSITORIES

Atomic Energy Act of 1954, as amended (42 USC 2011 *et seq.*) – The Atomic Energy Act, as amended, provides fundamental jurisdictional authority to DOE and the Nuclear Regulatory Commission over governmental and commercial use of nuclear materials. The Atomic Energy Act ensures proper management, production, possession, and use of radioactive materials. It gives the Nuclear Regulatory Commission specific authority to regulate the possession, transfer, storage, and disposal of nuclear materials, as well as aspects of transportation packaging design requirements for radioactive materials, including testing for packaging certification. Commission regulations applicable to the transportation of radioactive materials (10 CFR Part 71 and 73) require that shipping casks meet specified performance criteria under both normal transport and hypothetical accident conditions.

The Atomic Energy Act provides DOE the authority to develop generally applicable standards for protecting the environment from radioactive materials. In accordance with the Atomic Energy Act, DOE has established a system of requirements that it has issued as DOE Orders.

DOE Orders and regulations issued under authority of the Atomic Energy Act include the following:

- **DOE Order 435.1 (Radioactive Waste Management) –** This Order and its associated Manual and Guidance establish authorities, responsibilities, and requirements for the management of DOE HLW, transuranic waste, low-level waste, and the radioactive component of mixed waste. Those documents provide detailed HLW management requirements including waste incidental to reprocessing determinations; waste characterizations, certification, storage, treatment, and disposal; and HLW facility design and closure.

- **DOE Order 440.1A (Worker Protection Management for DOE Federal and Contractor Employees) –** This Order establishes the framework for an effective worker protection program that will reduce or prevent injuries, illnesses, and accidental losses by providing DOE Federal and contractor workers with a safe and healthful workplace.

- **DOE Order 5400.5 (Radiation Protection of the Public and the Environment) –** This Order establishes standards and requirements for 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 also codified in the proposed 10 CFR Part 834, Radiation Protection of the Public and the Environment.

- **DOE Order 414.1 (Quality Assurance) –** This Order sets forth 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.

Nuclear Waste Policy Act of 1982, as amended (42 USC 10101, *et seq.*) – The Nuclear Waste Policy Act directs the EPA to promulgate generally applicable standards for protection of the environment from offsite releases from radioactive material in repositories. It also requires the Nuclear Regulatory Commission to consider and approve or disapprove an application (if DOE submits one) for authorization to construct a repository and for a license to receive and possess spent nuclear fuel and high-level radioactive waste in a repository. The Nuclear Regulatory Commission licensing requirements, found at 10 CFR 60, contain criteria governing the issuance of a construction authorization and license for a geologic repository. The Nuclear Regulatory Commission regulations at 10 CFR 51.67 establish the basic requirements for DOE's EIS that will be used in its geologic repository license application. In addition, the Nuclear Waste Policy Act directs DOE to characterize and evaluate the suitability of the Yucca Mountain site as a potential geologic repository for the disposal of spent nuclear fuel and HLW. After considering the suitability of the site and other information, the Secretary may then recommend approval of the site to the President.

Energy Policy Act of 1992 (P.L 102-486) – Section 801 (a) of the Energy Policy Act of 1992 directed the Environmental Protection Agency (1) to retain the National Academy of Sciences to make findings and recommendations on reasonable public health and safety standards for a geologic repository, and (2) to establish specific standards based on and consistent with these findings and recommendations. The DOE repository design must meet Nuclear Regulatory Commission requirements for demonstrating compliance with EPA standards. The National Academy of Sciences issued its findings and recommendations in a 1995 report (National Research Council 1995). When EPA establishes its final standards, it will place them in the Code of Federal Regulations, probably at 40 CFR Part 197.

Section 801 (b) of the Energy Policy Act directs the Nuclear Regulatory Commission to revise its general technical requirements and criteria for geologic repositories (10 CFR Part 60) to be consistent with the standard established by the EPA. In February 1999, the Nuclear Regulatory Commission issued draft site-specific technical requirements and criteria (proposed 10 CFR Part 63). When finalized, the Commission would use these requirements and criteria in their final forms to approve or disapprove an application to construct a repository to receive and possess spent nuclear fuel at such a repository, and to close and decommission such a repository.

Waste Isolation Pilot Plant Land Withdrawal Act (P.L. 102-579) and the Waste Isolation Pilot Plant Land Withdrawal Act Amendments (P.L. 104-201) – The Waste Isolation Pilot Plant Land Withdrawal Act withdrew land from the public domain for the purposes of creating and operating the Waste Isolation Pilot Plant, the geologic repository in New Mexico designated as the national disposal site for defense transuranic waste. In addition to establishing the location for the facility, the Land Withdrawal Act also defines the characteristics and amount of waste that will be disposed of at the facility. The Amendments to the Waste Isolation Pilot Plant Land Withdrawal Act exempt waste to be disposed of at the Waste Isolation Pilot Plant from the Resource Conservation and Recovery Act land disposal restrictions. Any waste sent to the Waste Isolation Pilot Plant would have to comply with the document *Waste Acceptance Criteria for the Waste Isolation Pilot Plant* (DOE 1996).

10 CFR Part 61 – The regulations in 10 CFR Part 61 establish, for land disposal of low-level radioactive waste, the procedure, criteria, and terms and conditions upon which the Nuclear Regulatory Commission issues licenses for the disposal of radioactive waste containing byproduct, source, and special nuclear material. These regulations do not apply to HLW but do apply to low-level waste designated as Class A, Class B, and Class C radioactive waste. Disposal facilities for radioactive waste other than DOE-regulated facilities would have to obtain a Nuclear Regulatory Commission or agreement state license and comply with these regulations.

Proposed 10 CFR Part 63 – These regulations would contain the site-specific technical criteria for the licensing and operation of the repository at Yucca Mountain. The Nuclear Regulatory Commission is proposing that 10 CFR Part 63 would apply only to the repository at Yucca Mountain and that the existing generic regulations at 10 CFR 60 would remain in place and would not apply to the repository at Yucca Mountain.

Proposed 40 CFR Part 197 - These regulations would contain site-specific public health and safety standards governing storage or disposal of radioactive material within the proposed repository at Yucca Mountain.

Permits or Licenses Required – Any repository for HLW sited under the Nuclear Waste Policy Act would be required to be licensed by the Nuclear Regulatory Commission. DOE-managed activities currently taking place at a DOE-owned facility do not require a permit or license from the Nuclear Regulatory Commission. Nuclear Regulatory Commission licensing is also required for the containers in which waste will be shipped to a repository. Cask development and testing activities have been ongoing at the national level to support a licensing determination.

6.2.3 AIR QUALITY PROTECTION AND NOISE

Clean Air Act, as amended (42 USC 7401 et seq.) – The Clean Air Act 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 Act requires Federal agencies such as DOE, with jurisdiction over any property or facility that might result in the discharge of air pollutants, to comply with "all Federal, state, interstate, and local requirements" related to the control and abatement of air pollution.

The Clean Air Act requires the EPA to establish National Ambient Air Quality Standards to protect public health, with an adequate margin of safety, from any known or anticipated adverse effects of a regulated pollutant (42 USC 7409). It also requires the establishment of national standards of performance for new or modified stationary sources of atmospheric pollutants (42 USC 7411) and the evaluation of specific emission increases to prevent a significant deterioration in air quality (42 USC 7470). In addition, the Clean Air Act regulates emissions of hazardous air pollutants, including radionuclides, through the National Emission Standards for Hazardous Air Pollutants program (40 CFR Parts 61 and 63). Air emission standards are established at 40 CFR Parts 50 through 99. The following describes four key aspects of the Clean Air Act.

- **Prevention of Significant Deterioration –** Prevention of Significant Deterioration, as defined by the Clean Air Act, applies to major stationary sources and is designed to permanently limit the degradation of air quality from specific pollutants in areas that meet attainment standards. The Prevention of Significant Deterioration regulations apply to new construction and to major modifications made to stationary sources. A major modification is defined as a net increase in emissions beyond thresholds listed at 40 CFR 51.166(b)(23) and IDAPA 16.01.01 Section 581. Construction or modifications of facilities that fall under this classification are subject to a preconstruction review and permitting under the program that is outlined in the Clean Air Act. In order to receive approval, DOE must show that the source (1) will comply with ambient air quality levels designed to prevent deterioration of air quality, (2) will employ "best available control technology" for each pollutant regulated under the Clean Air Act that will emit significant amounts, and (3) will not adversely affect visibility.

- **Title V Operating Permit –** Congress amended the Clean Air Act in 1990 to include requirements for a comprehensive operating permit program. Title V of the 1990 amendments requires EPA to develop a Federally enforceable operating permit program for air pollution sources to be administered by the state and/or local air pollution agencies. The purpose of this permit program is to consolidate in a single document all of the Federal and state regulations applicable to a source, in order to facilitate source compliance and enforcement. The EPA promulgated regulations at Section 107 and 110 of the Clean Air Act that define the requirements for state programs.

- **Hazardous Air Pollutants –** Hazardous air pollutants are substances that may cause health and environmental effects at low concentrations. Currently, 189 compounds have been identified as hazardous air pollutants. A major source is defined as any stationary source, or a group of stationary sources located within a contiguous area under common control, that emits or has the potential to emit at least 10 tons per year of any single hazardous air pollutant or 25 tons per year of a combination of pollutants.

  The 1990 amendments to the Clean Air Act substantially revised the program to regulate potential emissions of hazardous air pollutants. The aim of the new control program is to require state-of-the-art pollution control technology on most existing and all new emission sources. These provisions regulate emissions by promulgating emissions limits reflecting use of the maximum achievable control technology. These emission limits are then incorporated into a facility's operating permit.

- **National Emission Standards for Hazardous Air Pollutants for Radionuclides –** Radionuclide emissions other than radon from DOE facilities are also covered under the National Emission Standards for Hazardous Air Pollutants program (40 CFR 61.90-97). To determine compliance with the standard, an effective dose equivalent value for the maximally exposed members of the public is calculated using EPA-approved sampling procedures, computer models, or other EPA-approved procedures.

  Any fabrication, erection, or installation of a new building or structure within a facility that emits pollutants in excess of 0.1 millirem per year would require that an application be submitted to EPA. This application must include the name of the applicant, the location or proposed location of the source, and technical information describing the source. If the application is for a modification of an existing facility, information provided to EPA must include the precise nature of the proposed changes, the productive capacity of the source before and after the changes are completed, and calculations of estimates of emissions before and after the changes are completed.

Responsibilities for Regulation of Air Quality – Under EPA regulations, the State of 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), to enforce performance standards for new stationary sources, and to issue permits to operate. The State of Idaho also administers a permit program that regulates sources that are too small to qualify as a major source under Prevention of Significant Deterioration. To date, the State of Idaho does not have authority delegated from EPA to administer the National Emission Standards for Hazardous Air Pollutants program regulating emissions of radionuclides at DOE facilities, so that authority remains with EPA (40 CFR 61.90 through 61.97). In addition to radionuclides, the National Emission Standards for Hazardous Air Pollutants program includes a limit for asbestos during demolition and renovation activities (40 CFR 61.145) that is likely to be important to the facility disposition alternatives considered in this EIS.

Noise Control Act of 1972 (42 U.S.S. 4901 *et seq.*) – Section 4 of the Noise Control Act directs Federal agencies to carry out programs in their jurisdictions "to the fullest extent within their authority" and in a manner that furthers a national policy of promoting an environment free from noise that jeopardizes health and welfare. This law provides requirements related to noise that would be generated by construction, operation, or closure activities associated with the proposed action and alternatives.

Permits or Approvals Required – Several of the activities under this EIS would involve construction of a source of air emissions. DOE would need to obtain a permit to construct and would need to conduct a National Emission Standards for Hazardous Air Pollutants review prior to commencing construction. New facilities would also be required to be included in the Title V Operating Permit after construction and start up. In addition, INEEL is located 33 miles from Craters of the Moon, a national monument. Within the boundaries of this national monument is a wilderness area, which could trigger additional and more stringent air quality protection. The State air quality rules provide for additional opportunities for the Federal land manager of Craters of the Moon to review any applications for a permit to construct under the Prevention of Significant Deterioration program.

6.2.4 WATER QUALITY PROTECTION

The Clean Water Act as amended (33 USC 1251 *et seq.*) – The purpose of the Clean Water Act, which amended the Federal Water Pollution Control Act, is to "restore and maintain the chemical, physical, and biological integrity of the Nation's water." The Clean Water Acts prohibits the "discharge of toxic pollutants in toxic amounts" to navigable waters of the United States. Section 313 of the Act generally requires all departments and agencies 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.

Under the Clean Water Act, states generally set water quality standards, and EPA or states regulate and issue permits for point-source discharges as part of the National Pollutant Discharge Elimination System permitting program. In Idaho, EPA is responsible for issuing these permits. EPA regulations for this program are codified at 40 CFR Part 122. If the construction or operation of the selected action would result in point-source discharges, DOE could need to obtain a National Pollutant Discharge Elimination System permit from the EPA.

Section 401 and 405 of the Water Quality Act of 1987 added Section 402(p) to the Clean Water Act. Section 402(p) requires the EPA to establish regulations for the Agency or individual states to issue permits for stormwater discharges associated with industrial activity, including construction activities that could disturb five or more acres (40 CFR Part 122). The EPA administers these permits in Idaho.

Construction of new facilities or modifications to existing facilities at INTEC will require the development of written stormwater discharge plans that conform to requirements of the existing discharge permit that has

been issued for INEEL. The INEEL discharge permit will then need to be appended to include the additional or modified facilities.

The Clean Water Act at 33 USC 1313 directs states to formulate programs to address water quality and avoid pollution from non-point sources. Idaho Water Quality Standards and Wastewater Treatment Requirements and Wastewater Land Application Permit Regulations Provisions (IDAPA 16.01.02) require protection of designated water uses and the establishment of water quality standards that will protect those uses. The State of Idaho has established groundwater quality standards and is enforcing them under state authority (IDAPA 16.01.11). The State of Idaho requires a wastewater land application permit for the treatment, by land application, of municipal and industrial wastewaters. A permit application must be submitted to the State at least 180 days prior to the day on which the land application of wastewater is to begin.

Safe Drinking Water Act, as amended (42 USC 300(f) *et seq.*) – The primary objective of the Safe Drinking Water Act is to protect the quality of water supplies. This law grants EPA the authority to protect quality of public drinking water supplies by establishing national primary drinking water regulations. In accordance with the Safe Drinking Water Act, the EPA has delegated authority for enforcement of drinking water standards to the states. Regulations (40 CFR Part 123, 141, 145, 147, and 149) specify maximum contaminant levels, including those for radioactivity, in public water systems, which are generally defined as systems that serve at least 15 service connections or regularly serve at least 25 year-round residents.

The Safe Drinking Water Act also authorizes EPA to regulate the underground injection of waste and other contaminants into wells. The Agency has codified its regulations at 40 CFR Part 144. The proposed action or alternatives would not involve underground injection.

The State of Idaho has received authorization from EPA to implement the public drinking water system program and the underground injection control program under the Safe Drinking Water Act. The Idaho Regulations for Public Drinking Water Systems (IDAPA 16.01.08) set forth maximum contaminant levels for public drinking water systems. The Division of Environmental Quality, as a subdivision of the Idaho Department of Health and Welfare, sets forth monitoring and reporting requirements for inorganic and organic chemicals, and radiochemicals.

The Safe Drinking Water Act also provides for designation of aquifers to be protected from degradation due to their importance as the sole source of drinking water. The Snake River Plain aquifer underlying INEEL has been designated as a sole source aquifer by EPA (40 FR 100-109, October 7, 1991) because groundwater supplies 100 percent of the drinking water consumed within the Eastern Snake River Plain and an alternative source or sources is not available.

Executive Orders 11988 (Floodplain Management) and 11990 (Protection of Wetlands) – Executive Order 11988 directs federal agencies to establish procedures to ensure that any Federal action taken in a floodplain considers the potential effects of flood hazards and floodplain management and avoids floodplain impacts to the extent practicable.

Executive Order 11990 directs Federal agencies to avoid new construction in wetlands unless there is no practicable alternative and unless the proposed action includes all practicable measures to minimize harm to wetlands that might result from such use. DOE requirements for compliance with floodplain and wetlands activity are codified at 10 CFR 1022.

Compliance and Floodplain/Wetland Environmental Review Requirements (10 CFR 1022) – Federal regulations (10 CFR Part 1022) establish policy and procedures for discharging DOE responsibilities regarding the consideration of floodplain/wetlands factors in DOE planning and decisionmaking. These regulations also establish DOE procedures for identifying proposed actions located in floodplains, providing opportunity for early public review of such proposed actions, preparing floodplain assessments, and issuing statements of findings for actions in a floodplain. The rules apply to all DOE proposed floodplain actions.

If DOE determines that an action it proposes would take place wholly or partly in a floodplain, it is required to prepare a notice of floodplain involvement and a floodplain assessment containing a project description, a discussion of floodplain effects, alternatives, and mitigations. For a proposed floodplain action for which a National Environmental Policy Act document such as an environmental impact statement or an environmental assessment is required, DOE is to include the floodplain assessment in the document. For floodplain actions for which DOE does not have to prepare such a document, the Department is to issue a separate document as the floodplain assessment. After the conclusion of public comment, DOE is to reevaluate the practicability of alternatives and of mitigation measures, considering all substantive comments.

If it is found that no practicable alternative to locating in the floodplain is available, DOE must design or modify its action to minimize potential harm to and within the floodplain. For actions in a floodplain, DOE must publish a statement of findings of three pages or less containing a brief description of proposed action, a location map, an explanation indicating the reason for locating the action in the floodplain, a list of alternatives considered, a statement indicating whether the action conforms to applicable State or local floodplain protection standards, and a brief description of steps DOE will take to minimize potential harm to or within the floodplain. For floodplain actions that require the preparation of an EIS, the Final EIS can incorporate the statement of findings. Before implementing a proposed floodplain action, DOE must endeavor to allow at least 15 days of public review of the statement of findings.

This draft EIS addresses whether parts of INTEC are located in flood prone areas and specifically seeks comment on this issue. If DOE determines that the proposed action will take place in a floodplain, DOE will follow the requirements of 10 CFR 1022.

Permits Required – The existing INTEC Stormwater Pollution Prevention Plan required as part of the National Pollutant Discharge Elimination System permit program might need to be revised to reflect any new construction activities.

6.2.5 CONTROL OF POLLUTION

Resource Conservation and Recovery Act (RCRA), as amended (42 USC 6901 *et seq.*) – RCRA regulates the treatment, storage, and disposal of hazardous wastes. The EPA regulations implementing RCRA are found in 40 CFR Parts 260-280. These regulations define hazardous wastes and specify hazardous waste transportation, handling, treatment, storage, and disposal requirements. For purposes of the Idaho HLW & FD EIS, this set of laws is very significant, regardless of which alternative is chosen by DOE. All alternatives under consideration in this EIS involve some sort of RCRA regulation. Also noteworthy is that this area of the law deals with two different approaches to regulation. First, RCRA regulates the wastes themselves and sets standards for waste forms that may be disposed of. Second, RCRA regulates the design and operation of the waste management facilities and establishes standards for their performance.

EPA defines waste that exhibits the characteristics of ignitability, corrosivity, reactivity, or toxicity as “characteristic” hazardous waste. EPA has also identified certain materials as hazardous waste by listing them in the RCRA regulations. These materials are referred to as “listed” hazardous waste. “Mixed waste” is radioactively contaminated hazardous waste. The definition of “solid waste” in RCRA specifically excludes the radiological component (source, special nuclear, or byproduct material as defined by the Atomic Energy Act). As a result, mixed waste is regulated under multiple authorities: by RCRA, as implemented by EPA or authorized states for the hazardous waste components; and by the Atomic Energy Act for radiological components as implemented by either DOE or the Nuclear Regulatory Commission.

RCRA applies mainly to active facilities that generate and manage hazardous waste. This law imposed management requirements on generators and transporters of hazardous waste and upon owners and operators of treatment, storage, and disposal facilities. EPA has established a comprehensive set of regulations governing all aspects of treatment, storage, and disposal facilities, including location, design, operation, and closure. A facility is regulated as a “treatment facility” if the operator uses any process that is designed to change the physical, chemical, or biological character, or the composition of any waste. Storage means the holding of hazardous waste for a temporary period, at the end of which, the waste is treated, disposed of, or stored elsewhere. A facility that stores hazardous waste is subject to different types of storage requirements based upon the amount and toxicity of the hazardous waste as well as the time of storage. A "disposal facility" is a facility at which hazardous waste is intentionally placed and will remain after closure. The owner and operator of a new treatment, storage, of disposal facility must obtain a RCRA permit. RCRA requires every owner/operator of an existing facility to obtain a permit or close.

Key issues under RCRA that affect this EIS are as follows:

- **RCRA Permits -** In order for a facility to be granted a RCRA permit, it must submit a RCRA Part A and B application. The RCRA Part A application is a short form to provide basic information about the facility, such as name, location, description of processes used for treating, storing, and disposing of hazardous wastes, a topographical map of the facility site, and an indication if the facility is new or existing. Submission of the Part A application allows an existing facility to continue to operate under interim status until the Part B application is submitted and approved.

  Interim status is the period of operation for existing facilities until the RCRA permitting process is complete or the facility is closed. The design and operating standards for interim status facilities are largely equivalent to those for permitted facilities. This EIS analyzes new facilities that will be permitted under RCRA and existing facilities that are operating under interim status. Facilities that are operating under interim status, such as the New Waste Calcining Facility, bin sets, and the Process Equipment Waste Evaporator, may be required to obtain a RCRA permit or be shut down.

  A RCRA Part B application requires comprehensive and detailed information to demonstrate compliance with the applicable technical standards for treatment, storage, and disposal facilities. The Part B application includes specific waste management plans and procedures mandated by 40 CFR 270.14 and outlined in 40 CFR 264. The final RCRA permit governs the application of those standards (which include operation, management, emergency, and closure procedures) to the particular facility. The hazardous waste regulations that establish the requirements for obtaining RCRA permits are published in 40 CFR 270. The State of Idaho is authorized by EPA to administer its own RCRA program and is responsible for reviewing applications and issuing permits.

  Treatment or disposal activities at other sites may require RCRA permits or approvals. The states of Nevada, Washington, and New Mexico carry out programs similar to Idaho's in which the federal requirements are enforced under state law. Therefore, any hazardous waste management activities taking place in other states as a result of implementing one of the alternatives would be subject to the hazardous waste requirements of that particular state.

- **Listed Hazardous Waste and the Delisting Process -** Listed hazardous waste remains hazardous waste to be managed under RCRA even after treatment. Delisting is EPA's designated method to exclude a listed waste from the hazardous waste regulations under RCRA. This method is defined under 40 CFR 260.22. The basic premise for delisting is to demonstrate that listed wastes, residues resulting from the treatment of listed wastes, or mixtures containing listed wastes will not pose a hazard to human health or the environment under a reasonable worst-case management scenario. For a waste to be excluded, it must not meet the criteria for which it was listed, exhibit any hazardous characteristics, or exhibit any additional factors, including additional constituents, which may cause the waste to be hazardous.

Different types of delisting exclusions may be granted (standard, conditional, or upfront) depending on the variability of the waste and whether the waste already exists or has not yet been generated. In 1995, EPA delegated the Federal delisting program to its regional offices. In addition to the regional offices, the State of Idaho and approximately 18 other states have received EPA authorization to administer a delisting program.

- **Land Disposal Restrictions and Determination of Equivalent Treatment** - The Hazardous and Solid Waste Amendments of 1984 added provisions to RCRA to prohibit the land disposal of untreated hazardous wastes. These restrictions are intended to minimize reliance on land disposal of untreated hazardous wastes and to require advanced treatment and recycling of wastes. The RCRA land disposal restrictions require that hazardous waste be treated to meet applicable standards set forth in 40 CFR 268 prior to disposal. The standards may consist of required treatment technologies or concentration levels that must be achieved for hazardous constituents. Characteristic hazardous wastes (e.g., corrosive or toxic) must generally be "decharacterized" (treated to no longer exhibit the hazardous characteristic). Once hazardous waste is treated in accordance with the applicable treatment standards, it may be disposed of under applicable requirements.

  In 1990, EPA established several treatment standards specific to mixed wastes (i.e., waste that contains hazardous waste and source, special nuclear, or byproduct material subject to the Atomic Energy Act). These standards include vitrification of mixed HLW exhibiting the hazardous characteristics of corrosivity and toxicity for certain metals. Vitrification and other treatment technologies are evaluated in this EIS to treat INEEL mixed HLW. If DOE elects to use a treatment technology other than vitrification for mixed HLW, it will be necessary to obtain a "determination of equivalent treatment" under RCRA [40 CFR 268.42(b)]. This determination will require that DOE demonstrate that the alternative technology (e.g., hot isostatic press, hydroceramic cement) achieves performance equivalent to that of vitrification. DOE would be required to demonstrate that the alternative treatment is in compliance with Federal, state, and local requirements and is protective of human health and the environment.

Idaho Hazardous Waste Management Act, Idaho Code 39-4400 et seq.; The Idaho Hazardous Waste Management Regulations, Idaho Department of Health and Welfare, Rules and Regulations (IDAPA 16.01.05) adopt the Federal regulations regarding hazardous waste rulemaking, hazardous waste delisting, and identification of wastes – The State of Idaho has been given authority from EPA to enact and carry out a hazardous waste program that enables the state to assume primacy over hazardous waste management in the State of Idaho. This includes authority to issue permits for treatment, storage, and disposal of hazardous waste. The Idaho regulations include requirements for hazardous waste generators, transporters, and management facilities as well as detailed procedures for permitting these activities. Under the state's law (Idaho Code 39-4404), regulations may not be promulgated that impose conditions or requirements more stringent or broader in scope than RCRA and the RCRA regulations of EPA.

Federal Facility Compliance Act (42 USC 6921 and 6961) – The Federal Facility Compliance Act amended RCRA in 1992 and requires DOE to prepare plans for developing treatment capacity for mixed wastes stored or generated at each facility. After consultation with other affected states, the host-state or EPA must approve each plan. The appropriate regulator must also issue an order requiring compliance with the plan.

DOE and the State of Idaho have an approved plan, known as the "Site Treatment Plan," and associated consent order. Some of the waste being analyzed in this EIS has been designated for treatment according to terms in the INEEL Site Treatment Plan. If DOE makes a decision based on this EIS that differs from that agreed to with the State of Idaho in the Site Treatment Plan, that Plan would be subject to renegotiation.

Notice of Noncompliance Consent Order – The EPA Notice of Noncompliance Consent Order (Monson 1992) addresses concerns regarding RCRA secondary containment requirements for the INEEL HLW tanks by prescribing dates by which they must be removed from service. In accordance with the Consent Order and an August 18, 1998 modification (Cory 1998), five of the tanks (known as pillar and panel tanks) must be removed from service on or before June 30, 2003 and the remaining tanks on or before December 31, 2012. A third modification to the Consent Order (Kelly 1999) further stipulates that DOE must place the calciner at the New Waste Calcining Facility in standby mode by June 1, 2000 unless, and until, the facility receives a hazardous waste permit for continued operation.

The Idaho Hazardous Waste Facility Siting Act (Idaho Code 39-5801 et seq.) – This act requires commercial facilities to obtain a hazardous waste facility siting license prior to commencing construction. A panel including representatives of the nearest community is convened to review and approve the siting application. This Act applies to commercial facilities; therefore, it would be applicable to any privatized facilities used for waste processing and facilities disposition.

The Idaho Solid Waste Management Regulations, (IDAPA 16.01.06) – These regulations provide standards for the management of non-hazardous solid wastes to minimize the detrimental effects of disposal. These state regulations could affect the activities under this EIS involving management of non-hazardous wastes.

Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended (42 USC 9601 et seq.) – CERCLA, as amended by the Superfund Amendments and Reauthorization Act, authorizes EPA to require responsible site owners, operators, arrangers, and transporters to clean up releases of hazardous substances, including certain radioactive substances. This Act applies to both the Federal government and to private citizens. Executive Order 12580 delegates to heads of executive departments and agencies the responsibility for undertaking remedial actions for releases or threatened releases at sites that are not on the National Priorities List and removal actions other than emergencies where the release is from any facility under the jurisdiction or control of executive departments or agencies.

Sites determined to have a certain level of risk to health or the environment are placed upon the National Priorities List so that their clean up can be scheduled and tracked to completion. INEEL was placed on the National Priorities List in 1989 due to confirmed releases of contaminants to the environment. Over 350 known and potential individual release sites have been identified at INEEL. In addition, there are over 300 contaminated facilities on INEEL. The three agencies involved in the cleanup of those sites are the State of Idaho, EPA, and DOE as the lead agency. These three agencies signed the Federal Facility Agreement and Consent Order in 1991 that outlines a process and schedule for conducting investigation and remediation activities at INEEL. To better manage the investigation and cleanup, the Agreement divides the INEEL into 10 "Waste Area Groups." INTEC is within Waste Area Group 3.

CERCLA also establishes an emergency response program in the event of a release or a threatened release to the environment. The Act includes requirements for reporting to Federal and state agencies releases of certain hazardous substances in excess of specified amounts. The requirements of the Act could apply to the proposed project in the event of a release of hazardous substances to the environment.

CERCLA also addresses damages for the injury, destruction, or loss of natural resources that are not or cannot be addressed through the remedial action. The Federal government, state governments, and Indian tribes are trustees of the natural resources that belong to, are managed by, or are otherwise controlled by those respective governing bodies. As trustees, they may assess damages and recover costs necessary to restore, replace, or acquire equivalent resources when there is injury to natural resources as a result of release of a hazardous substance.

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 the Emergency Planning and Community Right-to Know Act, Federal facilities, including those owned by DOE, must provide information on hazardous and toxic chemicals to state emergency response commissions, local emergency planning committees, and EPA. The goal of providing this information is to ensure that emergency plans are sufficient to respond to unplanned releases of hazardous substances. The required information includes inventories of specific chemicals used or stored and descriptions of releases that occur from sites. This law, implemented at 40 CFR Parts 302 through 372, requires agencies to provide material safety data sheet reports, emergency and hazardous chemical inventory reports, and toxic chemical release reports to appropriate local, state, and Federal agencies. DOE has been complying with the provisions of the Emergency Planning and Community Right-to-Know Act and with regulations for maintaining and using inventories of chemicals for site characterization activities. If the proposed action or alternative is implemented, DOE would continue to comply with such provisions, as applicable, in storing and using chemicals for project activities.

Executive Order 12856, Right to Know Laws and Pollution Prevention Requirements – This Order directs Federal agencies to reduce and report toxic chemicals entering any waste stream; improve emergency planning, response, and accident notification; and encourage the use of clean technologies and testing of innovative prevention technologies. In addition, the Order states that Federal agencies are persons for purposes of the Emergency Planning and Community Right-to-Know Act (SARA Title III), which requires agencies to meet the requirements of the Act. Compliance with these orders, as applicable, would be required for a range of DOE activities associated with the proposed action or alternatives.

Toxic Substances Control Act (15 USC 2601 *et seq.*) – The Toxic Substances Control Act provides EPA with the authority to require testing of both new and old chemical substances entering the environment and to regulate them where necessary. The Act also regulates the treatment, storage, and disposal of certain toxic substances not regulated by RCRA or other statutes, specifically polychlorinated biphenyls, chlorofluorocarbons, asbestos, dioxins, certain metal-working fluids, and hexavalent chromium. Some disposal activities under this Act might require a permit from EPA.

Hazardous Materials Transportation Act, 49 U.S.C. 1801 and Regulations – Federal law provides for uniform regulation of the transportation of hazardous and radioactive materials. Transport of hazardous and radioactive materials, substances, and wastes is governed by U.S. Department of Transportation, Nuclear Regulatory Commission, and EPA regulations. These regulations may be found in 49 CFR 100-178, 10 CFR 71, and 40 CFR 262, respectively.

U.S. Department of Transportation hazardous material regulations govern the hazard communication (marking, hazard labeling, vehicle placarding, and emergency response telephone number) and transport requirements, such as required entries on shipping papers or EPA waste manifests. Nuclear Regulatory Commission regulations applicable to radioactive materials transportation are found in 10 CFR 71 and detail packaging design requirements, including the testing required for package certification. EPA regulations govern offsite transportation of hazardous wastes. DOE Order 460.1A (Packaging and Transportation Safety) sets forth DOE policy and assigns responsibilities to establish safety requirements for the proper packaging and transportation of DOE offsite shipments and onsite transfers of hazardous materials and for modal transport. (Offsite is any area within or outside a DOE site to which the public has free and uncontrolled access; onsite is any area within the boundaries of a DOE site or facility to which access is controlled.)

Individual states and Tribes often have their own statutes and/or regulations governing transportation of hazardous or radioactive materials. These laws might also be applicable to DOE transportation activities. As long as the laws are narrowly tailored to address a local concern, they do not conflict with Federal requirements or federal sovereign immunity, and they do not restrict interstate commerce. On the other hand, if the local laws impose an unreasonable burden on DOE, a Federal court would determine that the law was unconstitutional. An example of a local law that affects transportation of materials offsite from the INEEL is the Shoshone-Bannock Tribal Ordinance, the Nuclear Materials Transportation Act, ENVR 92-S5, which restricts transportation of radioactive materials across the Shoshone-Bannock Reservation.

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, then on environmental safe recycling, treatment, and disposal. DOE requires each of its sites to establish specific goals to reduce the generation of waste. If the Department were to build and operate facilities, it would also implement a pollution prevention plan.

The Idaho Settlement Agreement/Consent Order – In October 1995, the State of Idaho, the Department of the Navy, and DOE settled the cases of Public Service Co. of Colorado v. Batt, No. CV-91-0035-S-EJL (D. Id.) and United States v. Batt, No. CV-91-0054-S-EJL (D. Id.). Under the Idaho Settlement Agreement, DOE is obligated to meet the following milestones related to management of calcined waste and sodium-bearing liquid high-level wastes (DOE has subsequently determined that the sodium-bearing liquid high-level waste is more appropriately managed as liquid mixed transuranic waste.):

Elements of the 1995 Idaho Settlement Agreement/Consent Order Pertaining to HLW Management

- *Complete calcination of liquid mixed HLW by June 30, 1998 (done).*
- *Begin calcination of liquid mixed transuranic waste/SBW by June 2001 (started).*
- *Complete calcination of liquid mixed transuranic waste/SBW by December 2012.*
- *Start negotiations with the State of Idaho regarding a plan and schedule for treatment of calcined waste by December 31, 1999 (started).*
- *"DOE shall accelerate efforts to evaluate alternatives for the treatment of calcined waste so as to put it into a form suitable for transport to a permanent repository or interim storage facility outside of Idaho."*
- *"It is presently contemplated by DOE that the plan and schedule shall provide for the completion of the treatment of all calcined waste located at INEL by a target date of December 31, 2035."*

6.2.6 OVERVIEW OF REGULATORY COMPLIANCE AT INTEC

Air Quality – INTEC is part of the INEEL's Title V permit-to-operate application submitted in July 1995. The State of Idaho is currently reviewing this application.

Water Quality – INTEC has a plan in place for control of stormwater run-on and run-off. The existing percolation ponds at INTEC have permits under the state wastewater land application program. There are no underground injection wells currently operated at INTEC. Projections indicate that for all alternatives (see Section 5.2.12, Utilities and Energy), all sanitary, wastewater would be treated in existing facilities, and the existing drinking water wells would be adequate to service new facilities or modified existing facilities.

CERCLA – As noted in the previous discussion, INEEL is currently on the National Priorities List. Issues involving clean-up on INEEL are subject to the requirements in the Federal Facility Agreement and Consent Order. Activities carried out under the Federal Facility Agreement and Consent Order will be assumed to meet any corrective action requirements of the Resource Conservation and Recovery Act Section 3008(h) Consent Order and Compliance Agreement. A Record of Decision addressing clean up of certain portions of INTEC was final in October 1999.

RCRA Permits – In October 1985, DOE submitted RCRA permit applications to EPA Region X for a number of hazardous waste units at INEEL. INEEL has several units operating under RCRA "interim status" rules and the Part B permit. In addition, there are several Consent Orders that specify how INEEL complies with RCRA.

RCRA Notices of Violation – DOE has received seven Notices of Violation from the State of Idaho. Six of those resulted in signed Consent Orders, which specify how the INEEL will comply with RCRA, and three of those Consent Orders have been closed because DOE has taken the appropriate action to address the violations. A Consent Order for the latest Notice of Violation is currently being negotiated between DOE and the State of Idaho.

EPA Notice of Noncompliance – On January 29, 1990, DOE received a Notice of Noncompliance from EPA Region X. That Notice of Noncompliance was based primarily on secondary containment issues for the INTEC Tank Farm. In 1992, DOE and the Idaho Department of Health and Welfare signed a Consent Order to resolve this Notice of Noncompliance (Monson 1992). In accordance with the Notice of Noncompliance Consent Order and an August 18, 1998 modification (Cory 1998), DOE must cease use of the five pillar and panel tanks on or before June 30, 2003 and the remaining tanks on or before December 31, 2012. DOE and the Idaho Department of Environmental Quality have agreed to define "cease use" as emptying the tanks to their heels using the existing waste transfer equipment. The third modification of the Notice of Noncompliance Consent Order (Kelly 1999) further stipulates that DOE must place the calciner at the New Waste Calcining Facility in standby mode by June 1, 2000 unless, and until, the facility receives a hazardous waste permit for continued operation.

Toxic Substances Control Act – The waste stream described in this EIS contains very small amounts of polychlorinated biphenyl contamination. DOE is presently working with EPA to reach agreement on what measures are necessary to insure compliance with the Toxic Substances Control Act at INTEC.

6.3 Compliance of Alternatives with Regulatory Requirements

This section identifies the permits, licenses, and approvals that apply to the different alternatives being evaluated. Section 6.3.1 identifies which alternatives require RCRA, air, water, Nuclear Regulatory Commission, and/or U.S. Department of Transportation permits, licenses, or approvals, and also lists the delisting and "determination of equivalent treatment" approvals required. Significant issues related to regulatory requirements are discussed in Section 6.3.2. Section 6.3.3 provides a discussion of the specific issues involved with each alternative.

6.3.1 PERMITS, LICENSES, AND/OR APPROVALS REQUIRED FOR EACH ALTERNATIVE

Examples of waste processing facilities that would require permits, licenses, and/or approvals are listed in Table 6-3. These facilities include existing facilities that would require permits, licenses, and/or approvals to continue to operate, or new facilities that would require permits, licenses, and/or approvals to commence construction and to operate once they are constructed. Table 6-4 summarizes which RCRA, air, water, Nuclear Regulatory Commission, and U.S. Department of Transportation permits, licenses, or approvals would be required for each alternative. Table 6-5 lists the Federal permits, licenses, and other entitlements that may be required to implement the proposed actions. The permitting requirements are described in a general manner. For example, the designation of "solid and hazardous waste" would encompass any permitting requirements under RCRA, or any state solid or hazardous waste permitting requirements. "Air" would encompass any permitting requirements under the Clean Air Act or state equivalent and would also include any approvals needed to be obtained, such as approvals required under the National Emissions Standards for Hazardous Air Pollutants. Finally, "water" would encompass any permitting requirements under the Clean Water Act and related programs, including National Pollutant Discharge Elimination System permits in general and for stormwater discharge, wastewater applications permits (specific to the State of Idaho), and any approvals required under the Safe Drinking Water Act.

6.3.2 ISSUES AND IMPLICATIONS OF REGULATORY REQUIREMENTS

The previous sections have identified the requirements for permits and licenses associated with the various alternatives as well as the current assumptions under which the program is proceeding. There is uncertainty regarding the ability of DOE to reach agreement with the regulatory agencies on many of these issues. The consequences of not being able to develop a regulatory framework upon which all parties can agree may have serious implications. This section discusses some of those implications.

6.3.2.1 Delisting

As described in Section 6.2.5, delisting is EPA's designated method to exclude listed hazardous waste from regulation under RCRA. Because the treated forms of the INTEC wastes that would be the subject of the delisting do not currently exist, DOE would seek the type of delisting known as an "upfront" exclusion. This is a special type of conditional exclusion that could be granted for a waste that has not yet been generated.

The INTEC waste streams are a combination of characteristic (e.g., corrosive or toxic) and listed hazardous wastes that are regulated under RCRA. Without delisting, the treated waste forms produced from these materials under the various alternatives in this EIS would continue to be regulated as mixed wastes under RCRA even if the applicable land disposal restrictions were met. INEEL presently has no mixed waste disposal capacity. Some offsite low-level mixed waste disposal capacity is available but it is limited by the radiological characteristics of the wastes that may be disposed of. Capacity for mixed transuranic waste exists at the Waste Isolation Pilot Plant, although not all types of hazardous wastes in the INTEC mixed waste

Table 6-3. Examples of facilities that may require permits, licenses, and/or approvals.

Existing facilities	Description
Tank Farm	The Tank Farm stores mixed transuranic waste (SBW and newly generated liquid waste).
New Waste Calcining Facility (NWCF)	The calciner at the NWCF was developed to convert liquid waste solutions stored in the Tank Farm into a more stable granular form called calcine. The waste solution is evaporated in a fluidized bed calciner and the off-gas produced passes through a cyclone, an offgas cleanup system, and HEPA filters before it is discharged to the main stack.
Calcined Solids Storage Facilities (bin sets)	After calcination, the calcine and the fines particles collected by the cyclone are pneumatically transferred to the bin sets for storage. Air circulates through the bin sets to remove heat that is generated by the radionuclides present in the calcine.
High-Level Liquid Waste Evaporator (HLLWE)	The HLLWE concentrates solutions currently stored in the Tank Farm. The HLLWE concentrates the waste solutions to a specific gravity that approaches the design basis of the Tank Farm. The vapors generated are condensed for further processing in the PEWE. The concentrated bottoms are transferred back to the Tank Farm for storage.
Process Equipment Waste Evaporator (PEWE)	The PEWE concentrates the mixed transuranic newly generated liquid waste. The PEWE bottoms are transferred to the Tank Farm for storage and the overhead vapors condensed for processing at the LET&D Facility.
Liquid Effluent Treatment and Disposal (LET&D) Facility	The LET&D Facility is used to concentrate the nitric acid in the waste solutions. The concentrated acid is recycled to the NWCF for use as scrub solution or sent to the Tank Farm for storage. The process offgas is filtered and discharged at the main stack.
Proposed facilities	**Description**
Vitrification Facility (two types)	The vitrification process would combine the waste stream with glass formers for processing in a glass melter. Vitrification facilities would be used under the Full Separations Option (separated high-level waste fraction) and Early Vitrification Option [mixed transuranic waste/SBW and calcine treated separately].
Hot Isostatic Press Facility	In the Hot Isostatic Pressed Waste Option, silicates and titanium or aluminum powder would be blended with retrieved calcine, placed in special HIP cans, and subjected to high pressure and temperature to form a glass-ceramic product.
Cementation Facility	The Direct Cement Waste Option would involve blending calcine with pozzolan clay, blast furnace slag, caustic soda, and water. The mixture would be placed in stainless steel canisters, cured at elevated temperatures, and then heated under vacuum to produce a cement waste form.
Grout Facility (two types)	The grout facility would evaporate and denitrate the low-level waste fraction to produce low-level Class A or C type grout. The grout formed in the Full Separations and Planning Basis Options would be considered Class A type, while the grout formed in the Transuranic Separations Option would be classified as Class C type due to higher concentrations of radioactivity.
Calcine Retrieval and Transport System	The Calcine Retrieval and Transport System would retrieve the calcine from the bin sets. After retrieval, the calcine would be transported to another bin set (e.g., transfer from bin set 1 to bin set 6 or 7 under No Action and Continued Current Operations Alternatives) or to other facilities to be further processed.
Waste Separations Facility (two types)	This facility would receive mixed transuranic waste/SBW from the Tank Farm and mixed HLW calcine from the bin sets. After some initial treatment of these feed streams, the radionuclides would be chemically separated into two streams, the high-level waste fraction or transuranic fraction would contain the transuranic nuclides, cesium, and strontium. The low-level waste fraction would contain the rest of the nuclides. Under the Transuranic Separations Option, the cesium and strontium would not be separated and would remain in the low-level waste fraction.

Table 6-3. (continued).

Existing facilities	Description
Interim Storage Facility	This facility provides interim storage for road-ready HLW until shipment to a geologic repository.
Low-Activity Waste Disposal Facility	This facility receives containerized low-level waste Class A or Class C type grout for disposal.

HEPA = High Efficiency Particulate Air.

streams have been identified on the Waste Isolation Pilot Plant hazardous waste permit. The candidate geologic repository at Yucca Mountain does not plan to accept RCRA-regulated hazardous wastes. Therefore, DOE may need to obtain a "delisting" to exclude treated INEEL waste from RCRA regulation in order to implement the selected action. There are uncertainties associated with DOE's ability to delist the wastes produced from mixed HLW and mixed transuranic waste/SBW treatment. Among these uncertainties are:

- Delisting action will require a comprehensive evaluation of waste characteristics, most likely including analytical results of representative samples of the wastes to be delisted. The information likely to be required by the regulatory agencies is beyond that which is currently available. At a minimum, testing of the inputs and outputs of the treatment process will be required. Because of the current storage configuration of the waste in the bin sets and Tank Farm, it will be difficult to obtain representative samples of the waste forms. This is complicated by the presence of very high radiation levels associated with the waste, which make it very difficult to obtain the samples or perform the required analysis.

- Delisting actions are normally based, at least partially, on the results of treatability studies. These studies provide the information to demonstrate that the proposed treatment processes are actually capable of producing a waste form that could be considered non-hazardous. The technological maturity of some of the proposed treatment processes, and the level of their development is immature, and it will be some time in the future before such treatability studies could be conducted. Without data from such studies, it is uncertain that the regulatory agencies will commit to a delisting strategy.

- Delisting actions normally require some sort of verification testing of the final waste forms. Even if treatability studies show that adequate treatment is possible, testing of the final waste form will be required. As a result, DOE will not be sure that the proposed processes are capable of supporting a delisting until they have been proven in a full-scale production environment.

- The delisting process would take place in a complex regulatory environment. Two EPA regional offices and authorized states all have authority to act on a delisting petition, although a state's decision applies only within its borders and cannot improperly interfere with interstate commerce. Therefore, coordination and consultation with a number of states and EPA regional offices would be required prior to waste shipment for disposal. In addition, each listed waste stream will have its own delisting action, requiring multiple petitions and determinations.

Alternate approaches available to DOE to address the listed waste issue in lieu of delisting include: (1) development of alternative strategies, under initiatives such as EPA's Project XL, that would replace or modify regulatory require-

Table 6-4. Air, water, NRC, DOT, and RCRA permits, licenses, or approvals required for each alternative.

			Separations Alternative			Non-Separations Alternative			
Permit, license, and/or approval type	No Action Alternative	Continued Current Operations Alternative	Full Separations Option	Planning Basis Option	Transuranic Separations Option	Hot Isostatic Pressed Waste Option	Direct Cement Waste Option	Early Vitrification Option	Minimum INEEL Processing Alternative
Air									
Permit to construct	–[a]	●[b]	●	●	●	●	●	●	●
Title V Operating	–	●	●	●	●	●	●	●	●
Maximum Achievable Control Technology[c]	–	●	–	●	–	●	●	–	–
Water									
National Pollutant Discharge Elimination System	–	–	●	●	●	●	●	●	●
U.S. Nuclear Regulatory Commission									
Incidental Waste Consultation	–	●	●	●	●	●	●	●	●
Container License	–	●	●	●	●	●	●	●	●
U.S. Department of Transportation									
Transportation	–	●	●	●	●	●	●	●	●
Resource Conservation and Recovery Act Part B									
Treatment	–	●	●	●	●	●	●	●	●
Storage	(d)	●	●	●	●	●	●	●	●
Disposal	–	–	–	–	–	–	–	–	–
Resource Conservation and Recovery Act approval									
Delisting	–	●	●	●	●	●	●	●	●
Determination of Equivalent Treatment	–	–	–	–	–	●	●	–	–

a. Dash indicates that no permit/license/approval is required.
b. ● indicates that a permit/license/approval is required.
c. These entries indicate that the Maximum Achievable Control Technology Rule for hazardous waste combustors would be applicable to calciner operations under these alternatives and options.
d. Future RCRA permit requirements for the Tank Farm and bin sets are uncertain.

Table 6-5. Facility-specific list of permits, licenses, and approvals that may be required.

Facility	Hazardous waste	Air	Water
Tank Farm	●[a]	–[b]	–
New Waste Calcining Facility	●	●	–
Calcined Solids Storage Facilities (bin sets)	●	●	–
High-Level Liquid Waste Evaporator	●	●	–
Process Equipment Waste Evaporator	●	●	–
Liquid Effluent Treatment and Disposal Facility	●	●	–
Vitrification Facility (two types)	●	●	–
Hot Isostatic Press Facility	●	●	–
Cementation Facility	●	●	–
Grout Facility (two types)	●	●	–
Calcine Retrieval and Transport System	●	●	–
Waste Separations Facility (two types)	●	●	–
Interim Storage Facility	–	–	–
Low-Activity Waste Disposal Facility	–	●	–

a. ● indicates that a permit/license/approval is required.
b. Dash indicates that no permit/license/approval is required.

ments on the condition that the alternative requirements produce greater environmental benefits and (2) exclusion by Congressional amendment.

President Clinton created Project XL, which stands for "eXcellence and Leadership," with his March 15, 1995, Reinventing Environmental Regulation initiative. This program is designed to give regulated sources the flexibility to develop alternative strategies that will replace or modify specific regulatory requirements, on the condition that they produce greater environmental benefits. A successful proposal will develop alternative pollution reduction strategies that meet eight criteria: better environmental results; cost savings and paperwork reduction; stakeholder support; test of an innovative strategy; transferability; feasibility; identification of monitoring, reporting, and evaluation methods; and avoidance of shifting risk burden. The ability for DOE to meet the requirements of an XL proposal are uncertain at this time. A Congressional Amendment could occur if Congress determined that methods employed to treat waste destined for a geologic repository and the design of the repository were adequate to protect human health and the environment without further regulation under RCRA. The likelihood of that kind of congressional action is also uncertain, but a similar, albeit limited, action has occurred for the Waste Isolation Pilot Plant.

There are several implications of the failure to achieve a determination that treated waste forms are no longer subject to RCRA. Long-term RCRA-compliant storage will be required for those waste forms for which delisting is not granted. The cost of both building and operating RCRA-compliant storage facilities is higher than for non-regulated units. Worker radiation exposures could be higher due to increased inspection requirements. Most significantly, without delisting no disposal site has been identified for the final HLW form. Current plans for the proposed Yucca Mountain repository exclude RCRA-regulated hazardous wastes. This implies that the treated HLW would remain in Idaho until a repository or storage site meeting RCRA requirements becomes available.

6.3.2.2 Waste Incidental to Reprocessing

The terms "incidental waste" or "waste incidental to reprocessing" refer to a process for identifying waste streams that might otherwise be considered HLW due to their origin, but are actually low-level or transuranic waste, if the waste incidental to reprocessing requirements contained in DOE Manual 435.1-1 are met (DOE 1999a). Thus, it is a process by which the DOE can make a determination that, for example, waste residues remaining in HLW tanks, equipment, or transfer lines, are managed as low-level or transuranic waste if the requirements in Section II.B of DOE Manual 435.1-1 have been or will be met. The requirements contained in this section of DOE Manual 435.1-1 are divided into two processes, the "citation" process and the "evaluation" process, and are explained further in the following discussion.

Waste resulting from processing spent nuclear fuel that is determined to be incidental to reprocessing is not HLW, and shall be managed under DOE's regulatory authority in accordance with the requirements for transuranic waste or low-level waste, as appropriate. When determining whether spent nuclear fuel processing plant wastes are another waste type or as HLW, either the citation or evaluation process described below shall be used.

Citation – Waste incidental to reprocessing by citation includes spent nuclear fuel reprocessing plant wastes that meet the "incidental waste" description included in the Notice of Proposed Rulemaking (34 FR 8712; June 3, 1969) for promulgation of proposed Appendix D, 10 CFR Part 50, Paragraphs 6 and 7. These radioactive wastes are the result of processing plant operations. Examples of wastes that have been determined to be included within the citation process are:

- Contaminated "job wastes," a general category of wastes that are generated during HLW transfer, pretreatment, treatment, storage and disposal activities and includes protective clothing, personnel protective equipment, work tools, ventilation filter media, and other job-related materials necessary to complete HLW management activities

- Sample media (e.g., sampling vials, crucibles, other hardware)

- Decontamination media and decontamination solutions (e.g., swabs, other "decon" work-related materials)

- Laboratory clothing, tools, and equipment.

Those waste that have been interpreted to be excluded from the citation process are:

- Ion exchange beds

- Sludges

- Process filter media

- Contaminated components and equipment.

The authority and responsibility for using the citation process resides with the Field Element Manager at the DOE Field or Operations Office. Consultation and coordination with the DOE Office of Environmental Management is encouraged to support consistent interpretations across the DOE complex, but is not required.

Evaluation – Determinations that any waste is incidental to reprocessing by the evaluation process shall be developed under good record-keeping practices, with an adequate quality assurance process, and shall be documented to support the determinations. Such wastes may include, but are not limited to, spent nuclear fuel reprocessing plant wastes that:

(a) Will be managed as low-level waste and meet the following criteria:

(1) Have been processed, or will be processed, to remove key radionuclides to the maximum extent that is technically and economically practical. Although not formally defined; it is generally understood that "key radionuclides" applies to those radionuclides that are controlled by concentration limits in 10 CFR 61.55. A technically practical process must be evaluated to a sufficient degree through a formal, documented assessment of such factors as technical risk, incompatible physical or chemical requirements with the waste, and potential impacts to the public, the worker, and the environment. The "economically practical" part of the requirement is determined by the development of total life-cycle costs for an alternative, or unit costs, (e.g., cost per curie removed).

(2) Will be managed to meet safety requirements comparable to the performance objectives set out in 10 CFR Part 61, Subpart C, "Performance Objectives." An assessment will need to be prepared that documents a reasonable expectation that DOE Manual 435.1-1, Chapter IV, low-level waste performance objectives, will be met.

(3) Are to be managed, pursuant to DOE's authority under the Atomic Energy Act of 1954, as amended, and in accordance with provisions of Chapter IV of DOE Manual 435.1-1, provided the waste will be incorporated in a solid physical form at a concentration that does not exceed the applicable concentration limits for Class C low-level waste set out in 10 CFR 61.55, "Waste Classification" or will meet alternative requirements for waste classification and characterization as DOE may authorize. DOE will need to demonstrate that the calculated concentration of major radionuclides

expected in the treated waste will not exceed the limits in 10 CFR 61.55, or an analysis that provides reasonable expectation that compliance with DOE Manual 435.1-1, Chapter IV, performance objectives can be achieved.

(b) Will be managed as transuranic waste and meet the following criteria:

(1) Have been processed, or will be processed, to remove key radionuclides to the maximum extent that is technically and economically practical. The process for meeting this requirement is the same as described for low-level waste management in (a)(1) above.

(2) Will meet alternative requirements for waste classification and characteristics, as DOE may authorize. The DOE Field Element would request that the DOE Office of Environmental Management accept, on a case by case basis, the designation of a waste stream as transuranic. DOE Headquarters shall be consulted and an analysis submitted for review and acceptance that provides reasonable assurance that after the evaluation of the specific characteristics of the waste, disposal site characteristics, and method of disposal, compliance with the 40 CFR 191 performance objectives measures can be achieved.

(3) Are managed pursuant to DOE's authority under the Atomic Energy Act of 1954, as amended, in accordance with the provisions of Chapter III of DOE Manual 435.1-1, as appropriate. This will require the preparation of a performance assessment that provides reasonable expectation that the performance objective measures of 40 CFR 191 can be achieved. When using the Evaluation Process, the Field Office Element is required to consult and coordinate with the DOE Office of Environmental Management. Consultation with the Nuclear Regulatory Commission is also strongly encouraged.

In developing the waste processing alternatives, DOE made assumptions regarding the radioactive waste classification of the input waste streams, HLW calcine and mixed transuranic waste (SBW and newly generated liquid waste), and the output waste streams (e.g., HLW, transuranic waste, low-level waste Class A or Class C type grout). DOE will classify all wastes in accordance with the processes in DOE Manual 435.1-1 as described above.

6.3.2.3 Hazardous Waste Codes Applicable to INEEL's HLW & SBW

Currently, the mixed HLW and mixed transuranic waste/SBW at INTEC are being evaluated to determine precisely what hazardous waste codes are applicable to these wastes. That evaluation will be critical to determine whether the transuranic waste streams meet the waste acceptance criteria at the Waste Isolation Pilot Plant because some of the waste codes on the current RCRA Part A application for the INTEC HLW systems are not acceptable for disposal at the Waste Isolation Pilot Plant.

The INEEL mixed HLW is also characterized by more waste codes than those encompassed by the vitrification treatment standard for HLW. Multiple treatment technologies may be associated with these additional codes, and it would be impractical to treat INEEL waste using all of the specified methods. For those waste codes that are not eliminated after further evaluation, DOE would need to seek a determination of equivalent treatment under 40 CFR 268.42(b) to demonstrate that a proposed treatment process provides adequate treatment for all hazardous constituents contained in the waste. In order to accomplish this, DOE would need to demonstrate that the proposed treatment provides a measure of performance equivalent to the land disposal restrictions standard. If radiological exposure risk considerations indicate that it is impractical to perform the required sampling and analysis, DOE could pursue one of two options:

- Establish operating limits over which the technology has been demonstrated to achieve the required concentration levels for hazardous constituents. These operating limits could be determined using nonradioactive surrogates to minimize radiological exposures. All waste produced under these operating conditions would be considered to achieve the required performance.

- Establish alternate test methods that reduce radiological exposure from that associated with conventional sampling and analysis techniques.

6.3.2.4 Repository Capacity and Waste Acceptance Criteria

The Nuclear Waste Policy Act limited the amount of spent nuclear fuel and HLW that could be placed in the Nation's first geologic repository until a second repository would become operational. At the time, the projected inventory of spent nuclear fuel that would require disposal was approximately 140,000 metric tons of heavy metal (MTHM). The limitation was meant to provide "regional equity" among potential repository sites. When the Nuclear Waste Policy Act was amended in 1987, it authorized DOE to characterize only one candidate site and required DOE to terminate all activities on a potential second repository. In this regard, DOE was directed to report to Congress no sooner than January 2007 on the need for a second repository. However, the statutory limit of 70,000 MTHM on first repository emplacement was never revised. Estimates of the amount of spent nuclear fuel that will require geologic disposal are less now, perhaps as little as 86,000 MTHM. This inventory, plus additional quantities of DOE-owned and managed spent nuclear fuel and HLW, clearly exceeds the statutory limit on emplacement in the first repository.

For planning purposes, DOE would emplace 10,000 to 11,000 waste packages containing no more than 70,000 MTHM of spent nuclear fuel and HLW in the repository. Of that amount, 63,000 MTHM would be spent nuclear fuel assemblies that would be shipped from commercial sites to the repository. The remaining 7,000 MTHM would consist of about 2,333 MTHM of DOE spent nuclear fuel and HLW currently estimated to be approximately 8,315 canisters (the equivalent of 4,667 MTHM) that DOE would ship to the repository (DOE 1999b). To determine the number of canisters of HLW included in the waste inventory, DOE used 0.5 MTHM per canister of defense HLW. DOE has used the 0.5 MTHM per canister approach since 1985. In 1985, DOE published a report in response to Section 8 of the Nuclear Waste Policy Act (of 1982) that required the Secretary of Energy to recommend to the President whether defense HLW should be disposed of in a geologic repository along with commercial spent nuclear fuel. That report, *An Evaluation of Commercial Repository Capacity for the Disposal of Defense High-Level Waste* (DOE 1985) provided the basis, in part, for the President's determination that defense HLW should be disposed of in a geologic repository. Given that determination, DOE decided to allocate 10 percent of the capacity of the first repository for the disposal of DOE spent nuclear fuel (2,333 MTHM) and HLW (4,667 MTHM) (Dreyfus 1995; Lytle 1995).

Calculating the MTHM quantity for spent nuclear fuel is straightforward. It is determined by the actual heavy metal content of the spent fuel. However, an equivalence method for determining the MTHM in defense HLW is necessary because almost all of its heavy metal has been removed. A number of alternative methods for determining MTHM equivalence for HLW have been considered over the years. Four of those methods are described in the following paragraphs.

Historical Method - Table 1-1 of DOE (1985) provided a method to estimate the MTHM equivalence for HLW based on comparing the radioactive (curie) equivalence of commercial HLW and defense HLW. The method relies on the relative curie content of a hypothetical (in the early 1980s) canister of defense HLW from the Savannah River Site, Hanford, or INEEL, and a hypothetical canister of vitrified waste from processing of high-burnup commercial spent nuclear fuel. Based on commercial HLW containing 2.3 MTHM per canister (heavy metal has not been removed from commercial waste) and defense HLW estimated to contain approximately 22 percent of the radioactivity of a canister of commercial HLW, defense HLW was estimated to contain the equivalent of 0.5 MTHM per canister. Since 1985, DOE has used this 0.5 MTHM equivalence per canister of defense HLW in its consideration of the potential impacts of the disposal of defense HLW, including the analysis presented in the *Draft Environmental Impact Statement for a Geologic Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, Nevada* (DOE/EIS-0250D). Less than 50 percent of the total inventory of HLW could be disposed of in the repository within the 4,667 MTHM allocation for HLW. There has been no determination of which waste would be shipped to the repository, or the order of shipments.

Spent Nuclear Fuel Reprocessed Method - Another method of determining MTHM equivalence, based on the quantity of spent nuclear fuel processed, would be to consider the MTHM in the HLW to be the same as the MTHM in the spent nuclear fuel before it was processed. Using this method, less than 5 percent of the total inventory of HLW could be disposed of in the repository within the 4,667 MTHM allocation for HLW.

Total Radioactivity Method - The total radioactivity method, would establish equivalence based on a comparison of radioactivity inventory (curies) of defense HLW to that of a standard MTHM of commercial spent nuclear fuel. For this equivalence method the standard spent nuclear fuel characteristics are based on pressurized-water reactor fuel with uranium-235 enrichment of 3.11 percent and 39.65 gigawatt-days per MTHM burnup. Using this method, 100 percent of the total inventory of HLW could be disposed of in the repository within the 4,667 MTHM allocation for HLW.

Radiotoxicity Method - The radiotoxicity method, uses a comparison of the relative radiotoxicity of defense HLW to that of a standard MTHM of commercial spent nuclear fuel, and is thus considered an extension of the total radioactivity method. Radiotoxicity compares the inventory of specific radionuclides to a regulatory release limit for that radionuclide, and uses these relationships to develop an overall radiotoxicity index. For this equivalence, the standard spent nuclear fuel characteristics are based on pressurized-water reactor fuel with uranium-235 enrichment of 3.11 percent and 39.65 gigawatt-days per MTHM burnup. Using this method, 100 percent of the total inventory of HLW could be disposed of in the repository within the 4,667 MTHM allocation for HLW.

A recent INEEL report (Knecht et al. 1999) promotes the use of either the Total Radioactivity Method or the Radiotoxicity Method rather that the continued use of the Historical Method.

Therefore, under any scenario analyzed in this Idaho HLW & FD EIS, there will be a degree of uncertainty regarding the ability of one or more repositories to dispose of all of the projected canisters of HLW around the DOE complex. Additional uncertainty includes the potential for schedule delays, funding reductions, and technical complexities to license, construct, and operate a national geologic repository. Delays in the availability of disposal capacity for INEEL HLW should be considered as a contingency requiring safe storage at an interim site.

Currently, borosilicate glass is the only approved waste form for HLW destined for a repository. Other HLW forms (e.g., grouted HLW) identified in some of the alternatives would need to be demonstrated equivalent to the vitrified waste form. Without that determination, any HLW form other than vitrified waste would have to be placed into long-term storage. The acceptance of that waste form into the second repository would be uncertain.

6.3.2.5 Cumulative Risk To The Groundwater

In accordance with the Federal Facility Agreement and Consent Order, the existing contamination from releases at INTEC was assessed for risk to human health and the environment, including the Snake River Plain aquifer, as part of Operable Unit 3-13. That assessment only evaluated the hazardous substances (radionuclides and non-radionuclides) that have already been released to the environment. Under CERCLA, remedial action is required to mitigate the risk to acceptable levels if contamination presents an unacceptable risk (greater that 1 in 10,000 chance of developing a tumor) or exceeds the national primary drinking water standards (40 CFR 141) maximum contaminant levels. Currently, there is contamination in the INTEC area (soils and groundwater) that exceeds acceptable risk levels. Any contaminant inventory remaining in the INTEC facilities after they are dispositioned in accordance with applicable requirements will result in the potential for additional contamination to migrate and impact the Snake River Plain aquifer. Cumulative risk evaluated by this EIS includes the risk from both the INTEC facility disposition activities and releases that have already occurred. Therefore, any facility disposition scenario that results in unacceptable cumulative risk would require additional actions to mitigate the risks to acceptable levels. Those additional actions could be additional work (added contaminant removal, stabilization, or other controlling mechanisms) for the facility disposition activity. If these additional actions are not taken under the facility disposition process, the CERCLA remedial action on the Snake River Plain aquifer would be required to implement additional activities to reduce the impacts to acceptable levels. The methodologies used to evaluate the long-term risk from the disposition of HLW facilities are described in Appendix C.9. Section 5.4 presents the cumulative risk of these facility disposition activities and the existing contamination from releases of INTEC being evaluated under CERCLA.

6.3.2.6 RCRA Closure

When hazardous waste management facilities cease operation, they must be closed in a manner that ensures they will not pose a future threat to human health and the environment. RCRA provides two types of closure for hazardous waste management facilities.

Under the first type, known as RCRA clean closure, the facility is decontaminated in accordance with the closure standard. The closure performance standard calls for removal of hazardous wastes and decontamination of all hazardous waste residuals. The action, however, does not address any radiological contamination that may be present. This standard can be achieved in two ways: (1) decontamination of hazardous contaminants to concentrations at background levels or analytical detection limits or (2) decontamination of hazardous contaminants to performance-based concentration limits (i.e., levels at which the hazardous constituents no longer pose a threat to human health or the environment). After the RCRA clean closure is certified to be complete, the facility is no longer subject to RCRA permitting requirements.

The other type of closure, known as closure to landfill standards, imposes no specific residual contamination limits but would require that DOE place an engineered cap over the facility and implement post-closure care. This would include maintenance of the facility, monitoring for releases of hazardous constituents to the environment, and taking corrective action if releases occur. A post-closure permit or alternate enforceable document would be issued covering maintenance, monitoring, and corrective action provisions.

The disposal options evaluated in this EIS include use of RCRA closed INTEC HLW management facilities (Tank Farm, bin sets) as disposal sites for the low-level waste fraction produced under the Separations Alternative. These disposal options assume that the facility undergoes a performance-based closure prior to low-level waste fraction disposal operations. Substantial efforts will be necessary to remove residual contamination from these facilities to reach the performance-based closure standards. Inability to achieve a RCRA clean closure could prevent these INTEC facilities from being used for low-level waste fraction disposal.

6.3.2.7 RCRA/CERCLA Interface

INEEL was placed on the National Priorities List under CERCLA in 1989. In response to this listing, DOE, EPA, and the State of Idaho negotiated a Federal Facility Agreement and Consent Order that describes how DOE will implement CERCLA remedial activities and RCRA corrective action obligations at the INEEL.

INTEC is designated as Waste Area Group 3 in the Federal Facility Agreement and Consent Order. Waste Area Group 3 contains 99 release sites. Many of these release sites are co-located with or surrounding the HLW management facilities considered under this EIS. DOE is currently initiating remedial action for Waste Area Group 3 under the requirements of CERCLA.

Risk management decisions under the facilities disposition alternatives must be integrated with the CERCLA evaluation and decisionmaking for Waste Area Group 3. Decisions on the final end state for the INTEC must consider the cumulative impacts of soil and groundwater contamination influence by the release sites as well as the contributions from the waste processing and facility disposition alternatives.

6.3.2.8 Maximum Achievable Control Technology Standards for Hazardous Waste Combustion

On April 19, 1996, EPA proposed to revise the standards for hazardous waste combustion facilities under joint authority of the Clean Air Act and RCRA (61 FR 17358). EPA revised the proposed emissions standards on May 2, 1997 (62 FR 24212) and finalized this rule on September 30, 1999 (64 FR 52827). Any facility identified in this EIS that would qualify as a hazardous waste combustion unit or similar miscellaneous unit will be required to comply with these new standards. The standards were developed under Clean Air Act provisions concerning the maximum achievable level of control over hazardous air pollutants, taking into consideration the cost of achieving the emission reduction. Those Maximum Achievable Control Technology standards would impose strict limits for dioxins/furans, mercury, semi-volatile and low volatility metals, particulate matter, and hydrochloric acid/chlorine gas from facilities that burn hazardous waste. Standards were also established for carbon monoxide and hydrocarbons to control other toxic organic emissions. Monitoring and recordkeeping would be required to ensure the emission limits are not exceeded. Compliance with the emission standards and associated monitoring requirements must be achieved within 3 years of the effective date (with potential for a 1-year extension). If an existing facility cannot be modified to comply with the standards within that period, it must be shut down until the new emissions controls are in operation. Several alternatives involve upgrades to the New Waste Calcining Facility in anticipation of more stringent air emission standards under this rule.

6.3.2.9 Compliance with Existing Agreements

None of the proposed alternatives would meet all of the commitments under the Idaho Settlement Agreement/Consent Order, the Site Treatment Plan, and the Notice of Noncompliance Consent Order. Table 6-6 lists the compliance status of the proposed alternatives with the enforceable milestones applicable to the INEEL HLW Program.

6.3.3 ADDITIONAL WASTE PROCESSING ALTERNATIVE SPECIFIC ISSUES

6.3.3.1 No Action Alternative

The No Action Alternative results in noncompliance with the final commitments in the Notice of Noncompliance Consent Order and the Idaho Settlement Agreement/Consent Order. Several of the INTEC units, such as the Tank Farm and bin sets, are operating as interim status units. Future RCRA permit requirements are uncertain.

6.3.3.2 Continued Current Operations Alternative

Significant modifications would be required to bring the calciner at the New Waste Calcining Facility into compliance with the Maximum Achievable Control Technology standards for hazardous waste combustion facilities.

This alternative has issues related to delisting and incidental waste as discussed in Sections 6.3.2.1 and 6.3.2.2. In order for the mercury produced as a result of the calcining process to be disposed of as low-level waste, it must be delisted and classified as incidental waste. The alternative also has the issues related to ability of DOE to permit the Tank Farm and bin sets as described in the No Action Alternative.

Table 6-6. Compliance status of the proposed alternatives with the INEEL HLW enforceable milestones.

Milestone	No Action Alternative	Continued Current Operations Alternative	Separations Alternative: Full Separations Option	Separations Alternative: Planning Basis Option	Separations Alternative: Transuranic Separations Option	Non-Separations Alternative: Hot Isostatic Pressed Waste Option	Non-Separations Alternative: Direct Cement Waste Option	Non-Separations Alternative: Early Vitrification Option	Minimum INEEL Processing Alternative
June 30, 2003 – Cease use of pillar and panel tanks in Tank Farm[a]	●[b]	●	●	●	●	●	●	●	●
December 31, 2012 – Cease use of monolithic tanks in Tank Farm[c]	–[d]	–	–	–	–	–	–	–	●
December 31, 2012 – Complete calcination of mixed transuranic waste/SBW[e]	–	–	–	●	–	–	–	–	–
December 31, 2035 –HLW ready for disposal outside of Idaho[f]	–	–	●	●	●	●	●	●	●
December 31, 2035 – All waste ready for disposal outside of Idaho[g]	–	–	●	●	●	●	●	●	●

a. Notice of Noncompliance Consent Order, Section 6.20.B.3.
b. ● indicates that the proposed alternative would satisfy the milestone.
c. Notice of Noncompliance Consent Order, Section 6.20.B.5.
d. Dash indicates that the proposed alternative would not satisfy the milestone.
e. Idaho Settlement Agreement/Consent Order, Section E.5.
f. Idaho Settlement Agreement/Consent Order, Section E.6.
g. "All Waste" means that waste identified in the Idaho Settlement Agreement/Consent Order Sections E.4, E.5, and E6.

6.3.3.3 Separations Alternative

The three options considered in the Separations Alternative are the Full Separations Option, the Planning Basis Option, and the Transuranic Separations Option. The disposal options evaluated in this EIS include use of closed INTEC HLW management facilities (Tank Farm, bin sets) as disposal sites for the low-level waste fraction produced under the Separations Alternative. These disposal options assume that the facilities undergo a performance-based closure prior to low-level waste fraction disposal operations. Substantial efforts will be necessary to remove residual hazardous waste contamination from these facilities to reach the performance-based closure standards. Inability to close in a manner for which RCRA post-closure requirements would not apply could prevent these INTEC facilities from being used for low-level waste fraction disposal.

These options have issues related to delisting, incidental waste, and hazardous waste codes applicable to INEEL's mixed HLW and mixed transuranic waste/SBW as discussed in Sections 6.3.2.1 through 6.3.2.3. The waste streams that must be delisted for the Full Separations and Planning Basis Options include the vitrified HLW, mixed low-level waste Class A type grout, and mercury. In addition to delisting, the mixed low-level waste Class A type grout and the mercury must be classified as incidental waste. The waste streams that must be delisted for the Transuranic Separations Option include the mixed low-level waste Class C type grout and mercury. These same waste streams must also be classified as incidental waste under this option.

6.3.3.4 Non-Separations Alternative

The three options considered in the Non-Separations Alternative are (1) Hot Isostatic Pressed Waste Option, (2) Direct Cement Waste Option, and (3) Early Vitrification Option. For all three of these options there are delisting, incidental waste, and hazardous waste code issues as previously described in Sections 6.3.2.1 through 6.3.2.3.

Hot Isostatic Pressed Waste Option

Two additional concerns associated with this alternative are permitting issues related to New Waste Calcining Facility operations, as identified in the Continued Current Operations Alternative, and a determination of equivalent treatment. The Hot Isostatic Press Facility must be able to demonstrate performance equivalent to the RCRA treatment performance standard of vitrification for HLW. The waste streams that must be delisted for this option include the treated HLW, grout produced from the mixed transuranic newly generated liquid waste, and mercury. In addition to delisting, the mercury must be classified as incidental waste.

Direct Cement Waste Option

Two additional concerns associated with this alternative are permitting issues related to New Waste Calcining Facility operations, as identified in the Continued Current Operations Alternative, and a determination of equivalent treatment. The Direct Cement Facility must be able to demonstrate performance equivalent to the RCRA treatment standard of vitrification for HLW. The waste streams that must be delisted for this option include the treated HLW, grout produced from the mixed transuranic newly generated liquid waste, and mercury. In addition to delisting, the mercury must be classified as incidental waste.

Early Vitrification Option

This alternative does not have any additional issues to those previously identified for all three non-separations alternatives. The waste streams that must be delisted for this option include the treated HLW, grout produced from the vitrification plant offgas, and mercury. In addition to delisting, the grout and mercury must be classified as incidental waste.

6.3.3.5 Minimum INEEL Processing Alternative

The Minimum INEEL Processing Alternative has delisting, incidental waste, and hazardous waste codes [applicable to INEEL's HLW and mixed transuranic waste/SBW] issues as previously discussed in Sections 6.3.2.1 through 6.3.2.3. The waste streams that must be delisted for this alternative include the vitrified high-level waste fraction, vitrified low-level waste fraction, and grout produced from the mixed transuranic newly generated liquid waste.

6.3.4 ADDITIONAL FACILITY DISPOSITION ALTERNATIVES SPECIFIC ISSUES

Facility disposition activities would be carried out in accordance with DOE requirements for closure of HLW facilities as described in DOE Manual 435.1-1 (DOE 1999a). At closure, the facility must be decontaminated to meet DOE decommissioning requirements or, if the facility cannot meet the decommissioning requirements, closed consistent with applicable disposal site standards. Alternatives that do not result in complete removal of HLW from the INTEC facilities would require that any residual waste satisfy the waste incidental to reprocessing requirements (see Section 6.3.2.2) The applicable disposal site standards would be determined by the characteristics of the residual material (i.e., low-level waste or transuranic waste). DOE may also follow the CERCLA process in accordance with Executive Order 12580 (see Section 6.2.5) to demonstrate compliance with the applicable radioactive waste disposal standards.

DOE is currently developing an incidental waste determination for the tank heels in the INTEC Tank Farm. Decisions whether the tank heels and other residual HLW satisfy the waste incidental to reprocessing criteria are important in determining the applicable standards for evaluating the facility disposition alternatives. For example, if the tank heels were classified as HLW or transuranic waste, DOE would be required to evaluate the performance of the closed Tank Farm against the performance objectives in 40 CFR 191. DOE may seek technical consultation with Nuclear Regulatory Commission regarding its waste incidental to reprocessing determination. The ultimate disposition of the tank heels will be determined through RCRA closure plans for the tanks that must be negotiated with the State of Idaho.

Due to the configuration of many of the buildings and facilities at INTEC, one building may have within its confines several different regulatory or programmatic drivers. For example, a facility might have one area being operated and closed in accordance with RCRA requirements, another area being closed in accordance with CERCLA requirements, and another area to be operated as a permitted unit. This poses a complicated environment for decisionmaking and will require an integrated approach to ensure consistency.


7.0
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8.0 List of Preparers

This list presents the individuals who contributed to the technical content of this environmental impact statement. The preparation of the EIS was directed by Thomas L. Wichmann of the U.S. Department of Energy Idaho Operations Office. S. J. Connor provided project management of the Integrating Contractor, Tetra Tech NUS, Inc. R. H. Holder provided project management for Jason Associates Corporation, DOE's Support Services Contractor.

Some of the individuals listed below prepared specific sections in accordance with their technical qualifications. Other technical experts provided input to those sections through in-depth review and data verification. Still others provided overall technical or management reviews for their respective organizations.

U.S. Department of Energy

Name:	**Lynne Boyle, CPA**
Affiliation:	U.S. Department of Energy
Education:	B.S., Accounting, 1979
Technical Experience:	20 years of accounting experience including 2 years in government auditing, 3 years as non-government company controller, 3 years in government financial accounting, 3 years as program analyst for INEEL government EM programs.
EIS Responsibility:	Cost Analysis Technical Lead

Name:	**Bradley P. Bugger**
Affiliation:	U.S. Department of Energy
Education:	B.S., Journalism, 1979
Technical Experience:	9 years experience as a contractor and federal employee in stakeholder involvement, media relations and intergovernmental activities.
EIS Responsibility:	Public Affairs Lead

Name:	**Robert J. Creed, Jr., PG**
Affiliation:	U.S. Department of Energy
Education:	M.S., Geology, 1998 B.S., Earth Sciences, 1983
Technical Experience:	10 years of experience in DOE research and project management in contaminant transport, earthquake engineering and flood hydrology.
EIS Responsibility:	Analytical Lead - Geology and Water Resources

Name:	**Jack D. Depperschmidt**
Affiliation:	U.S. Department of Energy
Education:	B.S., Wildlife Biology, 1985
Technical Experience:	13 years; 2 years experience with NESHAP approvals and State Air Permitting; 11 years experience with Toxic Substances Control Act and Resource Conservation and Recovery Act Permitting and Compliance; 4 years experience with the National Environmental Policy Act making NEPA determinations.
EIS Responsibility:	Regulatory Compliance Associate Advisor; NEPA Compliance Associate Advisor

Name:	**Denise M. Glore**
Affiliation:	U.S. Department of Energy
Education:	J.D., 1985 M.S., Biology, 1980 B.A., Geography and Anthropology, 1978
Technical Experience:	19 years, including 13 years as environmental attorney; 6 years in photogrammetry, NEPA data collection and statistical analysis.
EIS Responsibility:	Consultations, Legal and Regulatory Issues

Name:	**Jan Hagers**
Affiliation:	U.S. Department of Energy
Education:	M.B.A., 1974 B.S., Mechanical Engineering, 1968
Technical Experience:	30 years engineering experience on nuclear projects with 7 years NEPA experience as a manager or technical lead.
EIS Responsibility:	Analytical Lead - Environmental Justice

Name:	**David Herrin**
Affiliation:	U.S. Department of Energy
Education:	M.S., Electrical Engineering, 1992 B.S., Electrical Engineering, 1990
Technical Experience:	6 years experience in construction project management and program oversight for Power Management Group, also technical lead for electrical systems on advanced Test Reactor Safety Analysis Report.
EIS Responsibility:	Analytical Lead – Facility Accidents, Traffic and Transportation, Utilities and Energy

Name:	**Talley Jenkins**
Affiliation:	U.S. Department of Energy
Education:	M.S., Metallurgical Engineering, 1991 B.S., Metallurgical Engineering, 1989
Technical Experience:	7 years involvement in Environmental Restoration program dealing with risk assessment, feasibility studies, and remedial action.
EIS Responsibility:	CERCLA and WAG-3 Coordinator; Facilities Disposition Advisor

Name:	**William D. Jensen**
Affiliation:	U.S. Department of Energy
Education:	M.E., Chemical Engineering, 1975 B.E.S., Chemical Engineering, 1968
Technical Experience:	29 years, 22 years Special Projects Manager, DOE-ID, Facility Manager, Idaho Chemical Processing Plant, Deputy Assistant Manager, Nuclear Programs, Acting Manager, ES&H Oversight, Director, Safety Division, Chief, Nuclear Safety Branch and Nuclear Engineer, Nuclear Safety Branch, Idaho Operations Office, 2 years, Nuclear Safety Specialist, and Quality Assurance Engineer, Richland Operations Office, 5 years Test and Decontamination Engineer, Pearl Harbor Naval Shipyard.
EIS Responsibility:	Facility Accidents Advisor

Name:	**Richard Kimmel**
Affiliation:	U.S. Department of Energy
Education:	B.S., Civil Engineering, 1969
Technical Experience:	30 years, including 2 years of natural gas systems engineering, 20 years of construction engineering and project/environmental management at fossil-fueled and nuclear power plants, and 8 years of program and project management with DOE including public involvement, NEPA analyses, the preparation of Safety Analysis Reports, and Operational Readiness Reviews.
EIS Responsibility:	Deputy EIS Project Manager

Name:	**Seb Klein**
Affiliation:	U.S. Department of Energy
Education:	M.B.A., 1993 B.A., Accounting, 1991 B.A., Management & Organization, 1991
Technical Experience:	8 years including 2 years experience in compiling and developing socioeconomic data for INEEL, 5 years as a program/budget analyst, 1 year as labor/employee benefit analyst for INEEL.
EIS Responsibility:	Analytical Lead - Socioeconomics

Name:	**Paul Martin**
Affiliation:	U.S. Department of Energy
Education:	B.S., Wildlife Science, 1974 B.A., English, 1965
Technical Experience:	25 years experience in NEPA document preparation, land use analysis and environmental management.
EIS Responsibility:	Analytical Lead – Land Use, Aesthetics and Scenic Resources, Irretrievable and Irreversible Impacts

Name:	**Patricia M. Natoni**
Affiliation:	U.S. Department of Energy
Education:	M.S., Agronomy, 1993 B.S., Biology, 1991
Technical Experience:	5 years; 4 years as Cultural Resources Program Coordinator, 3 years in public involvement.
EIS Responsibility:	Analytical Lead - Cultural Resources

Name:	**Dan Sanow**
Affiliation:	U.S. Department of Energy
Education:	B.B.S., Management and Organization, 1990
Technical Experience:	10 years program management in areas of deactivation, D&D, waste management, construction engineering, Quality Engineering and audit of NQA-1 programs.
EIS Responsibility:	Facility Disposition

Name:	**Ralph W. Russell**
Affiliation:	U.S. Department of Energy
Education:	B.S., Chemical Engineering, 1970
Technical Experience:	22 years air quality; 4 years public involvement.
EIS Responsibility:	Analytical Lead - Air Resources

Name:	**Robert Starck**
Affiliation:	U.S. Department of Energy
Education:	B.S., Zoology, 1975
Technical Experience:	15 years environmental science.
EIS Responsibility:	Analytical Lead - Cultural Resources

Name:	**Roger Twitchell**
Affiliation:	U.S. Department of Energy
Education:	B.S., Botany, 1979
Technical Experience:	22 years natural resources management experience including 7 years NEPA specialist with BLM, 6 years natural resources officer with the Marine Corps, 8 years with DOE on NEPA, CERCLA, RCRA and NRDA projects, 4 years as DOE-ID NEPA Compliance Officer.
EIS Responsibility:	INEEL NEPA Compliance Officer; Analytical Lead - Ecological Resources, Cumulative Impacts

Name:	**Kathleen B. Whitaker**
Affiliation:	U.S. Department of Energy
Education:	B.A., English, 1973
Technical Experience:	14 years Public Affairs Management, Department of Army. 7 years Public Participation and NEPA Public Involvement, DOE.
EIS Responsibility:	EIS Stakeholder Involvement Lead

Name:	**Thomas L. Wichmann**
Affiliation:	U.S. Department of Energy
Education:	U.S. Naval Nuclear Propulsion Program Graduate Light Water Breeder Reactor/Expended Core Facility Project Officer S1W Naval Nuclear Reactor Prototype Project Officer
Technical Experience:	29 years; 20 years Nuclear Power Plant Operations and maintenance, 5 years radioactive and hazardous materials transportation; 5 years managing preparation of NEPA documents and conducting NEPA analyses (accidents and waste management).
EIS Responsibility:	EIS Project Manager

Name:	**Mary V. Willcox**
Affiliation:	U.S. Department of Energy
Education:	B.S., Chemistry, 1990
Technical Experience:	9 years; 3 years radiochemist, 3 years technical manager for NEPA analysis; 3 years Mixed Low-level Waste Program Manager.
EIS Responsibility:	Technical Reviewer

State of Idaho

Name:	**Ann Dold**
Affiliation:	State of Idaho INEEL Oversight Program
Education:	B.S., Environmental Planning, 1983
Technical Experience:	15 years experience in environmental affairs.
EIS Responsibility:	Project lead for State of Idaho

Name:	**Jerry Downs**
Affiliation:	State of Idaho INEEL Oversight Program
Education:	Ph.D., Physics, 1975
Technical Experience:	23 years experience in air quality and 3 years in transportation risk assessments.
EIS Responsibility:	Air quality and transportation risk issues, QA/QC issues

Name:	**Bill Eastlake**
Affiliation:	Idaho Public Utilities Commission
Education:	Ph.D., Economics, 1969
Technical Experience:	20 years experience utility issues.
EIS Responsibility:	Impacts to utilities

Name:	**David Frederick**
Affiliation:	State of Idaho INEEL Oversight Program
Education:	M.S., Geology, 1990
Technical Experience:	10 years experience in geology and groundwater issues.
EIS Responsibility:	Reviewer for geology/hydrology issues

Name:	**Jamie Fuhrman**
Affiliation:	State of Idaho INEEL Oversight Program
Education:	B.S., Political Science, 1987
Technical Experience:	10 years experience in public information and media relations.
EIS Responsibility:	Public Information Officer

Name:	**Tom Gesell**
Affiliation:	Idaho State University
Education:	Ph.D, Physics, 1971
Technical Experience:	27 years experience in health physics.
EIS Responsibility:	Accident and health risk assessment

Name:	**Robert Guenzler, P.E.**
Affiliation:	State of Idaho INEEL Oversight Program
Education:	M.S., Civil Engineering, 1966
Technical Experience:	30 years experience in structural analysis and earthquake engineering.
EIS Responsibility:	Nuclear engineering and technology

Name:	**Flint Hall**
Affiliation:	State of Idaho INEEL Oversight Program
Education:	M.S., Geology, 1992
Technical Experience:	8 years experience in environmental monitoring of groundwater.
EIS Responsibility:	Geology/hydrology issues

Name:	**Manuel Leon**
Affiliation:	Idaho Department of Labor
Education:	Ph.D., Psychology, 1976
Technical Experience:	10 years experience in economic analysis.
EIS Responsibility:	Socioeconomic issues

Name:	**Alan Merritt**
Affiliation:	State of Idaho INEEL Oversight Program
Education:	M.S., Zoology, 1980
Technical Experience:	15 years experience in water and wastewater chemistry, hazardous and radioactive waste management.
EIS Responsibility:	Deputy Project Lead for State of Idaho

Name:	**Rensay Owen**
Affiliation:	State of Idaho Division of Environmental Quality
Education:	B.S., Zoology, 1985
Technical Experience:	8 years experience in RCRA and radioactive waste management.
EIS Responsibility:	RCRA issues

Name:	**Scott Reno**
Affiliation:	State of Idaho Division of Environmental Quality
Education:	B.S., Chemistry, 1990
Technical Experience:	7 years experience in sewage treatment, underground storage tanks and CERCLA issues.
EIS Responsibility:	CERCLA issues

Name:	**Duane Sammons**
Affiliation:	Lt. Idaho State Police
Technical Experience:	24 years experience in law enforcement.
EIS Responsibility:	Law enforcement issues

Name:	**Bryan Smith**
Affiliation:	Idaho Department of Transportation
Technical Experience:	11 years experience in hazardous materials and emergency management and transportation issues.
EIS Responsibility:	Transportation issues

Name:	**Alan Schilk**
Affiliation:	State of Idaho INEEL Oversight Program
Education:	Ph.D., Radiochemistry, 1991
Technical Experience:	10 years experience in environmental monitoring and modeling radionuclide transport in the environment.
EIS Responsibility:	Nuclear engineering and technology issues

Name:	**Luke Paulus**
Affiliation:	State of Idaho INEEL Oversight Program
Education:	M.S., Health Physics, 1995
Technical Experience:	5 years experience in laboratory analysis, risk assessment and environmental monitoring.
EIS Responsibility:	Accident and health risk assessment issues

Name:	**Doug Walker**
Affiliation:	State of Idaho INEEL Oversight Program
Education:	B.S., Health Physics, 1990
Technical Experience:	7 years experience in environmental monitoring and emergency response.
EIS Responsibility:	Accident and health risk assessment issues

Name:	**Gerry Winter**
Affiliation:	State of Idaho Division of Environmental Quality
Education:	M.S., Hydrology, 1979
Technical Experience:	25 years experience in groundwater issues.
EIS Responsibility:	Geology and hydrology issues

Tetra Tech NUS and associated subcontractors

Name:	**Yvonne F. Abernethy**
Affiliation:	Tetra Tech NUS
Education:	M.S., Forest Management and Economics, 1984 B.S., Forest Management, 1979
Technical Experience:	5 years preparing NEPA documents; 14 years in natural resource management and environmental planning.
EIS Responsibility:	Quality Assurance, Data Management

Name:	**Michele D. Blackburn**
Affiliation:	Tetra Tech NUS
Technical Experience:	10 years experience in graphic design, layout and illustrations for NEPA documents.
EIS Responsibility:	Graphics Lead

Name:	**Janet Bouknight**
Affiliation:	Tetra Tech NUS
Education:	B.S., Biological Sciences, 1995 M.S., Environmental Toxicology, 1998
Technical Experience:	3 years in polymer research; 1 year in ecological risk assessment.
EIS Responsibility:	Ecological Resources; Project Information

Name:	**Bruce Bradford, P.E.**
Affiliation:	Tetra Tech NUS
Education:	Ph.D., Civil Engineering, 1974 M.S., Civil Engineering, 1966 B.S., Civil Engineering, 1965
Technical Experience:	15 years preparing NEPA documents; 32 years in civil engineering specializing in hydrology, hydraulics, and water resources.
EIS Responsibility:	Senior Technical Reviewer

Name:	**Steven J. Connor**
Affiliation:	Tetra Tech NUS
Education:	M.S., Physics, 1974 B.S., Physics, 1973
Technical Experience:	23 years in environmental management systems, radiological effluent monitoring, analytical laboratory quality assurance, gamma spectrometry, radiological transportation risk assessments, environmental transport, dose assessments, human health risk assessments, and NEPA document preparation.
EIS Responsibility:	Tetra Tech NUS Project Manager

Name:	**William Craig**
Affiliation:	Tetra Tech NUS
Education:	M.S., Planning, 1977 B.S., Forestry, 1972
Technical Experience:	10 years preparing NEPA documents; 20 years utility fuel planning and powerplant siting.
EIS Responsibility:	Socioeconomics

Name:	**Kent T. Cubbage**
Affiliation:	Tetra Tech NUS
Education:	M.S. Environmental Toxicology, 1993 B.S., Environmental Biology, 1991
Technical Experience:	6 years experience in toxicology, risk assessment, and aquatic and terrestrial ecology.
EIS Responsibility:	Ecological Resources

Name:	**Sandy Enyeart, P.E.**
Affiliation:	Tetra Tech NUS
Education:	B.S., Civil Engineering, 1974 B.A., Fine Arts, 1987
Technical Experience:	10 years preparing NEPA documents, 22 years DOE experience primarily in water resources, NEPA, and safety analysis.
EIS Responsibility:	Geology and Soils; Water Resources

Name:	**Philip Fulmer**
Affiliation:	Tetra Tech NUS
Education:	Ph.D. Nuclear Engineering, 1993 M.S., Health Physics, 1990 B.A., Health Physics, 1989
Technical Experience:	10 years experience in radiation protection, internal radiation dosimetry, and external radiation dosimetry.
EIS Responsibility:	Facility Disposition Modeling

Name	**Jean-Luc Glorieux, P.E.**
Affiliation:	Tetra Tech NUS
Education:	M.S., Chemistry, 1968 B.S., Chemistry, 1966
Technical Experience:	30 years of environmental engineering experience.
EIS Responsibility:	Project Engineering

Name:	**Kathryn Hauer**
Affiliation:	Tetra Tech NUS
Education:	M.A., English, 1985 B.A., English, 1983
Technical Experience:	12 years experience in technical writing, editing, and teaching in both government and business disciplines; 5 years in preparation of NEPA documents.
EIS Responsibility:	Editor

Name:	**Brian Hill**
Affiliation:	Tetra Tech NUS
Education:	B.S., Environmental Health, 1988
Technical Experience:	3 years preparing NEPA documents; 11 years in health physics, industrial hygiene, emergency preparedness, and environmental science.
EIS Responsibility:	Environmental Consequences Data, Health and Safety

Name:	**Tom Ivory**
Affiliation:	Tetra Tech NUS
Education:	Ph.D. Environmental Microbiology, 1973 M.S., Environmental Microbiology, 1967 B.A., Biology, 1965
Technical Experience:	25 years preparing NEPA documents; 25 years in environmental management and quality assurance; 10 years in environmental risk assessment.
EIS Responsibility:	Ecological Resources Lead

Name:	**Douglas Kennemore**
Affiliation:	Tetra Tech NUS
Education:	M.S., Biology, 1995 B.S., Biology, 1991
Technical Experience:	2 years preparing NEPA documents; 7 years botany and plant community investigations.
EIS Responsibility:	Cultural Resources, Aesthetic and Scenic Resources

Name:	**Lisa A. Matis**
Affiliation:	Tetra Tech NUS
Education:	M.S., Mechanical Engineering, 1989 B.S., Chemical Engineering, 1984
Technical Experience:	9 years preparing NEPA documents; 14 years of waste management and regulatory compliance services.
EIS Responsibility:	Consultation and Environmental Requirements; Background; Alternatives; Waste and Materials

Name:	**William R. McDonell**
Affiliation:	Tetra Tech NUS
Education:	Ph.D., Nuclear Chemistry, 1951 M.S., Chemistry, 1948 B.S., Chemistry, 1947
Technical Experience:	50 years experience in nuclear and radiation technologies including strategies for nuclear waste disposal.
EIS Responsibility:	Senior Consultant

Name:	**Aparajita Morrison**
Affiliation:	Tetra Tech NUS
Education:	B.S., Health Physics, 1985
Technical Experience:	5 years preparing NEPA documents; 13 years of Environmental and Occupational Health Physics Experience.
EIS Responsibility:	Health and Safety

Name:	**Philip R. Moore**
Affiliation:	Tetra Tech NUS
Education:	M.S., Wildlife & Fisheries Biology, 1983 B.A., English, 1975
Technical Experience:	8 years preparing NEPA documents; 17 years as fishery biologist and aquatic ecologist.
EIS Responsibility:	Environmental Consequences Technical Lead; Land Use

Name:	**Richard F. Orthen**
Affiliation:	Tetra Tech NUS
Education:	B.S., Chemistry, 1979
Technical Experience:	6 years preparing NEPA documents; 20 years occupational and environmental health physics.
EIS Responsibility:	Traffic and Transportation

Name:	**David N. Perry**
Affiliation:	Tetra Tech NUS
Education:	B.S., Civil Engineering, 1997
Technical Experience:	2 years of experience as GIS analyst and environmental engineer, developing environmental GIS applications and analytical databases.
EIS Responsibility:	Environmental Justice

Name:	**Diane Sinkowski**
Affiliation:	Tetra Tech NUS
Education:	M.E., Environmental Engineering, 1994 B.S., Nuclear Engineering Sciences, 1990
Technical Experience:	4 years preparing NEPA documents; 6 years in fate and transport modeling, human health impacts, environmental compliance, and health physics.
EIS Responsibility:	Facility closure modeling; Project Information; Traffic and Transportation and Utilities and Energy.

Name:	**James S. Willison, P.E., CHP**
Affiliation:	Tetra Tech NUS
Education:	M.S., Nuclear Engineering, 1982 B.S., Nuclear Engineering, 1980
Technical Experience:	2 years preparing NEPA documents; 14 years of accident analyses at nuclear facilities; health physics and radiological engineering.
EIS Responsibility:	Facility Accidents

Name:	**Philip L. Young, CHP**
Affiliation:	Tetra Tech NUS
Education:	M.S., Health Physics, 1989 B.S., Radiation Health, 1988
Technical Experience:	10 years experience in NEPA document preparation, radiological risk assessment, radioactive waste management, and radiological environmental monitoring.
EIS Responsibility:	Tetra Tech NUS Deputy Project Manager; Alternatives lead

Name:	**Kent Bostick**
Affiliation:	Jacobs Engineering Group
Education:	M.S., Groundwater Hydrology, 1977 B.S., Soil Science, 1975
Technical Experience:	20 years experience in environmental compliance at DOE and DOD facilities; 10 years in the preparation of NEPA documents.
EIS Responsibility:	Hanford Impacts

Name:	**Dwayne Crumpler**
Affiliation:	Jacobs Engineering Group
Education:	M.S., Geology, 1989 B.S., Geology, 1985
Technical Experience:	10 years experience in environmental compliance at DOE, DOD and private sector facilities; 3 years in the preparation of NEPA documents.
EIS Responsibility:	Hanford Impacts

Name:	**Doug Evans**
Affiliation:	Jacobs Engineering Group
Education:	M.S., Geology, 1989 B.S., Geology, 1980
Technical Experience:	10 years experience in environmental compliance at DOE; 7 years in the preparation of NEPA documents.
EIS Responsibility:	Hanford Impacts

Name:	**Harry Fugate**
Affiliation:	Jacobs Engineering Group
Education:	M.S., Environmental Engineering, 1989 MBA, 1988 B.S., Civil and Environmental Engineering, 1986
Technical Experience:	10 years experience in environmental compliance at DOE; 1 year in the preparation of NEPA documents.
EIS Responsibility:	Hanford Impacts

Name:	**Greg Gavel**
Affiliation:	Jacobs Engineering Group
Education:	B.S., Nuclear Engineering, 1990
Technical Experience:	10 years experience in processing engineering for private sector clients; 1 year in the preparation of NEPA documents.
EIS Responsibility:	Hanford Impacts

Name:	**Michael Harker**
Affiliation:	Jacobs Engineering Group
Education:	B.S., Zoology, 1979
Technical Experience:	15 years experience in environmental compliance at DOE; 5 years in the preparation of NEPA documents.
EIS Responsibility:	Hanford Impacts

Name:	**Colin Henderson**
Affiliation:	Jacobs Engineering Group
Education:	M.S., Environmental Engineering, 1996 B.S., Mechanical Engineering, 1986
Technical Experience:	10 years engineering experience with industry and environmental compliance at DOE; 5 years experience in the preparation of NEPA documents.
EIS Responsibility:	Hanford Impacts

Name:	**Kathleen Moore**
Affiliation:	Jacobs Engineering Group
Education:	M.P.H. Epidemiology and Public Health, 1989 B.S., Biochemistry, 1978
Technical Experience:	10 years experience in environmental compliance at DOE and DOD; 8 years in the preparation of NEPA documents.
EIS Responsibility:	Hanford Impacts

Name:	**Dave Nichols**
Affiliation:	Jacobs Engineering Group
Education:	B.A., Political Science and Communications, 1980
Technical Experience:	15 years experience in environmental compliance for DOE, DOD, EPA and industry; 9 years experience in the preparation of NEPA documents.
EIS Responsibility:	Hanford Impacts

Name:	**Jack Sabin**
Affiliation:	Jacobs Engineering Group
Education:	B.A., Mechanical Engineering, 1973
Technical Experience:	40 years experience in engineering, project scheduling, and cost estimating for DOE and industry; 3 years experience in the preparation of NEPA documents.
EIS Responsibility:	Hanford Impacts

Name:	**Mike Worthington**
Affiliation:	Jacobs Engineering Group
Education:	B.S., Chemical Engineering, 1971
Technical Experience:	25 years experience in chemical and processing engineering for industry; 1 year experience in the preparation of NEPA documents.
EIS Responsibility:	Hanford Impacts

Name:	**Kirsten Schandfield**
Affiliation:	David Miller & Associates
Education:	M.B.A., Business Administration, 1992 B.S., Psychology, 1985
Technical Experience:	12 years of experience in preparation of financial and cost analyses for government and public institutions.
EIS Responsibility:	Cost Analysis of Alternatives

Name	**Vinicio Vannicola, Jr.**
Affiliation:	David Miller & Associates
Education:	M.B.A., Business Administration, 1992 B.S., Economics and Finance, 1986
Technical Experience:	12 years of experience in preparation of financial and cost analyses for government and public institutions.
EIS Responsibility:	Cost Analysis of Alternatives

Name:	**Robert C. Peel**
Affiliation:	Rogers & Associates Engineering Corp.
Education:	B.S., Geography, 1976
Technical Experience:	23 years of Environmental management, environmental compliance, and NEPA experience.
EIS Responsibility:	Cost Analysis of Alternatives, local coordination, issues management

Name:	**Bret Rogers**
Affiliation:	Rogers & Associates Engineering Corp.
Education:	M.S., Environmental Engineering, 1998 B.S., Physics, 1994
Technical Experience:	4 years experience in risk assessment for transportation of radioactive materials.
EIS Responsibility:	Traffic and Transportation

Name:	**Vern C. Rogers**
Affiliation:	Rogers & Associates Engineering Corp.
Education:	M.S., Nuclear Engineering, 1995 B.S., Physics, 1990
Technical Experience:	13 years NEPA experience in DOE and EPA research and project management in contaminant fate and transport, risk and performance assessment, regulatory development and support, and cost and economic analysis.
EIS Responsibility:	Traffic and Transportation

Name:	**Rich Belanger, CHP**
Affiliation:	Ryan-Belanger Associates
Education:	M.S., Radiological Physics, 1976 A.B. Biology, 1974
Technical Experience:	More than 20 years of operational and consulting experience in radiation protection and environmental studies, including over 5 years of direct involvement in NEPA projects.
EIS Responsibility:	Air Resources and facility closure modeling

Name:	**Deborah Ryan**
Affiliation:	Ryan-Belanger Associates
Education:	B.S., Meteorology, 1976
Technical Experience:	20 years of experience in air pollution control and air quality assessments, including over 5 years of direct involvement in NEPA projects.
EIS Responsibility:	Air Resources

Name:	**John Raudsup**
Affiliation:	Ryan-Belanger Associates
Education:	B.S., Chemical Engineering, 1983
Technical Experience:	15 years of operational and consulting experience in nuclear and chemical facility operations and environmental impact assessment, including over 3 years of direct involvement in NEPA projects.
EIS Responsibility:	Air Resources

Name:	**Sara McQueen**
Affiliation:	Tetra Tech, Inc.
Education:	B.A., Economics, 1995
Technical Experience:	More than 3 years experience conducting socioeconomic analyses and environmental justice evaluations under NEPA for DOE and DOD.
EIS Responsibility:	Environmental Justice

Name:	**Fred Blazine**
Affiliation:	Erin Engineering Research
Education:	M.B.A, Business Administration & Analysis, 1980 M.A., Industrial Management, 1975 B.S.E.E., Electrical Engineering, 1960
Technical Experience:	3 years as systems engineer for environmental projects supporting the Idaho National Engineering and Engineering Laboratory and DOE; 10 years as a systems engineer developing USAF avionics systems; over 20 years as a project engineer developing and testing avionics systems.
EIS Responsibility:	Senior Alternatives Analysis Engineer

Name:	**Stanley Fong**
Affiliation:	Erin Engineering Research
Education:	B.S., Chemical Engineering, 1990
Technical Experience:	8 years experience in safety analysis, risk assessment, dispersion modeling, and health consequences assessment.
EIS Responsibility:	Facility Accidents

Name:	**Richard Thow**
Affiliation:	Erin Engineering Research
Education:	B.S., Civil Engineering, 1984
Technical Experience:	8 years in nuclear licensing and structural engineering for commercial nuclear facilities.
EIS Responsibility:	Facility Accidents

Name:	**Al Unione**
Affiliation:	Erin Engineering Research
Education:	Ph.D., Mechanics and Hydraulics, 1972 M.S., Mechanics and Hydraulics, 1970 B.S., Mechanical and Aerospace Engineering 1967
Technical Experience:	26 years of professional experience; 23 years of experience in risk assessments, safety assessment, probabilistic risk evaluations, and health impact evaluations; 6 years experience in conducting accident analyses for EISs.
EIS Responsibility:	Facility Accidents Lead

Name:	**Ken Krivanek**
Affiliation:	GTI
Education:	M.S., Thermal & Environmental Engineering, 1979 M.S., Geochemistry/Hydrology, 1976 B.S., Geology/Mineralogy, 1972
Technical Experience:	23 years as an environmental and systems engineer; 15 years preparing NEPA documents.
EIS Responsibility:	Facility Accidents, Technical Resource Document

Jason Associates Corporation

Name:	**William Berry**
Affiliation:	Jason Associates Corporation
Education:	Ph.D., Entomology, 1988 M.S., Biology, 1983 B.S., Biology, 1981
Technical Experience:	10 years of experience in environmental compliance, environmental impact assessment, ecological risk assessment, and remedial investigations/feasibility studies at DOE and DOD facilities.
EIS Responsibility:	Unavoidable Adverse Impacts; Irreversible and Irretrievable Commitments of Resources; Short-Term Use Versus Long-Term Productivity of the Environment; Cumulative Impacts

Name:	**Herbert A. Bohrer**
Affiliation:	Jason Associates Corporation
Education:	B.S., Mechanical Engineering, 1971
Technical Experience:	35 years nuclear operations experience; 20 years waste management experience; 3 years NEPA experience.
EIS Responsibility:	Appendix A; Consultations and Environmental Requirements

Name:	**Albert Bowman**
Affiliation:	Jason Associates Corporation
Education:	B.A., Physics and Mathematics, 1958
Technical Experience:	34 years of university and government experience in engineering, environmental and NEPA compliance, and related fields including: 16 years nuclear engineering and environmental compliance; 13 years of NEPA experience and preparation of environmental impacts assessments.
EIS Responsibility:	Senior Technical Advisor

Name:	**Carole Cole**
Affiliation:	Jason Associates Corporation
Education:	B.S., Experimental Psychology, 1967
Technical Experience:	20 years of experience specializing in government and industry, communications, public participation, and media planning.
EIS Responsibility:	Public Involvement; Summary

Name:	**Theran Cook**
Affiliation:	Jason Associates Corporation
Education:	U.S. Naval Nuclear Propulsion Program Graduate NRC Licensed reactor operator
Technical Experience:	30 years of experience in the development of safety analysis reports, operational safety requirements, technical specifications, and technical safety requirements for commercial nuclear and DOE facilities.
EIS Responsibility:	Facility Accidents

Name:	**Keith Davis, P.E.**
Affiliation:	Jason Associates Corporation
Education:	M.S., Civil and Environmental Engineering, 1976 B.S., Civil Engineering, 1973
Technical Experience:	22 years of experience in civil and environmental engineering projects; hazardous and radioactive mixed waste management; RCRA facility operation, permitting and closure; CERCLA release response, site investigations, feasibility studies, and remedial action planning; and NEPA environmental impact analyses.
EIS Responsibility:	Waste and Materials

Name:	**Kevin Harris**
Affiliation:	Jason Associates Corporation
Education:	M.S., Environmental Engineering, 1997 B.S., Environmental Engineering, 1995
Technical Experience:	2 years experience in environmental engineering projects including RCRA closure; emergency management assessments; Citizen Advisory Board technical support; environmental baseline modeling; and environmental sampling.
EIS Responsibility:	Waste and Materials; Consultations and Environmental Requirements

Name:	**Kim Johnson**
Affiliation:	Jason Associates Corporation
Education:	B.S., Biology, 1994
Technical Experience:	4 years of experience in environmental compliance, environmental site assessment, and environmental restoration; 2 years in preparation of NEPA documents.
EIS Responsibility:	Affected Environment: Land Use, Aesthetic Scenic Resources, Ecological Resources, Utilities and Energy, Environmental Justice, and Cumulative Impacts

Name:	**Daren K. Jensen**
Affiliation:	Jason Associates Corporation
Education:	B.S., Physics, 1992 A.A.S, General Education, 1989
Technical Experience:	13 years of environment, safety, health and quality assurance experience with emphasis on radiological program development, regulatory compliance, ALARA implementation, auditing, and training.
EIS Responsibility:	Quality Assurance Program, Data Management

Name:	**Emily Scarborough**
Affiliation:	Jason Associates Corporation
Education:	B.S., Biology, 1981
Technical Experience:	15 years of experience in various areas of health physics, including field operations, training, regulatory compliance, and risk assessment.
EIS Responsibility:	Affected Environment: Health and Safety

Name:	**Michael J. Spry**
Affiliation:	Portage Environmental, Inc.
Education:	M.S., Land Rehabilitation, 1986 B.S., Environmental Studies, 1983
Technical Experience:	15 years of experience in environmental compliance, preparing CERCLA compliance documents, conducting RCRA facility closures and performing NEPA impact analyses.
EIS Responsibility:	Affected Environment: Cultural Resources

Name:	**Nelson Soucek**
Affiliation:	Jason Associates Corporation
Education:	A.A., Fine Arts, 1975
Technical Experience:	22 years of visual communications experience.
EIS Responsibility:	Affected Environment: Graphics

Tetra Tech NUS Publications Group

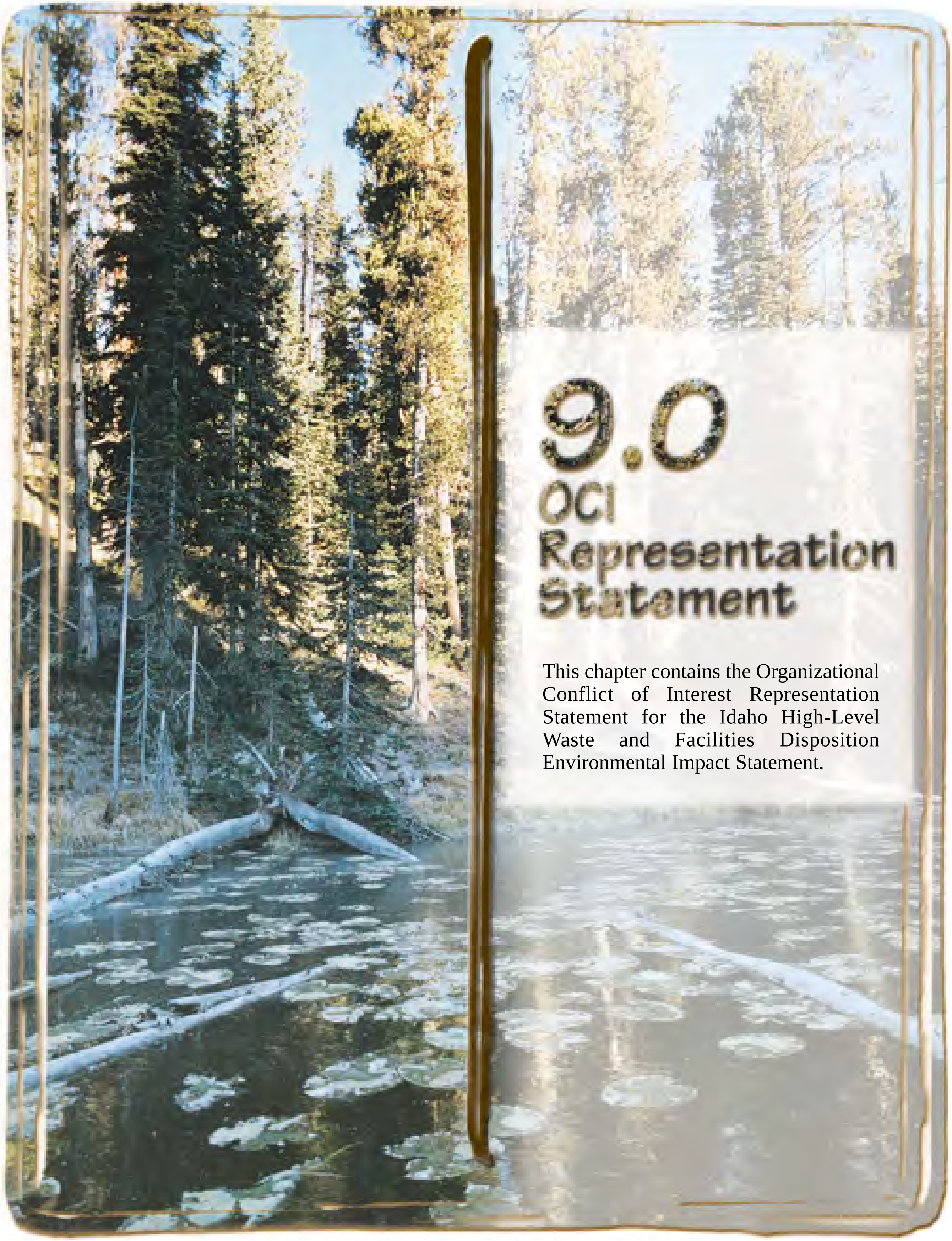
Dwight Coleman (Reproduction)
Keely Kennemore (Illustrations)
Rebecca Moore (Graphics & List of Preparers)
Mary T. Saunders (Word Processing)
Regina J. Speir (Word Processing)

Photography Acknowledgements

Steve Ashe
Beverly Bastain
Donna Berlin
Michele Blackburn
Cindy Copeland
John Capek
Mike Crane
Norm Free
Douglas Kennemore
Rebecca Moore
Chris Morgan
Ron Paarmann
Rick Romero
Ron Thinnes
Byron Williams

High-Level Waste EIS Project Office

LoAnn Belnap (Administrative Record)
Cindy Brown (Administrative Record Manager)
Lonnie Martinell (Project Secretary)
Don Minton (Administrative Supervisor)



9.0 OCI Representation Statement

This chapter contains the Organizational Conflict of Interest Representation Statement for the Idaho High-Level Waste and Facilities Disposition Environmental Impact Statement.

NEPA FINANCIAL DISCLOSURE STATEMENT FOR PREPARATION OF DEPARTMENT OF ENERGY IDAHO HIGH-LEVEL WASTE AND FACILITIES DISPOSITION ENVIRONMENTAL IMPACT STATEMENT

Council on Environmental Quality Regulations at 40 CFR 1506.5(c), which have been adopted by the DOE (10 CFR Part 1021), require contractors who will prepare an EIS to execute a disclosure specifying that they have no financial interest or other interest in the outcome of the project. The term "financial or other interest in the outcome of the project" for purposes of this disclosure is defined in the March 23, 1981, guidance, Forty Most Asked Questions Concerning CEQ's National Environmental Policy Act Regulations," 46 Fed. Reg. 18,026-18,038, Questions 17a and 17b.

"Financial or other interest in the outcome of the project" includes "any financial benefit such as a promise of future construction or design work in the project, as well as indirect benefits the contractor is aware of (e.g., if the project would aid proposals sponsored by the firm's other clients)," 46 Fed. Reg. 18,031.

In accordance with these requirements, the undersigned hereby certifies that the company and any of its proposed subcontractors have no financial or other interest in the outcome of the above named project.

Certified by:

8/6/99
Date

Signature

[illegible]
Name

Vice President
Title

[illegible]

NEPA FINANCIAL DISCLOSURE STATEMENT FOR PREPARATION OF DEPARTMENT OF ENERGY IDAHO HIGH-LEVEL WASTE AND FACILITIES DISPOSITION ENVIRONMENTAL IMPACT STATEMENT

Council on Environmental Quality Regulations at 40 CFR 1506.5(c), which have been adopted by the DOE (10 CFR Part 1021), require contractors who will prepare an EIS to execute a disclosure specifying that they have no financial interest or other interest in the outcome of the project. The term "financial or other interest in the outcome of the project" for purposes of this disclosure is defined in the March 23, 1981, guidance, Forty Most Asked Questions Concerning CEQ's National Environmental Policy Act Regulations," 46 Fed. Reg. 18,026-18,038, Questions 17a and 17b.

"Financial or other interest in the outcome of the project" includes "any financial benefit such as a promise of future construction or design work in the project, as well as indirect benefits the contractor is aware of (e.g., if the project would aid proposals sponsored by the firm's other clients)," 46 Fed. Reg. 18,031.

In accordance with these requirements, the undersigned hereby certifies that the company and any of its proposed subcontractors have no financial or other interest in the outcome of the above named project.

Certified by:

[illegible]
Date

Signature

Richard Holder
Name

Vice President
Title

[illegible]
Company

NEPA FINANCIAL DISCLOSURE STATEMENT FOR PREPARATION OF DEPARTMENT OF ENERGY IDAHO HIGH-LEVEL WASTE AND FACILITIES DISPOSITION ENVIRONMENTAL IMPACT STATEMENT

Council on Environmental Quality Regulations at 40 CFR 1506.5(c), which have been adopted by the DOE (10 CFR Part 1021), require contractors who will prepare an EIS to execute a disclosure specifying that they have no financial interest or other interest in the outcome of the project. The term "financial or other interest in the outcome of the project" for purposes of this disclosure is defined in the March 23, 1981, guidance, Forty Most Asked Questions Concerning CEQ's National Environmental Policy Act Regulations," 46 Fed. Reg. 18,026-18,038, Questions 17a and 17b.

"Financial or other interest in the outcome of the project" includes "any financial benefit such as a promise of future construction or design work in the project, as well as indirect benefits the contractor is aware of (e.g., if the project would aid proposals sponsored by the firm's other clients)." 46 Fed. Reg. 18,031.

In accordance with these requirements, the undersigned hereby certifies that the company and any of its proposed subcontractors have no financial or other interest in the outcome of the above named project.

Certified by:

August 5, 1999
Date

Signature

[illegible]
Name

[illegible]
Title

[illegible]
[illegible]

NEPA FINANCIAL DISCLOSURE STATEMENT FOR PREPARATION OF DEPARTMENT OF ENERGY IDAHO HIGH-LEVEL WASTE AND FACILITIES DISPOSITION ENVIRONMENTAL IMPACT STATEMENT

Council on Environmental Quality Regulations at 40 CFR 1506.5(c), which have been adopted by the DOE (10 CFR Part 1021), require contractors who will prepare an EIS to execute a disclosure specifying that they have no financial interest or other interest in the outcome of the project. The term "financial or other interest in the outcome of the project" for purposes of this disclosure is defined in the March 23, 1981, guidance, Forty Most Asked Questions Concerning CEQ's National Environmental Policy Act Regulations," 46 Fed. Reg. 18,026-18,038, Questions 17a and 17b.

"Financial or other interest in the outcome of the project" includes "any financial benefit such as a promise of future construction or design work in the project, as well as indirect benefits the contractor is aware of (e.g., if the project would aid proposals sponsored by the firm's other clients)." 46 Fed. Reg. 18,031.

In accordance with these requirements, the undersigned hereby certifies that the company and any of its proposed subcontractors have no financial or other interest in the outcome of the above named project.

Certified by:

June 28, 1999
Date

Signature

Jeff Jones
Name

Director of Operations
Title

Global Technologies Incorporated
Company

NEPA FINANCIAL DISCLOSURE STATEMENT FOR PREPARATION OF DEPARTMENT OF ENERGY IDAHO HIGH-LEVEL WASTE AND FACILITIES DISPOSITION ENVIRONMENTAL IMPACT STATEMENT

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Certified by:

10-24-99
Date

Signature

Deborah Ryan
Name

Principal
Title

Ryan-[illegible] Associates
Company

NEPA FINANCIAL DISCLOSURE STATEMENT FOR PREPARATION OF DEPARTMENT OF ENERGY IDAHO HIGH-LEVEL WASTE AND FACILITIES DISPOSITION ENVIRONMENTAL IMPACT STATEMENT

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In accordance with these requirements, the undersigned hereby certifies that the company and any of its proposed subcontractors have no financial or other interest in the outcome of the above named project.

Certified by:

August 4, 1999
Date

Signature

Alfred [illegible]
Name

Director of Technology & [illegible]
Title

[illegible] Engineering & Research, Inc.
Company

NEPA FINANCIAL DISCLOSURE STATEMENT FOR PREPARATION OF DEPARTMENT OF ENERGY IDAHO HIGH-LEVEL WASTE AND FACILITIES DISPOSITION ENVIRONMENTAL IMPACT STATEMENT

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In accordance with these requirements, the undersigned hereby certifies that the company and any of its proposed subcontractors have no financial or other interest in the outcome of the above named project.

Certified by:

2/3/99
Date

Signature

Vincenzo Vitoniola
Name

Vice President
Title

David Miller & Associates
Company

NEPA FINANCIAL DISCLOSURE STATEMENT FOR PREPARATION OF DEPARTMENT OF ENERGY IDAHO HIGH-LEVEL WASTE AND FACILITIES DISPOSITION ENVIRONMENTAL IMPACT STATEMENT

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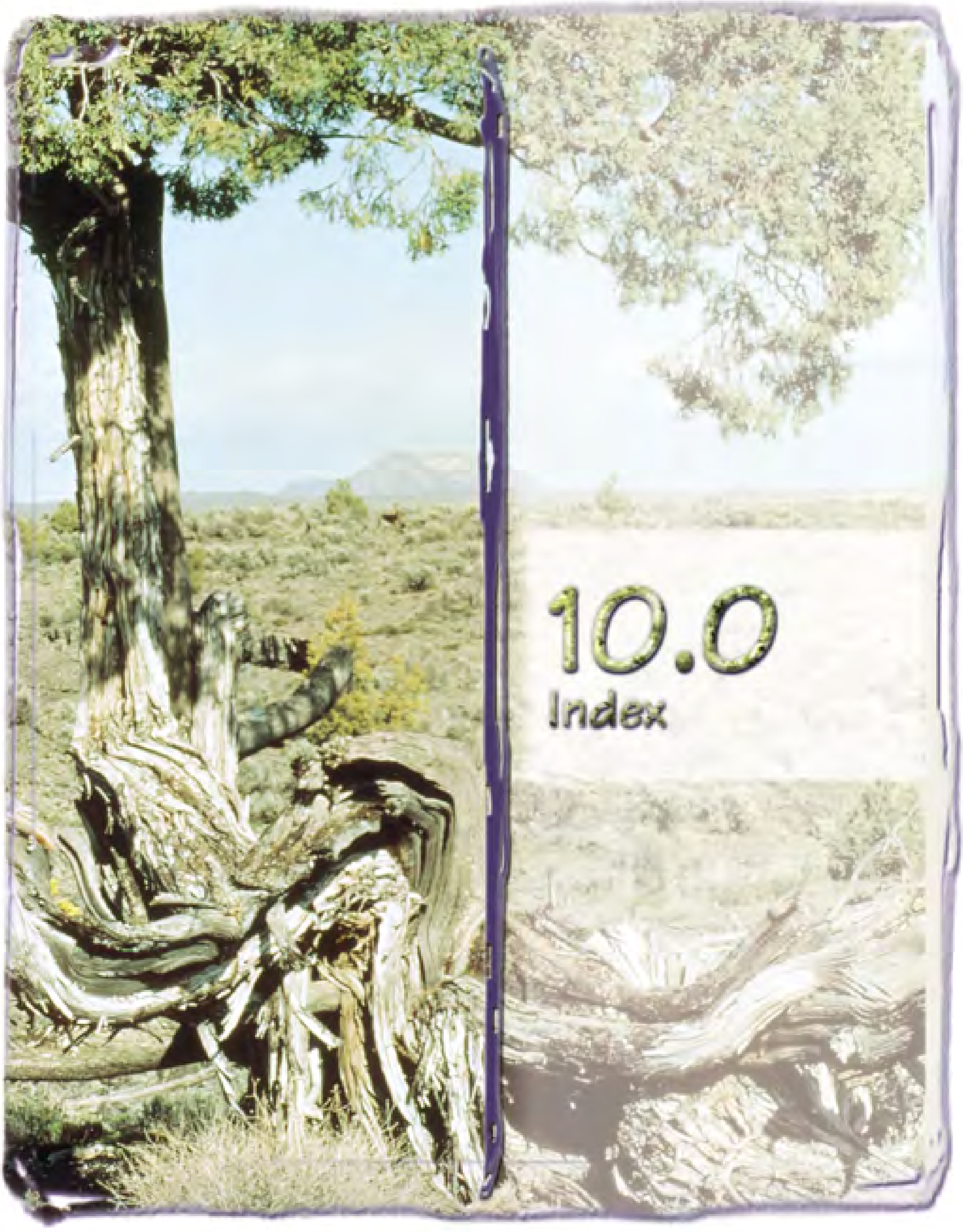
Certified by:

7/20/99
Date

Signature

Michael J. Spry
Name

President, Portage Environmental, Inc.
Title


10.0
Index

A

B

C

E

F

G

I

L

M

N

P

R

S

T

U

W

Y

Idaho High-Level Waste & Facilities Disposition

DRAFT ENVIRONMENTAL IMPACT STATEMENT

DECEMBER 1999 DOE/EIS-0287D

DEPARTMENT OF ENERGY UNITED STATES OF AMERICA

GREAT SEAL OF THE STATE OF IDAHO

Volume 3

APPENDICES A THROUGH C.5

APPENDIX A

SITE EVALUATION PROCESS

NOTE: This appendix and the references associated with it refer to the historically used radioactive waste terms, sodium bearing waste (SBW) and newly generated liquid waste. These terms have been used at the INEEL over the years to describe liquid radioactive wastes generated in association with high level waste and other waste management activities.

In July 1999, the Department of Energy published DOE Order 435.1 "Radioactive Waste Management." This Order establishes terms and definitions for radioactive waste. The radioactive waste terms used in the main body of this Idaho HLW & FD EIS refer to the terms specified in the Order. In most cases, this EIS parenthetically refers to the historical waste term.

To assist the reader in corresponding the historical radioactive waste terms used in this appendix with radioactive waste terms used in the main body of this EIS and the Summary, a cross-reference table has been provided in Section 1.2.2 of Volume 1 of this EIS.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

APPENDIX A. SITE EVALUATION PROCESS

A.1 Introduction

The U.S. Department of Energy (DOE) is preparing the Idaho High-Level Waste and Facilities Disposition Environmental Impact Statement (Idaho HLW & FD EIS), in accordance with the National Environmental Policy Act (NEPA), to evaluate alternatives for managing the high-level waste (HLW) and associated radioactive wastes at the Idaho National Engineering and Environmental Laboratory (INEEL). *Process for Identifying Potential Alternatives for the INEEL High-Level Waste and Facilities Disposition Environmental Impact Statement* (DOE 1999) describes the process DOE used to identify potential alternatives to be analyzed in the EIS. Each of the alternatives and options would involve constructing new waste processing facilities. Some of the waste processing alternatives would first separate the waste into high-activity and low-activity fractions. After treatment, the high-activity waste would be disposed of in a national geologic repository. The treated low-activity waste would be suitable for near-surface disposal.

Because HLW treatment and interim storage facilities and low-activity waste disposal facilities are options being evaluated in the Idaho HLW & FD EIS, DOE performed a preliminary site evaluation to assess the feasibility of locating such facilities on INEEL. This appendix describes the selection process that DOE used to identify locations for the potential siting of waste processing facilities (Section A.3) and disposal sites (Section A.4) in support of HLW operations. DOE has not made the final site selection decision. The preliminary site evaluation described in this appendix was used to identify potential sites to allow for impact analysis within the EIS. A complete description of the process used and the factors considered in identifying off-INEEL locations and sites for HLW treatment operations are included in DOE (1999).

A.2 Methodology

DOE used a qualitative approach based on existing data for the preliminary site evaluations. Only those criteria specific to the preliminary evaluation of locations were considered. Other concerns such as radiological consequences, risk assessment, site-specific seismic studies, site characterization, consequences to air quality, proximity to known Resource Conservation and Recovery Act (RCRA) or Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) sites, safety analysis, and other requirements for final site selection were deferred pending the analysis in the Idaho HLW & FD EIS. If it is determined through this EIS process that new facilities will be located on

INEEL, the preliminary site evaluations can be used to define additional data needed to support final site selections.

The scope for the preliminary site evaluation included:

- Identify critical (“must”) and desirable (“want”) site criteria.
- Identify candidate locations on INEEL for both HLW treatment and interim storage facilities and the Low-Activity Waste Disposal Facility.
- Limit candidate sites for the HLW treatment and interim storage facilities to existing operational facilities or areas not located over the Snake River Plain aquifer.
- Consider any location, including an area not over the Snake River Plain aquifer, for the Low-Activity Waste Disposal Facility.
- Screen candidate sites against the critical and desirable criteria using existing information.
- Rank the candidate sites based on their relative suitability.

General assumptions applied to the preliminary site evaluations included:

- The new facilities will be dedicated primarily to the Idaho Nuclear Technology and Engineering Center (INTEC) wastes.
- Only sites on INEEL will be considered.
- If new facilities are constructed, appropriate site surveys, characterization, and risk assessment will be conducted before final site selection.
- DOE land-use plans will be observed.
- The draft U.S. geological survey approximate boundaries for the 100-year floodplain of the Big Lost River (Berenbrock and Kjelstrom 1998) are conservative and appropriate for preliminary site evaluation.

The first step in the evaluation process was to identify pertinent regulations for siting waste treatment, storage, and disposal facilities. Appendix A of Holdren et al. (1997) presents the results of this review of regulations. This information was used to develop two categories of site evaluation criteria: regulations with specific siting requirements designated as "must" criteria and regulations with recommendations for locating facilities designated as "want" criteria. In addition to the criteria that address regulatory requirements and recommendations, other "want" criteria were identified based on professional judgement. These other criteria address risk assessment, logistics, and other characteristics not clearly defined in regulations.

Once the criteria were determined, DOE identified candidate sites and performed initial screening against the criteria in preparation for decision analysis sessions. Candidate sites were identified based on professional judgement with the screening criteria in mind. Many areas of INEEL were not considered because of *a priori* knowledge about their inability to satisfy the screening criteria.

After the preliminary identification of criteria and screening of candidate sites was completed, decision analysis sessions were conducted to validate the results. Two decision analysis sessions were conducted, one for the HLW treatment and interim storage facilities and one for the Low-Activity Waste Disposal Facility. Participants from various areas of expertise (i.e., facility planning, transportation, safety, engineering, waste management, environmental affairs, risk assessment, hydrology, archeology, ecology, and seismology) formed an interdisciplinary team to ensure that all relevant screening criteria and viable candidate sites were identified and to evaluate the candidate sites against the screening criteria.

The decision analysis sessions began with refinement of the screening criteria. Through a consensus process, the team developed lists of criteria. The "want" criteria were assigned a weight, based on relative importance, on a scale of 1 to 10. A "want" criterion considered extremely important was assigned a weight of 10 with smaller weights assigned to criteria judged to be less critical. Criteria of equally perceived importance could be assigned equal weights.

The preliminary list of candidate sites was reviewed. With one exception, candidate locations for the HLW treatment and interim storage facilities were limited to current operational areas with at least some level of infrastructure. The preliminary list of candidate sites for the HLW treatment and interim storage facilities was accepted without change. Although the preliminary list contained candidate low-activity waste disposal sites representative of the most desirable physical characteristics of INEEL, three additional sites were added based on the potential to reuse previously disturbed areas.

The team then evaluated the candidate sites against the screening criteria. Sites were first evaluated against the "must" criteria. Any site failing to satisfy all of "must" criteria was eliminated from further consideration. If all of the "must" criteria were satisfied, the site was evaluated against the "want" criteria. For each "want" criterion, the candidate sites were assigned a value from 1 to 10 to describe how well, in the judgement of the team, the site satisfied the criterion. The site or sites that best satisfied the criterion were rated a 10, with lesser values assigned to the remaining sites.

The final component of the decision analysis was to compile overall rankings for the candidate sites based on the "want" criteria. The overall ranking was determined by calculating the product of the weight assigned to each criterion and the relative site ranking, and then summing the results.

DOE applied input from the decision analysis sessions during a secondary data gathering and screening phase to produce the final results. Data were gathered to support additional requirements defined during the decision analysis sessions. The relative comparisons of the candidate sites were then completed. A draft report was prepared and submitted to a peer-review committee comprised of members representing the areas of expertise pertinent to the preliminary site evaluation. In general, the comments generated by the peer review resulted in refinement or clarification of the information. No additional candidate locations or screening criteria were identified during the peer review.

A.3 High-Level Waste Treatment and Interim Storage Site Selection

The Idaho HLW & FD EIS analyzes facilities for treatment and interim storage of HLW and sodium-bearing waste that lie within the current INTEC boundaries. The INTEC candidate site for the proposed HLW processing facilities had the least impact to human health and the environment and the most advantageous logistical characteristics. DOE selected the site using a formal evaluation process that considered various INEEL locations and evaluated each against a set of evaluation criteria (Holdren et al. 1997). This section summarizes the HLW treatment and interim storage facilities site evaluation process.

A.3.1 IDENTIFICATION OF "MUST" CRITERIA

The first step in the evaluation process was to identify pertinent regulations for siting HLW treatment and interim storage facilities. For this evaluation, DOE assumed the HLW treatment and interim storage facilities would be subject to RCRA siting requirements and U.S. Nuclear Regulatory Commission (NRC) regulations. This step resulted in the development of a set of three specific siting requirements designated as "must" criteria:

1. Avoid the 100-year floodplain unless mitigations acceptable under RCRA are demonstrated

2. Avoid wetlands

3. Avoid critical habitats of endangered species

A.3.2 IDENTIFICATION OF "WANT" CRITERIA

In addition to those criteria formulated to address regulatory requirements and recommendations, DOE identified other "want" criteria based on professional judgment. These criteria address risk assessment, logistics, and other characteristics not clearly defined in regulations. Table A-1 provides the 17 "want" criteria and their relative weights.

Table A-1. "Want" criteria and relative weights for the HLW treatment and interim storage facility candidate sites.

Criterion number	Relative weight	Criterion
1	8	Minimize potential impacts from earthquakes
2	4	Minimize proximity to the 500-year floodplain
3	3	Reduce risk of a release to a stream
4	3	Minimize local flooding and ponding
5	2	Minimize impact to riparian areas
6	5	Minimize impact to ecologically sensitive areas
7	9	Locate in areas controlled by the DOE Idaho Operations Office
8	3	Minimize impacts to cultural resources
9	8	Locate in an area with optimal surficial sediment and topography for construction
10	2	Avoid areas over perched water
11	2	Locate in an area with characteristics that would impede downward migration of contaminants
12	9	Locate near existing infrastructure
13	9	Minimize transportation costs
14	5	Avoid vegetation transects
15	5	Locate in accordance with projected land-use plans
16	10	Minimize transportation safety issues
17	8	Minimize environmental impacts from transportation

A.3.3 IDENTIFICATION OF CANDIDATE SITES

With one exception, candidate sites were limited to existing operational areas because of the prohibitive costs that would be associated with establishing the new infrastructure (i.e., roads, utilities, emergency services, and technical and administrative support). For programmatic reasons, the analysis included one site not over the Snake River Plain aquifer and remote from existing facilities. There were twelve candidate sites evaluated for the HLW treatment and interim storage facilities:

1. INTEC

2. Central Facilities Area

3. Test Reactor Area

4. Power Burst Facility

5. Auxiliary Reactor Area

6. Argonne National Laboratory-West

7. Naval Reactors Facility

8. Radioactive Waste Management Complex

9. Test Area North

10. Experimental Breeder Reactor-I

11. Security Training Facility

12. Area north of the Big Lost River Sinks

Candidate sites 1 through 11 are located near or within existing INEEL operational areas. Site 12 was included to meet the programmatic need to consider a location not over the Snake River Plain aquifer. The locations of the candidate sites evaluated for the HLW treatment and interim storage facilities are shown in Figure A-1.

A.3.4 EVALUATION PROCESS

Because detailed specifications for the HLW treatment and interim storage facilities were not available, several assumptions were made for purposes of the preliminary site evaluation. These assumptions include:

- The facilities will include treatment, processing, and a co-located interim storage facility for HLW.

- Waste acceptance criteria for a federal repository will be finalized and the HLW from INTEC will eventually be transferred to a federal repository.

- The design description in Raytheon (1994) provides an adequate approximation of the required area for the HLW treatment and interim storage facilities (approximately 36,000 square meters), roughly equivalent to 9.2 acres.

- Up to five times the area of the facilities (180,000 square meters), equivalent to approximately 46 acres, may be required for construction, support facilities and future expansion.
- The facilities will process primarily INTEC waste.
- NRC licensing may eventually be negotiated for the HLW treatment and interim storage facilities.
- High activity liquid waste will be transported by pipeline. Transport by truck, rail, or other means is not currently feasible.
- The facilities will be housed in new construction. Existing buildings may be used for support activities, but no existing facilities will be reused for HLW treatment or interim storage facilities.
- Construction on sediment is significantly less costly than construction on basalt for comparable seismic designs.
- The HLW treatment and interim storage facilities will be classified as moderate hazard for purposes of seismic evaluation.

A.3.5 RESULTS OF EVALUATION PROCESS

Each of the candidate HLW treatment and interim storage facility sites satisfied the “must” criterion, although engineering controls or local restrictions may be required. If a candidate site had failed, it would have been eliminated from further consideration.

Each candidate site was then evaluated against the “want” criteria. Failure to satisfy one or more of these criteria is not a basis for eliminating a site from consideration. Depending on the relative importance of the criterion, engineering controls or other mitigative measures may be used to address the concern reflected by the criterion. In such cases, an estimate of the resources that may be required to implement the necessary engineering controls or mitigative measures is reflected in the relative site rankings. The relative ranking for the HLW treatment and interim storage facility candidate sites against the “want” criteria are provided in Table A-2.

For HLW treatment and interim storage facilities, the location at INTEC ranks far above the candidate sites in other operational areas on INEEL. The INTEC location meets the “want” criteria better than any other location because of the emphasis on transportation issues and infrastructure to support the new

Table A-2. Total scores and overall rankings for HLW treatment and interim storage facility candidate sites.[a]

Number	Candidate site	Total weighted score	Percent of maximum score[b]	Overall rank
1	INTEC	872	92	1
2	Central Facilities Area	660	70	2
3	Test Reactor Area	634	67	3
4	Power Burst Facility	590	62	4
5	Auxiliary Reactor Area	524	55	7
6	Argonne National Laboratory-West	502	53	10
7	Naval Reactors Facility	503	53	9
8	Radioactive Waste Management Complex	529	56	6
9	Test Area North	506	53	8
10	Experimental Breeder Reactor I	471	50	11
11	Security Training Facility	557	59	5
12	Area north of Big Lost River Sinks	321	34	12

a. Details of the evaluation of candidate sites against each of the criteria can be found in Holdren et al. (1997).
b. The maximum possible score was 950.

waste processing facilities. All other candidate sites require potentially hazardous and costly transportation of the waste from INTEC. With the exception of the area north of the Big Lost River Sinks (site 12), the range of scores for the remaining candidate sites is fairly small.

DOE is integrating its National Environmental Policy Act evaluation with other planning documents early in the decisionmaking process. In accordance with 40 CFR 1501.2(b), DOE must "identify environmental effects and values in adequate detail so they can be compared to economic and technical analyses…." The site evaluation process used for the EIS provides comparative analysis and considers DOE needs (such as mission) beyond only environmental concerns. Environmental factors must be considered but do not necessarily require equal weighting with other factors.

A.4 Low-Activity Waste Disposal Site Selection

The processes being analyzed in the Idaho HLW & FD EIS alternatives produce a variety of waste types and forms. These include HLW, transuranic waste, low-level waste, mixed low-level waste, and industrial waste. Selection of the sites for disposal of these wastes is outside the scope of this EIS. These sites are or have been the subject of separate NEPA analyses. The Idaho HLW & FD EIS analyzes disposal of the separated low-activity waste fraction produced under the Separations Alternative as either

Class A or Class C grout. A preliminary site evaluation was performed to identify a low-activity waste disposal site at INEEL for purposes of analysis in the EIS.

The overall scores for the low-activity waste disposal candidate sites indicate that several locations on INEEL would be suitable for such a disposal facility. The two highest scoring locations were a site near INTEC and a location in the central part of INEEL (near U.S. Geological Survey Site 14) removed from current operational facilities. The advantages of the INTEC location include reuse of a previously disturbed area, reduced transportation hazards, and existing seismic hazard evaluation. The other location is in a pristine area far away from existing INEEL infrastructure, but has characteristics that offer better natural reduction of contaminant migration in the vadose zone.

In this EIS, DOE analyzed one onsite location. Although there are geohydrological differences across the INEEL, the single location analyzed would be representative of many potential locations that DOE could select within the INEEL boundaries. A site co-located with the INTEC was selected for analysis. The general location of this site identified by Holdren et al. (1997) was narrowed to a specific location for analysis in the EIS (Kiser et al. 1998).

A.4.1 IDENTIFICATION OF "MUST" CRITERIA

The first step in the evaluation process was to identify pertinent regulations for siting waste disposal facilities. For this preliminary evaluation, DOE assumed the Low-Activity Waste Disposal Facility would be subject to NRC regulations. RCRA regulations would not apply because DOE has assumed that the low-activity waste would be delisted prior to disposal (see Chapter 6). The result of this step was the development of a set of four specific siting requirements designated as "must" criteria:

1. Avoid the 100-year floodplain

2. Avoid wetlands

3. Avoid critical habitats of endangered species

4. Avoid areas in which tectonic processes such as faulting, folding, seismic activity, or vulcanism (1) may occur with such frequency and extent to significantly affect the ability of the disposal site to meet performance objectives or (2) may preclude defensible modeling and prediction of long-term impacts.

A.4.2 IDENTIFICATION OF "WANT" CRITERIA

In addition to those criteria formulated to address regulatory requirements, "want" criteria were developed based on regulatory recommendations and professional judgement. Table A-3 provides the 19 "want" criteria and their relative weights. Most of the "want" criteria for the Low-Activity Waste Disposal Facility are duplicates of those identified for the HLW treatment and interim storage facilities. However, the relative weights assigned to the Low-Activity Waste Disposal Facility emphasize environmental issues because this facility would be a disposal facility whereas the HLW treatment and interim storage facilities would have limited operational lifetimes.

Table A-3. "Want" criteria and relative weights for the Low-Activity Waste Disposal Facility candidate sites.

Criterion number	Relative weight	Criterion
1	6	Minimize potential impacts from earthquakes
2	2	Minimize proximity to the 500-year floodplain
3	5	Reduce risk of release to a stream
4	8	Minimize local flooding and ponding
5	3	Minimize impact to riparian areas
6	7	Minimize impact to ecologically sensitive areas
7	9	Locate in areas controlled by the DOE Idaho Operations Office
8	7	Minimize impact to cultural resources
9	6	Locate in an area with thick surficial sediment
10	8	Avoid areas over perched water
11	10	Locate in an area with characteristics that impede the downward migration of contaminants
12	4	Locate in an area conducive to future expansion
13	2	Locate in accordance with projected land use plans
14	6	Locate near existing infrastructure
15	8	Minimize transportation issues
16	8	Locate in an area where discriminatory monitoring can be achieved
17	9	Avoid vegetation transects
18	8	Use previously disturbed areas
19	1	Avoid unexploded ordnance areas

A.4.3 IDENTIFICATION OF CANDIDATE SITES

The only limitation applied to selecting the candidate sites for the Low-Activity Waste Disposal Facility was that they be located within the boundaries of INEEL. The evaluation included a site not over the Snake River Plain aquifer. DOE based selection of candidate sites on professional judgment, as well as familiarity with the physical characteristics of INEEL and the potential influence of those characteristics on risk to human health and the environment. Many areas of INEEL were not considered because of *a* *priori* knowledge about their inability to satisfy screening criteria. The 16 candidate low-activity waste disposal sites evaluated were:

1. Area north of Big Lost River Sinks
2. Area south of INTEC
3. Near Auxiliary Reactor Area
4. Near Power Burst Facility
5. Near Test Reactor Area
6. Near Test Area North
7. Near the Radioactive Waste Management Complex
8. Near the New Production Reactor site
9. Near U.S. Geological Survey (USGS) Site 14
10. Near Corehole 2-2A and USGS-18
11. Playa area southeast of USGS Site 14
12. Crater in Section 23
13. Area near the Second Owsley Canal
14. Near Argonne National Laboratory - West
15. Within the Naval Ordnance Disposal Area
16. Near the Security Training Facility

The locations of the candidate sites evaluated for the Low-Activity Waste Disposal Facility are shown in Figure A-2.

A.4.4 EVALUATION PROCESS

The screening process used for the Low-Activity Waste Disposal Facility resembled the process described for the HLW treatment and interim storage facilities site. For the most part, the same methodology was used to evaluate Low-Activity Waste Disposal Facility candidate sites. The major difference was that the environmental criteria received more weight.

Because detailed specifications for the Low-Activity Waste Disposal Facility were not available, several assumptions were made for purposes of the preliminary site evaluation. These assumptions include:

- The waste will be grouted solid waste that will be delisted and meet the applicable RCRA Land Disposal Restrictions standards (i.e., the waste will not be regulated as hazardous waste under RCRA).

- The waste will meet requirements for classification as low-level waste.

- The Low-Activity Waste Disposal Facility will be an engineered structure designed to achieve long-term stability (i.e., for at least 500 years) and potential release from the disposal facility after 500 years will be sufficiently slow to maintain risk below acceptable levels. Locations were evaluated on the basis of natural and logistical considerations such as stable terrain and proximity to existing roads. Long-term stability during operation and ultimate closure of the facility will be dependent on engineering controls.

- In the absence of EPA siting regulations relative to earthquake ground motion and unstable terrain, it was assumed that compliance with RCRA, DOE, and NRC regulations would suffice to address any EPA concerns.

- The waste volume to be disposed of will be no greater than 25,000 cubic meters based on approximations for either Class A or Class C grout developed by Lockheed Martin Idaho Technologies Company.

- A minimum depth of 3 meters of surficial sediment is mandated by landfill design criteria.

A.4.5 RESULTS OF EVALUATION PROCESS

The overall scores for the candidate sites indicate that there are several locations on INEEL suitable for a Low-Activity Waste Disposal Facility. The total scores and relative ranking for the candidate sites against the "want" criteria are provided in Table A-4.

Table A-4. Total scores and overall rankings for Low-Activity Waste Disposal Facility candidate sites.

Number	Candidate site	Total weighted score	Percent of maximum score[a]	Overall rank
1	Area north of Big Lost River Sinks	NA[b]	NA	NA
2	Area south of INTEC	976	83	1
3	Near Auxiliary Reactor Area	823	70	5
4	Near Power Burst Facility	821	70	6
5	Near Test Reactor Area	897	77	3
6	Near Test Area North	774	66	11
7	Near the Radioactive Waste Management Complex	690	59	15
8	Near the New Production Reactor site	778	67	10
9	Near USGS Site 14	924	79	2
10	Near Corehole 2-2A and USGS-18	806	69	7
11	Playa area southeast of USGS Site 14	749	64	13
12	Crater in Section 23	709	61	14
13	Area near the Second Owsley Canal	758	65	12
14	Near Argonne National Laboratory - West	793	68	8
15	Within the Naval Ordnance Disposal Area	867	74	4
16	Near the Security Training Facility	787	67	9

a. The maximum possible score was 1,170.
b. NA means not applicable. The area north of the Big Lost River Sinks (site 1) failed the screening against the "must" criteria and was not evaluated further against the "want" criteria.

The scores for the top four candidate sites vary by less than 10 percent. Therefore, these sites could be worthy of further consideration in a final site selection study.

The preliminary evaluation used existing data for the candidate sites. Total scores for some candidate sites (9, 10, 11, 12, and 13) could be higher because the average data for the cumulative sediment and surficial sediment thicknesses at these location may not be representative of the maximum possible score.

Knowledge of these areas supports the conclusion that the sediment thicknesses are probably greater than indicated by the currently available data used in the preliminary site evaluation. These sites may be worthy of further consideration in a final site selection study.

A.4.6 FINAL SELECTION OF A LOW-ACTIVITY WASTE DISPOSAL FACILITY SITE FOR ANALYSIS

After further considering the preliminary evaluation, DOE selected a specific location adjacent to INTEC as the site to be analyzed in the EIS (Kiser et al. 1998). The final selection of the analysis site resulted from a determination that the site was the most cost-effective for inclusion in the feasibility design process. This site is generally located outside the southeast corner of and as near as possible to the INTEC security perimeter fence. (Subsequently, DOE also selected the Envirocare facility 80 miles west of Salt Lake City to be analyzed to provide an off-INEEL evaluation for disposal of the Class A grout produced under the Full Separations and Planning Basis options.)

A.5 Conclusions and Summary

Evaluation of many site characteristics provides useful insight for decision-making and points out some of the tradeoffs that must be made. Each candidate location offers some advantages over the others for both waste processing and disposal. For example, if aquifer protection were the most important consideration for a Low-Activity Waste Disposal Facility, a site within the thick lake sediments in the central portion of INEEL would be desirable. This area is also conducive to construction. However, this generally low elevation and low-relief area is sometimes subject to local flooding events. If protection from flooding were a major criterion, the basalt highlands offer good choices but may involve some sacrifice of aquifer protection or ease of construction. These highland areas are also far from existing infrastructure and would require waste transport over several miles.

Unlike the preliminary evaluation of candidate sites for HLW treatment and interim storage facilities that indicated clear advantages for siting the facilities at INTEC, the range of total weighted scores for the Low-Activity Waste Disposal Facility was very small. Emphasis on environmental issues (e.g., Criterion 11 - Locate in an area with characteristics that impede downward migration of contaminants) tended to balance against other highly weighted criteria. The overall scores for the Low-Activity Waste Disposal Facility candidate sites indicate that there are several suitable locations on INEEL. If it is determined that a Low-Activity Waste Disposal Facility will be constructed at INEEL, the final site decision analysis must determine whether locations such as the INTEC site that reuse previously disturbed areas, reduce transportation hazards, have been favorably evaluated for seismic hazards, and possess physical characteristics that impede contaminant migration are preferred over pristine locations such as U.S. Geological Survey Site 14 that offer better natural reduction of contaminant migration but are not in the preferred seismic zones and are far away from existing INEEL infrastructure.

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APPENDIX B

WASTE PROCESSING ALTERNATIVE SELECTION PROCESS

NOTE: This appendix and the references associated with it refer to the historically used radioactive waste terms, sodium bearing waste (SBW) and newly generated liquid waste. These terms have been used at the INEEL over the years to describe liquid radioactive wastes generated in association with high level waste and other waste management activities.

In July 1999, the Department of Energy published DOE Order 435.1 "Radioactive Waste Management." This Order establishes terms and definitions for radioactive waste. The radioactive waste terms used in the main body of this Idaho HLW & FD EIS refer to the terms specified in the Order. In most cases, this EIS parenthetically refers to the historical waste term.

To assist the reader in corresponding the historical radioactive waste terms used in this appendix with radioactive waste terms used in the main body of this EIS and the Summary, a cross-reference table has been provided in Section 1.2.2 of Volume 1 of this EIS.

TABLE OF CONTENTS

TABLE OF CONTENTS (continued)

List of Tables

APPENDIX B. WASTE PROCESSING ALTERNATIVE SELECTION PROCESS

B.1 Introduction

The U.S. Department of Energy (DOE) is preparing the Idaho High-Level Waste and Facilities Disposition Environmental Impact Statement (Idaho HLW & FD EIS), in accordance with the National Environmental Policy Act, to support the HLW decision-making process at the Idaho National Engineering and Environmental Laboratory (INEEL) formerly called the Idaho National Engineering Laboratory or INEL. Under the National Environmental Policy Act in 40 CFR 1502.14(a), an EIS must "rigorously explore and objectively evaluate all reasonable alternatives, and for alternatives which were eliminated from detailed study, briefly discuss the reasons for their having been eliminated."

The Notice of Intent for the Idaho HLW & FD EIS (62 FR 49209; September 19, 1997) identified three initial alternatives for managing the HLW at INEEL: the Proposed Action or Separations Alternative, No Action Alternative, and Non-Separations Alternative. Since the issuance of the Notice of Intent and in the course of exploring and evaluating reasonable alternatives for detailed EIS study, DOE has added a number of sub-alternatives, or options, that are variations of the three initial alternatives, and DOE has added two alternatives.

This appendix is a summary of the information contained in the document *Process for Identifying Potential Alternatives for the INEEL High-Level Waste and Facilities Disposition Draft Environmental Impact Statement* (DOE 1999). Appendix F of DOE (1999) represents DOE's alternative refinement process described in Section B.6.

B.2 Purpose

The purpose of this appendix is to describe the selection process that DOE employed to identify a reasonable range of waste processing alternatives for the Idaho HLW & FD EIS, including the identification and application of the criteria for assessing the validity of candidate alternatives. For purposes of this appendix, as well as this EIS, an "alternative" is defined as a complete set of proposed DOE actions to manage the INEEL HLW and other related wastes from the current state to an acceptable end state that, with the exception of the No Action Alternative and the Continued Current Operations Alternative, meets the HLW program purpose and need as stated in the Idaho HLW Notice of Intent.

The Council on Environmental Quality regulations direct all Federal agencies to use the National Environmental Policy Act process to identify and assess the reasonable alternatives to proposed actions that would avoid or minimize adverse effects of these actions upon the quality of the human environment [40 CFR 1500.2(e)]. These regulations further state that "reasonable alternatives include those that are practical or feasible from a common sense, technical, or economic standpoint. The number of reasonable alternatives considered in detail should represent the full spectrum of alternatives meeting the agency's purpose and need; but an EIS need not discuss every unique alternative, when an unmanageable number is involved."

The primary steps of this alternative selection process are:

- Review previous HLW management studies, DOE EISs, technical literature, industry recommendations, and stakeholder comments
- Identify an initial list of candidate alternatives
- Review engineering studies and public input
- Revise initial set of candidate alternatives based on recent studies and stakeholder inputs following the Notice of Intent and scoping meetings
- Identify screening criteria to evaluate the candidate alternatives
- Describe criteria that were used to assess each alternative
- Apply the screening criteria to each candidate alternative
- Select the recommended set of candidate alternatives for the Idaho HLW & FD EIS

B.3 Identification of Candidate Alternatives

B.3.1 ANALYSIS OF PREVIOUS INEEL AND OTHER HLW DOE STUDIES

The following paragraphs summarize the pre-1992 HLW activities and studies and the post-1992 HLW management studies. The 1992 date is significant because that is when DOE decided to discontinue the processing of spent nuclear fuel (DOE 1992). Details of these HLW activities and studies are contained in Section 4.0 of DOE (1999).

B.3.1.1 Pre-1992 Activities and Studies

"Historical Fuel Reprocessing and HLW Management in Idaho" (Knecht et al. 1997)

A summary of historical fuel reprocessing and waste management at the Idaho Nuclear Technology and Engineering Center (INTEC) (formerly called the Idaho Chemical Processing Plant or ICPP) appeared in Radwaste Magazine (Knecht et al. 1997). The article outlines some of the early technology development work at INTEC and includes 40 references related to waste forms produced from calcine, such as metal spray coating, grout matrix, metal matrix, glass, and ceramic. Early studies were also carried out in calcine retrieval, calcine dissolution, calcine stabilization, and transuranic element separation. In many cases, results of early technology development work were used to develop pre-conceptual design and costs. The design information supported the INEEL portion of a number of complex-wide defense waste management studies under the Atomic Energy Commission and the Energy Research and Development Agency, predecessors to DOE.

***Alternatives for Long-Term Management of Defense High-Level Waste, Idaho Chemical Processing Plant*, ERDA 77-43 (ERDA 1977)**

This INTEC report evaluated and provided cost and risk estimates for three alternatives: (1) retain the waste at INTEC in retrievable storage facilities; (2) ship the waste to a geologic repository; and (3) remove (separate) the actinides, ship the actinides to a geologic repository, and store the remaining waste at INTEC. Waste form options under these alternatives included calcine pelletization, metal matrix, and sintered glass ceramic to span the range of calcine, concrete, metal, glass and ceramic waste forms.

***Environmental Evaluation of Alternatives for Long-Term Management of Defense High-Level Radioactive Waste at the ICPP, IDO-10105* (DOE 1982a)**

The subject evaluation considered four alternatives: (1) calcine all waste and leave calcine in place (no action); (2) retrieve, modify the calcine, and dispose of modified calcine at INEEL; (3) retrieve, separate the actinides, dispose of the actinides offsite, and dispose of the remaining waste at INEEL; (4) delay retrieval, modify the calcine, and dispose of the calcine offsite. In this study the waste form options included calcine, glass or pelletized calcine, glass or stabilized calcine, glass for actinides, and calcine for onsite disposal.

***Long-Term Management of Defense High-Level Radioactive Wastes [Research and Development Program for Immobilization], Savannah River Plant,* DOE/EIS-0023 (DOE 1979)**

From 1970 to 1983 events outside of INEEL, such as waste-form research at DOE's Savannah River Site (SRS) influenced the INEEL HLW research and development program. As a result, DOE HLW management became focused on treating wastes first at SRS, then Hanford Site, and finally Idaho. In 1977, DOE issued this EIS for HLW immobilization research and development. This EIS evaluated a number of potential HLW forms, and a follow-on environmental assessment selected borosilicate glass as the preferred form (DOE 1982b).

***The Defense Waste Management Plan,* DOE/DP-0015 (DOE 1983)**

This plan established a schedule for waste treatment and assumed that the Savannah River Site and Hanford Site would vitrify their HLW. INEEL was assumed to construct a new facility to immobilize newly generated liquid waste as well as calcined HLW with annual production of approximately 500 HLW canisters. This plan provided estimates of HLW volumes to be generated through 2015. Subsequently, DOE-Idaho Operations Office completed the study (DOE 1983) in 1983 to evaluate reducing waste volumes by more efficient fuel processing methods.

B.3.1.2 Post-1992 HLW Management Studies

***ICPP Tank Farm System Analysis* (WINCO-1192) (WINCO 1994)**

This Tank Farm study proposed 14 variations of HLW separations alternatives. These alternatives differ with respect to the start of separations and immobilization operations, the number of calcining campaigns required, and various calcine pretreatment and treatment technologies. The conclusion was that the separation variations produced significant differences in calcine processing rates, bin set storage requirements, and final waste forms. This study underscored the advantages of a separations alternative and brought out the possibility of HLW calcine vitrification as a viable non-separations option.

***SBW Treatment Study,* WBP-8-95/ALO-3-95 (LITCO 1995a)**

The study evaluated feasible options for meeting the Notice of Noncompliance Consent Order to cease use of the INTEC pillar and panel tanks and the remaining tanks in the Tank Farm. The study addressed 15 separations and non-separations alternatives. The separations alternatives used an evaporation precipitation technique to reduce the sodium content of the SBW prior to calcining; the separations options also included cesium, strontium, and transuranic extraction methods for separating the high-activity fraction from the low-activity fraction. The non-separations alternatives focused on improving the calcine process by high-temperature operation or using additives such as aluminum nitrate, silica, and sugar to reduce the SBW volume. The study also included an alternative to ship all the concentrated SBW to Hanford for interim storage and processing.

***ICPP Radioactive Liquid and Calcine Waste Technologies Evaluation Technical Report and Recommendation,* INEL-94/0019 (LITCO 1995b)**

The purpose of the evaluation was to support DOE in developing a strategic plan to manage INTEC radioactive liquid and calcined waste by presenting performance data for viable candidate alternatives. The study addressed 27 alternatives for waste treatment including both separations and non-separations techniques. These alternatives varied with respect to facilities, SBW treatment, calciner operations, and calcine treatment. Screening against six criteria led to radionuclide partitioning as one of the top options to be considered. The report recommended a two-phased implementation of a high-activity waste immobilization plant to spread the funding requirements over a longer time period.

***HLW Alternatives Evaluation*, WBP-29-96 (LMITCO 1996)**

This study reviewed calcination and separations to determine the best path forward for INTEC HLW management. Both approaches appear to be reasonable, meet the Settlement Agreement/Consent Order and are technically feasible; the primary discriminator is cost. These approaches were developed into three basic options: (1) calcination of HLW until June 1998 and SBW until 2012; (2) calciner shutdown in 2001, radionuclide separation/grouting beginning in 2010, and calcine retrieval, dissolution, and separation commencing in 2015; and (3) separations and shipping of the high-activity waste offsite for immobilization and storage.

***Regulatory Analysis and Proposed Path Forward for the Idaho National Engineering Laboratory High-Level Waste Program*, DOE/ID-10544 (DOE 1996)**

This report provided a concise HLW regulatory analysis of the radionuclide constituents, identification of Resource Conservation and Recovery Act (RCRA) hazardous constituents, and plans for closure of the INTEC Tank Farm and bin sets. The report offered four major alternatives for consideration: no action, planning basis (DOE 1998), full treatment (separations), and limited vitrification.

B.3.2 CONSIDERATION OF PUBLIC COMMENTS

DOE conducted public scoping workshops on the Idaho HLW & FD EIS on October 16, 1997 in Idaho Falls, Idaho and on October 23, 1997 in Boise, Idaho. These public workshops and written scoping comments provided DOE public input about issues and potential alternatives that should be addressed in the Idaho HLW & FD EIS.

DOE also received scoping comments from the State of Idaho INEEL Oversight Program (Trever 1997), the State of Nevada Nuclear Waste Project Office (Loux 1997), and the INEEL Citizens Advisory Board (Rice 1997). All public comments were considered in developing the candidate alternatives for the Idaho HLW & FD EIS. A summary of the major stakeholder concerns appears in the next section; a list of new or modified alternatives obtained from the public inputs is shown later in the chapter.

B.3.2.1 Overall Stakeholder Concerns

Treatment Criteria – At this time, there is considerable uncertainty regarding the proposed repository at Yucca Mountain and the final technical standards for wastes to be disposed of there. Given those uncertainties, determine what criteria DOE should use to establish that the waste form(s) produced are suitable for disposal in a geologic repository outside the State of Idaho (i.e., that a "road-ready" waste form has been achieved).

Disposal – If a geologic repository is not available, determine what other disposal options exist for HLW outside the State of Idaho.

Storage/Disposal in Idaho – Clearly examine and explain any proposal to store or dispose of treated waste over the Snake River Plain aquifer, including performance-based or landfill closure of the Tank Farm as opposed to clean closure.

Hazardous Constituents – Develop a strategy for dealing with RCRA-regulated hazardous constituents.

Technical Viability/Privatization – Demonstrate in advance that the alternative selected will work. Stakeholders were cautious regarding privatization of the proposed actions.

Cost-risk benefits – The alternative selected should reduce health and safety risks enough to justify the cost of treatment and any additional risk to workers posed by the treatment activities.

Funding – Cleanup of the INEEL site is important, and the Federal government should seek adequate funding to honor its commitments to do so.

Compliance Concerns – Numerous, and in some cases conflicting, compliance requirements exist for INEEL HLW management and facilities disposition activities. These conflicts should be clarified, and the compliance factors prioritized. The majority of the stakeholders are supportive of the Settlement Agreement/Consent Order. Some stakeholders advocate consideration of "a fully compliant" alternative.

B.3.2.2 Public Comments Applied to Alternative Development

The following list of comments relate to new or modified alternatives resulting from stakeholder inputs. DOE considered these comments when preparing the list of Idaho HLW & FD EIS candidate alternatives.

- Include a true no action alternative—lock up and walk away.
- Postpone any action until waste decays to non-harmful levels, better technologies are developed, or disposal sites are identified.
- Calcine now, store onsite, and treat later when DOE disposal sites are available.
- Fully review options for disposing INEEL HLW onsite in Idaho.
- Dispose of high-activity and low-activity waste offsite, such as in a new repository.
- Store both high-activity and low-activity waste onsite for long-term time periods.
- Separate the transuranics out of HLW, dispose of at the Waste Isolation Pilot Plant, and dispose of the remainder at INEEL.
- Identify alternatives for bin set and Tank Farm closure including clean closure of HLW tanks.
- Consider a wide range of separations technologies.
- Vitrify all HLW before or after calcination.
- Consider technologies from other sites and countries.
- Ship HLW for treatment and long-term storage elsewhere such as the Nevada Test Site in Nevada.
- Explore volume reduction, filtration, and encapsulation technologies.
- Modify the No Action Alternative to include placement of calcine in closed INTEC tanks.

- Analyze treatment and disposal alternatives separately.
- Develop alternatives for facility disposition.
- Analyze all waste in all bin sets and tanks and all hazardous constituents.
- Use the same process the Hanford Site is using for waste immobilization.
- Don't let Yucca Mountain waste volume restrictions drive technology development; the Yucca Mountain repository may never open.

B.3.3 CANDIDATE ALTERNATIVES

DOE's first step in conducting the candidate alternative selection process was to review previous DOE and INTEC HLW studies as described earlier in this appendix. The study included five major INTEC waste treatment studies conducted between January 1994 and September 1997 and helped to ensure that DOE included all reasonable and viable alternatives. Potential alternatives were then identified through a systematic, iterative process that used several sources including: (1) previous INTEC HLW studies, (2) value engineering sessions, and (3) stakeholder comments received during the Idaho HLW & FD EIS scoping process.

B.3.3.1 Alternatives Considered for Initial Analysis

This systematic process resulted in an initial set of potential candidate alternatives for consideration in the Idaho HLW & FD EIS. The candidate alternatives include waste processing, interim storage, transportation, and final disposal options. It is important to note that each candidate alternative is composed of individual process stages (e.g., HLW treatment, interim storage, and/or disposal of low-activity grout) that are independent. Therefore, each candidate alternative is a combination of possible process stages that may be modified as the EIS preparation progresses. This modular approach will allow DOE greater programmatic flexibility in implementing the HLW alternatives and coordinating programs and technologies from other DOE sites. DOE identified the following waste processing alternatives and options for initial EIS screening, analysis, and evaluation.

1. No Action Alternative (as described in the Notice of Intent)

2. Separations Alternatives

   A. Full Separations
   B. 2006 Plan
   C. Transuranic Separations/Class A Grout
   D. Transuranic Separations/Class C Grout

3. Non-Separations Alternatives

   A. Vitrified Waste
   B. Hot Isostatic Pressed Waste
   C. Cement-Ceramic Waste
   D. Direct Cement Waste

Additional information concerning these candidate alternatives to be considered for initial analysis is provided in DOE (1999).

B.3.3.2 Alternatives Not Considered for Initial Analysis

Several candidate alternatives were eliminated from initial EIS analysis. These alternatives were not considered for one or more of the following reasons: (1) did not meet the purpose and need of the EIS, (2) required significantly more development work to achieve technical maturity, (3) are very similar to or are bounded by other selected alternatives, or (4) judged to be impractical or too costly for consideration.

Alternatives Rejected for Technological Reasons

- *In situ* vitrification
- Upgrading tanks for long-term storage
- Use of Hanford crystalline silicotitanate technology
- Storage of wastes in long-lasting concrete containers

- Homogenization and mixing of various wastes (i.e., slurry)
- Use of small solid units to fill tanks versus poured liquids

Alternatives Rejected That Do Not Support the EIS Purpose and Need

- Treatment of Argonne National Laboratory-West spent nuclear fuel at INTEC
- Burning of HLW in a reactor such as the Integral Fast Reactor
- Import other sites' HLW to INEEL for treatment and interim storage
- Use of old INTEC facilities as a second HLW repository

B.4 Evaluation of Candidate Alternatives

The primary purpose of this preliminary EIS alternative evaluation is to evaluate the candidate alternatives identified in Section B.3 and identify a reasonable set of alternatives for the Idaho HLW & FD EIS. The secondary purpose of this alternative evaluation is to provide a sound, traceable, and defensible process to support the final selection of potential Idaho HLW & FD EIS alternatives. These potential alternatives will provide for the treatment, storage, and disposition of HLW and SBW currently managed at the INTEC.

B.4.1 EVALUATION METHODOLOGY

The methodology for the identification of the candidate alternatives was based upon a comprehensive evaluation of all potential alternatives with respect to six essential Idaho HLW & FD EIS criteria (see next section). A DOE team of experienced personnel, who qualitatively assessed each alternative against the criteria, performed the evaluation. The DOE Evaluation Team was asked to recommend a reasonable set of candidate alternatives with high potential to meet the criteria and to identify unreasonable alternatives with low potential to meet the selection criteria.

Prior to the evaluation of the candidate alternatives, DOE reviewed a comprehensive list of documents and identified a set of considerations or sub-elements for the six evaluation criteria areas. The team focused on identifying important program considerations, stakeholder sensitivities, and related waste management data that would help evaluate potential alternatives with respect to each criterion.

The DOE Evaluation Team then systematically applied the criteria to all candidate alternatives to assess how well each alternative met the program goals and stakeholder concerns. The assessment of each alternative with respect to each criterion was done on a qualitative basis. Each alternative was given one of three ratings for each criterion as shown in the following table.

Table B-1. Alternative rating symbols.

Rating symbol	Alternative rating description
Plus (+)	Expected to satisfy the criteria with minor deficiencies or concerns
Zero (0)	Expected to satisfy the criteria with some deficiencies or concerns
Minus (–)	Expected to satisfy the criteria with major deficiencies or concerns

After reviewing the reference materials and conducting a structured, lengthy discussion period, the DOE Evaluation Team rated all candidate alternatives with respect to each of the six evaluation criteria. Then the team held a consensus meeting to determine an overall team rating for the alternatives with respect to each criterion. The team addressed each criterion in turn to ensure that all essential elements of each criterion were assessed and that the final qualitative ratings represented a team consensus.

The DOE Evaluation Team completed final discussions and analyses to determine which alternatives are considered reasonable and worthy of being retained as an EIS candidate alternative. The Team made a diligent effort to include a reasonable range of alternatives with potential to satisfy DOE program requirements and stakeholder and public concerns. The team agreed that inclusion of too many alternatives, rather than too few, will ensure that a reasonable range of viable alternatives is included in the EIS process to meet the National Environmental Policy Act requirements.

The DOE Evaluation Team was also asked to identify potential new alternatives that were not included in the initial set of candidate alternatives. The Evaluation Team accomplished this by reviewing the processes involved in selecting the initial set of candidate alternatives, then applying their knowledge of HLW management technologies and the requirements of the National Environmental Policy Act. This process resulted in the identification of the following additional alternatives for evaluation: (1) a No Action Orderly Shutdown Alternative, and (2) an Early Vitrification Option under the Non-Separations Alternative. The Team then evaluated these two additional alternatives against the evaluation criteria described below.

B.4.2 EVALUATION CRITERIA

A major step of the evaluation methodology was to develop the appropriate selection criteria. DOE developed the screening criteria to be used for selecting the set of alternatives. First, DOE determined that the appropriate criteria should have the following attributes:

- Logical, defensible, and clear to all parties
- Appropriate for waste processing alternative evaluation
- Limited to major program considerations and stakeholder concerns
- Easily evaluated by qualitative methods and analysis
- Inclusive of all major areas of concern and program viability

DOE proposed and analyzed a baseline set of eight criteria before selecting the final criteria. The eight baseline criteria (see Table B-2) were developed after reviewing the selection criteria used in previous HLW studies and two recent DOE Environmental Impact Statements: the *Department of Energy Programmatic Spent Nuclear Fuel Management and Idaho National Engineering Laboratory Environmental Restoration and Waste Management Programs Environmental Impact Statement* (SNF & INEL EIS) (DOE 1995) and the *Final Waste Management Programmatic Environmental Impact Statement for Managing Treatment, Storage, and Disposal of Radioactive and Hazardous Waste* (DOE 1997a). As a result of review and analysis of the candidate criteria in these documents, DOE selected the following six criteria deemed appropriate for this EIS: (1) Program Mission, (2) Technical Feasibility, (3) Cost Factors, (4) Environment, Safety, and Health, (5) Stakeholder and Tribal Issues, and (6) Program Flexibility.

Table B-2. Proposed versus selected criteria summary.

Proposed baseline criteria	Selected EIS criteria
1. Program Mission	1. Program Mission
2. Cost	2. Cost Factors
3. Technical Feasibility and Maturity	3. Technical Feasibility
4. Environment, Safety, and Health Impact	4. Environment, Safety, and Health
5. Stakeholder and Political Views	5. Stakeholder and Tribal Issues
6. Use of Existing Facilities	6. Program Flexibility
7. Transportation	
8. Compliance with Regulations and Agreements	

Table B-2 shows the eight baseline criteria in the left column and the six selected criteria in the right column. The selected criteria include all but the last three of the baseline criteria. “Use of Existing Facilities” and “Transportation” were not included because they were considered second order factors that would be reflected in “Cost Factors.” Similarly, “Compliance with Regulations and Agreements,” although very important to the overall mission in terms of ability to dispose of listed wastes, was not included because it is an essential element of the “Program Mission” and “Stakeholder and Tribal Issues” criteria. The “Program Flexibility” criterion was added because DOE considered funding flexibility a key program asset.

B.4.3 APPLICATION OF CRITERIA TO CANDIDATE ALTERNATIVES

B.4.3.1 Program Mission

The Program Mission criterion is essential to assessing capability of the alternatives to meet DOE complex-wide and INEEL HLW program objectives, major regulatory and National Environmental Policy Act milestones, and legal obligations. Table B-3 presents the results of the Evaluation Team’s ratings of the candidate alternatives against this criterion.

Table B-3. Program mission ratings.

Candidate alternative			Rating	Candidate alternative			Rating
1.	No Action			3.	Non-Separations		
	1A	Notice of Intent	–		3A	Vitrified Waste	+
	1B	Orderly Shutdown	–		3B	Hot Isostatic Pressed Waste	0
2.	Separations				3C	Cement-Ceramic	0
	2A	Full Separations	+		3D	Direct Cement	0
	2B	2006 Plan	+		3E	Early Vitrification	+
	2C	Transuranic Separations/ Class A Grout	+				
	2D	Transuranic Separations/ Class C Grout	+				

For the Program Mission criterion, both options under the No Action Alternative were assessed minus (–) ratings. These alternatives do not meet the Settlement Agreement/Consent Order requirement to have all HLW road ready by 2035, and they do not address the long-term issue of removing all HLW from the State of Idaho, nor does the Orderly Shutdown Option meet the requirement to complete calcination of liquid SBW by 2012.

All four separations alternatives were assessed a plus (+) rating with minor deficiencies or concerns. Since the separations concept was driven by program mission requirements to reduce HLW disposal volume, the high ratings were expected. The separations options may lower the HLW volume for repository disposal to minimize transportation risk and cost, and they are consistent with DOE planning documents such as the Environmental Management Contractor Report (EMI 1997), *Accelerating Cleanup: Paths to Closure* (DOE 1998), and National Environmental Policy Act Records of Decision (RODs), with minor exceptions.

Under the Non-Separations Alternative, the Vitrified Waste and Early Vitrification Options were assessed a plus (+) rating because both would meet the essential requirements of the Settlement Agreement/Consent Order and produce a final waste form (borosilicate glass) that has a high probability of acceptance at a geologic repository. The other three options under the Non-Separations Alternative were assessed a zero (0) rating with some deficiencies or concerns. All three options would require a determination of equivalency by U.S. Environmental Protection Agency (EPA).

B.4.3.2 Cost Factors

Inclusion of the Cost Factors criterion was considered essential because this EIS proposes a DOE Federal project that would be supported by taxpayer funding. This cost criterion includes consideration of life-cycle costs, ten-year costs, peak funding requirements, and the results of an independent risk-based cost study. The detailed cost estimates of the risk-based study are contained in Section 5.0 of DOE (1999). Table B-4 presents the results of the Evaluation Team's ratings of the candidate alternatives against this criterion.

Table B-4. Cost factor ratings.

Candidate alternative	Rating	Candidate alternative	Rating
1. No Action		3. Non-Separations	
1A Notice of Intent	0	3A Vitrified Waste	–
1B Orderly Shutdown	+	3B Hot Isostatic Pressed Waste	0
2. Separations		3C Cement-Ceramic	0
2A Full Separations	0	3D Direct Cement	0
2B 2006 Plan	–	3E Early Vitrification	–
2C Transuranic Separations/ Class A Grout	0		
2D Transuranic Separations/ Class C Grout	0		

All the candidate options, except Orderly Shutdown, 2006 Plan, Vitrified Waste, and Early Vitrification, were deemed equivalent with respect to cost and received the zero (0) rating with some deficiencies or concerns. No cost estimates were available for the Orderly Shutdown Option, but it was given a plus (+) rating because of the obvious minimal costs for an orderly shutdown of INTEC facilities. The 2006 Plan Option under the Separations Alternative was considered more expensive than the other separations options due to the calcination of both HLW and SBW and the subsequent calcine dissolving, separating, and processing the waste fractions into final waste forms.

With respect to the Non-Separations Alternatives, the Vitrified Waste Option was judged to have a higher life-cycle cost due to the high cost of a vitrification facility, the greater volume of material to be vitrified, and the greater amount of vitrified HLW to be transported to a geologic repository. No cost estimates were available for the Early Vitrification Option since it was a late entry to the candidate list. However, the Early Vitrification Option was assessed as more costly and assigned a minus (–) rating to reflect the potential cost of a vitrification facility and greater volumes of HLW compared to the Separations Alternative.

B.4.3.3 Technical Feasibility

Technical Feasibility or technical risk is a primary criterion to assess the capability of an alternative to meet the planned HLW program goals and milestones. Some alternatives may be more easily implemented due to use of proven technologies or the availability of well-developed processes. For alternatives that require new, unproven technologies, the Evaluation Team assessed the state of development (i.e., research and development, advanced development, or full-scale testing) and whether or not the proposed process requires a technical breakthrough or further testing and modification. Table B-5 presents the results of the Evaluation Team's ratings of the candidate alternatives against this criterion.

The DOE Evaluation Team concluded that both options under the No Action Alternative should receive a plus (+) rating because they rely solely on facilities and processes that are currently operational and require no major high-risk modifications. Therefore, the technical risk associated with these alternatives should be very low.

The Team also noted that all four options under the Separations Alternative use the same basic and proven dissolution, separations, vitrification, and grouting technologies. All these separations treatment

Table B-5. Technical feasibility ratings.

Candidate alternative	Rating	Candidate alternative	Rating
1. No Action		3. Non-Separations	
1A Notice of Intent	+	3A Vitrified Waste	+
1B Orderly Shutdown	+	3B Hot Isostatic Pressed Waste	+
2. Separations		3C Cement-Ceramic	–
2A Full Separations	+	3D Direct Cement	+
2B 2006 Plan	+	3E Early Vitrification	0
2C Transuranic Separations/ Class A Grout	+		
2D Transuranic Separations/ Class C Grout	+		

technologies are well developed, proven technologies that have been successfully demonstrated throughout the DOE complex and industry. The current DOE HLW treatment at the Savannah River Site Defense Waste Processing Facility and at the West Valley Demonstration Project evidences the technical maturity of the vitrification process. Therefore, all four options of the Separations Alternative received a plus (+) rating.

Under the Non-Separations Alternative, the Vitrified Waste, Hot Isostatic Pressed Waste, and Direct Cement Waste Options all received a plus (+) rating due to incorporation of well developed, demonstrated technologies at INEEL. The Early Vitrification Option was assessed a zero (0) rating because of the unknowns associated with the vitrification of SBW.

The Cement-Ceramic Option received a minus (–) rating due to the high-risk treatment process, (i.e., calcination of SBW/calcine slurry in the New Waste Calcining Facility). The New Waste Calcining Facility, designed to process a liquid feed, would have to undergo major modifications to process the slurry mixture. No research and development work has been done to demonstrate the feasibility of calcining this slurry feed in the New Waste Calcining Facility.

B.4.3.4 Environment, Safety, and Health

The Environment, Safety, and Health criterion focuses on the risk of radioactive and hazardous materials emissions, potential migration into the Snake River Plain aquifer, waste volume produced, potential worker exposure during operations, and complex process hazards. Table B-6 presents the results of the Evaluation Team's ratings of the candidate alternatives against this criterion.

Table B-6. Environment, safety, and health ratings.

Candidate alternative	Rating	Candidate alternative	Rating
1. No Action		3. Non-Separations	
1A Notice of Intent	0	3A Vitrified Waste	0
1B Orderly Shutdown	–	3B Hot Isostatic Pressed Waste	–
2. Separations		3C Cement-Ceramic	–
2A Full Separations	0	3D Direct Cement	0
2B 2006 Plan	–	3E Early Vitrification	0
2C Transuranic Separations/ Class A Grout	0		
2D Transuranic Separations/ Class C Grout	0		

Based on preliminary worker risk data (DOE 1997b), the Orderly Shutdown, 2006 Plan, Hot Isostatic Pressed Waste, and Cement-Ceramic Options were considered least acceptable due to increased worker risk as compared to the other alternatives and received a minus rating. The increased worker risk for the 2006 Plan, Hot Isostatic Pressed Waste, and Cement-Ceramic Alternatives was attributed to longer periods of hazardous activity and more complex and higher risk processes. In the case of the Orderly Shutdown Alternative, the liquid SBW in the Tank Farm and the HLW calcine in the bin sets, to be left indefinitely at the INTEC, increased worker and environmental risk. For these reasons these options were all assessed a minus (–) rating.

Based on the limited amount of definitive information (only worker risk data) available to the team, the remaining alternatives received a zero (0) rating because of minimal worker risk and insufficient information to rank the alternatives in the other sub-elements of Environment, Safety, and Health.

B.4.3.5 Stakeholder and Tribal Issues

Considerations for the Stakeholder and Tribal Issues criterion were obtained from stakeholder and public comments submitted during the EIS scoping period. The sub-elements of the Stakeholder and Tribal Issues criterion include final HLW form, disposal sites, aquifer impacts, waste acceptance criteria at the proposed geologic repository, definition of SBW, equity with respect to other DOE sites, HLW transportation, and tribal cultural and historic resources. Table B-7 presents the results of the Evaluation Team's ratings of the candidate alternatives against this criterion.

Table B-7. Stakeholder and tribal issues ratings.

Candidate alternative		Rating	Candidate alternative		Rating
1.	No Action		3.	Non-Separations	
1A	Notice of Intent	–	3A	Vitrified Waste	+
1B	Orderly Shutdown	–	3B	Hot Isostatic Pressed Waste	0
2.	Separations		3C	Cement-Ceramic	0
2A	Full Separations	0	3D	Direct Cement	0
2B	2006 Plan	0	3E	Early Vitrification	+
2C	Transuranic Separations/ Class A Grout	0			
2D	Transuranic Separations/ Class C Grout	+			

The DOE Evaluation Team assigned a minus (–) rating to both options under the No Action Alternative because neither alternative addresses the widespread opposition to long-term storage or disposal of HLW above the Snake River Plain aquifer. Also, the alternatives do not meet the Settlement Agreement/Consent Order requirement to have all INEEL HLW road ready by 2035.

Under the Separations Alternative, the Evaluation Team assigned the Full Separations, 2006 Plan, and Transuranic Separations/Class A Grout Options a zero (0) rating because of several concerns. These concerns include the long time estimated for the treatment processes, possible transportation for offsite treatment, health and safety of workers, and potential lack of a disposal facility that would accept INEEL HLW.

The Transuranic Separations/Class C Grout Option was given a plus (+) rating due to the possibility of eliminating the need for disposal of the HLW at the geologic repository. This is due to the planned classification of the high-activity fraction as transuranic waste, which would be eligible for disposal at the Waste Isolation Pilot Plant. Also, this option addresses the stakeholder concerns of meeting the Settlement Agreement/Consent Order milestones. Both of the Transuranic Separations options would require an “incidental waste” determination which may be difficult to obtain, thus decreasing the likelihood of success for these options.

Under the Non-Separations Alternative, the Evaluation Team gave the Vitrified Waste and Early Vitrification Options a plus (+) rating. These options respond to stakeholder concerns of reducing worker risk (no separations activities) and expediting vitrification, which produces the acceptable waste form for disposal in a geologic repository.

The team gave zero (0) ratings to the Hot Isostatic Pressed Waste, Cement-Ceramic, and Direct Cement Waste Options to reflect the concerns for technical complexity of the treatment processes and their capability to meet the waste acceptance criteria at the disposal site. Moreover, these options would require additional research and development before the EPA could determine waste form equivalency to borosilicate glass.

B.4.3.6 Program Flexibility

Program Flexibility is an attribute of program management that allows critical major funding decisions to be made in a logical, phased approach. Thus, critical decisions to implement costly programs could be done in a serial, time-phased manner to assess results of the initial phases or to allow time for technical maturity. The key to program flexibility is to minimize the number of irrevocable funding commitments at the early stages of a program. Table B-8 presents the results of the Evaluation Team's ratings of the candidate alternatives against this criterion.

Table B-8. Program flexibility ratings.

Candidate alternative			Rating	Candidate alternative			Rating
1.	No Action			3.	Non-Separations		
	1A	Notice of Intent	+		3A	Vitrified Waste	–
	1B	Orderly Shutdown	–		3B	Hot Isostatic Pressed Waste	–
2.	Separations				3C	Cement-Ceramic	–
	2A	Full Separations	0		3D	Direct Cement	–
	2B	2006 Plan	0		3E	Early Vitrification	–
	2C	Transuranic Separations/ Class A Grout	0				
	2D	Transuranic Separations/ Class C Grout	0				

The Notice of Intent Option of the No Action Alternative was assessed a plus (+) rating with minor deficiencies because it is a short term, business-as-usual alternative with no significant changes in operations and requires no new facilities. Therefore, this option has high program flexibility with respect to cost and schedule because no processes or facilities that require early funding commitments would be needed.

All four options under the Separations Alternative were assigned a zero (0) rating with some deficiencies or concerns. These separations options require early funding commitments for the new separations facility, which reduces program flexibility in the near-term. However, the options under the Separations

Alternative have high program flexibility in the long-term because the HLW is separated into high-activity and low-activity waste fractions that allow several immobilization and disposal options to be considered at later stages of the program.

The five options under the Non-Separations Alternative were considered to be relatively inflexible compared to the No Action and Separations Alternatives. These five options were assessed a minus (-) rating with major deficiencies or concerns. These concerns relate to the early program commitments to SBW calcination, SBW and calcine retrieval, HLW immobilization, HLW interim storage, and the potential need to construct a new vitrification facility at INEEL.

B.5 Evaluation Summary and Results

Based on the preliminary criteria ratings, the DOE Evaluation Team completed the final discussions and analyses to determine which options are considered reasonable and worthy of being retained on the HLW Candidate Alternative List. Options with all pluses (+) would be top candidates for inclusion. Options with pluses and zeroes (0) were also considered definite EIS candidates. However, options with more zeroes than pluses triggered additional analysis to ensure the zero ratings were not indications of inherent weaknesses. Options rated with one or more minuses were re-evaluated to determine if the minus ratings were significant enough to eliminate them. If the minus ratings indicated large areas of uncertainty, the evaluators reduced the uncertainty by obtaining and reviewing additional data.

The team made a diligent effort to include a reasonable range of options with potential to satisfy DOE program requirements and concerns of stakeholders and the public. At this stage of the EIS, it is considered better to include too many options rather than too few to ensure identification of an adequate range of options. In any case, subsequent EIS analyses will be sufficiently rigorous to identify unreasonable options and eliminate them from further consideration.

Table B-9 shows the total criteria ratings achieved by all the candidate alternatives during the alternative evaluation discussed in the previous section. As shown in the table, the Transuranic Separations/Class C Grout Option under the Separations Alternative was assessed the highest total rating of +3 and the Cement-Ceramic Option under the Non-Separations Alternative was assessed the lowest total rating of –3. Since the total rating spread (lowest to highest total rating) was only 6 points and the lowest alternative

Table B-9. Total rating of candidate alternatives.

Alternative	Program mission	Cost	Technical feasibility	ES&H	Stakeholder and tribal	Program flexibility	Total rating
1. No Action							
1A Notice of Intent	–	0	+	0(–)[a]	–	+	0(–1)[a]
1B Orderly Shutdown	–	+	+	–	–	–	–2
2. Separations							
2A Full Separations	+	0	+	0	0	0	+2
2B 2006 Plan	+	–	+	–	0	0	0
2C Transuranic Separations/Class A Grout	+	0	+	0	0	0	+2
2D Transuranic Separations/Class C Grout.	+	0	+	0	+	0	+3
3. Non-Separations							
3A Vitrified Waste	+	–	+	0	+	–	+1
3B Hot Isostatic Pressed Waste	0	0	+	–(0)[a]	0	–	–1(0)[a]
3C Cement-Ceramic	0	0	–	–(0)[a]	0	–	–3(–2)[a]
3D Direct Cement	0	0	+	0	0	–	0
3E Early Vitrification	+	–	0	0	+	–	0

a. The ratings in parentheses represent potential changes to final ratings and are based on discussions after the initial evaluation and additional information received by the Team. These potential changes have no effect on the Evaluation Team's final recommendations.

was only a –3 rating, the Evaluation Team recommended that none of the initial candidate alternatives be rejected at this time. Moreover, the Team analysis confirmed that none of the minus ratings indicated areas of serious or inherent weakness.

In Table B-9, the No Action Notice of Intent, Hot Isostatic Pressed Waste, and Cement-Ceramic Options have Environment, Safety, and Health criterion ratings that are followed by revised ratings in parentheses that resulted from further reviews. The rationale for these revised ratings is presented below; however, the ratings do not alter the final recommendations.

The No Action Notice of Intent Option was originally rated zero (0) because of minimal worker impact from continuing calcination. However, this option would require storing the calcine in the bin sets and leaving the tank heels in place indefinitely, which stakeholders would consider an unfavorable long-term situation. Thus, the team revised the Environment, Safety, and Health rating to a potential minus (–) rating.

The Hot Isostatic Pressed Waste and Cement-Ceramic Options were originally given minus (–) ratings for environment, safety, and health due to worker risk. The ratings were changed to a zero (0) rating after further review indicated that worker risk would be less than originally assessed because: (1) the risk-based alternative study (DOE 1997b) showed that the normalized worker risk for these options is less than the No Action Notice of Intent Option, which was accorded a zero rating, and (2) the alternatives pose less risk to the public than the No Action Notice of Intent Option because the waste would be processed and shipped to an offsite facility.

In summary, the Evaluation Team recommended that all the candidate options shown in Table B-9 be retained. However, some of the options have greater technical risk and require significant technology development to remain viable candidates.

B.6 Refinement of DEIS Alternatives

Following the evaluation of candidate alternatives described in the previous section, several events occurred that affected the selection of alternatives for the Idaho HLW & FD EIS. These events include consideration of shipping stabilized HLW (or calcine or separated high-activity waste) to the Hanford Site for processing, use of the proposed INEEL Advanced Mixed Waste Treatment Project for processing certain HLW-related waste streams, and use of a cesium ion exchange process for treatment of liquid SBW and newly generated liquid waste. These events led DOE to further refine the Idaho HLW & FD EIS alternative selection process. The details of this refinement process are contained in DOE (1999) and are summarized below.

B.6.1 DEIS ALTERNATIVES REFINEMENT (PHASE I)

DOE convened an Alternative Refinement Meeting on May 21, 1998 to evaluate the list of EIS alternatives considering the events described above. The following comparison factors (elimination criteria) were used by DOE personnel during the meeting:

- *Two or more alternatives share common process characteristics, but one presents*:

  - A bounding case for environment, safety, and health impacts
  - Substantially reduced cost

- Substantially reduced waste handling risks
- Similar impacts, but with an increased chance for public and/or regulator acceptance

- *An implementation alternative presents a process that would likely result in*:

  - Lack of expected regulator/DOE approval
  - Lack of ability to construct or operate facilities in the required time period
  - Significantly higher volume of waste for disposal
  - Significantly higher worker risk
  - Unreasonably higher cost to treat a small volume of waste
  - Unreasonably higher worker risk to process a small volume of waste
  - Creation of an intermediate waste form that cannot be transformed into an acceptable final waste form for disposal

The results of this meeting are documented in DOE (1999). DOE meeting attendees identified the following alternatives in Table B-10 as "alternatives considered but not analyzed" and "alternatives identified for further DEIS analysis with use of the comparison factors," as discussed previously. The rationale for these conclusions is described below.

Table B-10. Summary of the Phase I Alternative Refinement Meeting.

Alternatives considered but not analyzed	Alternatives identified for further analysis
• **No Action Alternative** – No Action Orderly Shutdown Option • **Separations Alternative** – 2006 Plan Option – Transuranic Separations/Class A Grout Option – Offsite Disposal of Class C Grout Option under the Transuranic Separations Option • **Non-Separations Alternative** – Vitrified Waste Option • **Minimum INEEL Processing Alternative** – Advanced Mixed Waste Treatment Facility Option	• **No Action Notice of Intent (per Notice of Intent)** • **Separation Alternative** – Full Separations Option – Transuranic Separations/Class C Grout Option • **Non-Separations Alternative** – Hot Isostatic Pressed Waste Option – Direct Cement Waste Option – Early Vitrification Option • **Minimum INEEL Processing Alternative** – Full Transport Option – Full Transport with Alternate SBW Treatment Option

No Action Alternative - Orderly Shutdown Option – The group concluded that the No Action Orderly Shutdown Option was not an environmentally responsible alternative and would not be an effective basis of comparison of the action alternatives. This option would not meet any of the Settlement Agreement/Consent Order and other requirements and does not tier off the SNF & INEL EIS decision to continue to operate the New Waste Calcining Facility (DOE 1999). Under this option, the decision to shut down the New Waste Calcining Facility would be made in Fiscal Year 2000, and none of the INTEC HLW management facilities, including the Tank Farm, would be closed. The process vessels would be emptied of waste solutions, and some decontamination rinses would be performed. The Orderly Shutdown Option would stop the operation of the Process Equipment Waste Evaporator system and the Liquid Effluent Treatment and Disposal Facility, and would not empty or close the Tank Farm. The shutdown facilities would be left in a safe condition but would not be monitored. Thus, the group concluded that this option would be eliminated from further consideration.

Separations Alternative - 2006 Plan Option – The 2006 Plan Option is identical to the Full Separations Option except that the SBW would not be processed (separated) directly but would be calcined in the New Waste Calcining Facility by 2012 before dissolution and separation.

Thus, the 2006 Plan Option would require three major processing facilities (i.e., New Waste Calcining Facility with high-temperature and Maximum Achievable Control Technology upgrades, Calcine Dissolution and Separations Facility, and a HLW Vitrification Facility). The proposed 2006 Plan Option waste form would require redissolution of calcine with potential higher life cycle costs and worker risks than other separation options. For these reasons and for the additional processing and storage facilities required, it is apparent that this option offers no advantages over the Full Separations Option. It was also predicted to cost considerably more than the Full Separations Option. The group determined that it be eliminated from the alternative list.

Non-Separations Alternative - Vitrified Waste Option – The calcining of SBW and newly generated liquid waste is the only action that differentiates the Vitrified Waste Option from the Early Vitrification Option. This option not only creates an additional waste form (SBW calcine) to be vitrified with the HLW calcine but also would not maintain the beneficial segregation of the SBW calcine from the HLW calcine. Because of this potential co-mingling, this option could result in a larger quantity of HLW being shipped to a geologic repository for disposal with the attendant higher disposal costs and would require greater facility costs for vitrification and storage. Therefore, it is apparent that there are no advantages for this option over the Early Vitrification Option that otherwise contains the same treatment concepts. For these reasons, the group concluded that the Vitrified Waste Option should be eliminated from further EIS consideration.

Offsite Low-Activity Waste Disposal – The group determined that offsite disposal of Class A grout should be retained in this EIS. Initially, Hanford was selected to be a representative offsite location for Class A grout disposal. However, disposal at Hanford has been eliminated from consideration because previous evaluations of low-activity grout disposal at Hanford have indicated that the long-term (beyond 1,000 years) impacts of low-activity grout disposal could exceed regulatory standards for groundwater protection. Also, Hanford's current HLW management strategy calls for vitrifying the low-activity waste prior to onsite disposal; thus, it is unlikely that Hanford would accept grouted INEEL low-activity waste for disposal. The group then recommended that the Envirocare facility in Utah be considered as a representative offsite disposal facility because it is a commercial facility that is limited only by its waste acceptance criteria.

No Action Alternative - per Notice of Intent – No Action Notice of Intent Option was re-aligned by the group to include the following requirements to meet the Notice of Noncompliance Consent Order:

- Run the New Waste Calcining Facility until June 2000.
- Place the New Waste Calcining Facility in standby and perform the high temperature and Maximum Achievable Control Technology upgrades.
- Run the High-Level Liquid Waste Evaporator until 2003 while the New Waste Calcining Facility is being upgraded.
- Complete the New Waste Calcining Facility permitting and upgrades by 2010.
- Run the New Waste Calcining Facility at an accelerated schedule to calcine the SBW by 2014.

Separations Alternative - Full Separations with Hanford Vitrification – This option is identical to the Full Separations Option except for the suboption to perform high-activity waste vitrification at the Hanford Site instead of at INEEL. In this option, the high-activity waste fraction would be solidified, packaged, and shipped to the Hanford Site for vitrification. The resulting HLW canisters would be returned to INEEL for interim storage awaiting shipment to a geologic repository. The group concluded that the Idaho HLW & FD EIS will include “Hanford Vitrification” as an independent transportation analysis that will be covered in this EIS. The at-Hanford impacts would be discussed in a separate section of the EIS. This would allow the public to isolate the “at-INEEL” and “at-Hanford” impacts.

Separations Alternative - Transuranic Separations/Class A Grout Option – This option is similar to the Full Separations Option, except the separation process under this option would result in three waste products:

- Transuranic waste
- Fission products (primarily strontium/cesium)
- Class A grout

In the Transuranic Separations/Class A Grout Option, the liquid SBW would be sent directly to the Separations Facility for processing into high-activity and low-activity waste streams. After the SBW is processed, the HLW calcine would be retrieved from the bin sets, dissolved, and processed in the Separations Facility. Ion exchange columns would be used to remove the cesium from the waste stream. The resulting effluent would undergo the transuranic extraction process to remove the transuranic elements for eventual shipment to the Waste Isolation Pilot Plant. Then strontium would be removed from the transuranic extraction effluent stream via the strontium extraction process. The cesium and strontium would be combined to produce a high-activity waste stream that would be vitrified into borosilicate glass. This glass would be stored in an interim storage facility before shipment to a geologic repository. The Transuranic Separations waste would be dried and denitrated to produce a granular solid waste, and the low-activity waste would be denitrated and grouted to form Class A grout.

Comparison of the Transuranic Separations/Class A Grout Option to the Transuranic Separations Option described earlier in this appendix provides justification for eliminating it from consideration. As was the case for the Full Separations Option, the Transuranic Separations/Class C Grout Option process would create only two waste streams: (1) solidified transuranic waste for disposal at the Waste Isolation Pilot Plant and (2) a low-activity waste stream to form Class C grout for onsite disposal. The Transuranic Separations/Class A Grout Option would involve more separations steps than the Transuranic Separations/Class C Grout Option and would require a larger Waste Separations Facility. Also, the Transuranic Separations/Class A Option would require a separate High-Activity Waste Treatment (Vitrification) Facility and a High-Level Waste Interim Storage Facility that have an estimated cost substantially greater than the Transuranic Separations (Class C Grout) Option.

The estimated total discounted cost for the Transuranic Separations/Class A Grout Option is $3.29 billion, which would be 80 percent greater than the estimated total discounted cost of $1.82 billion for the Transuranic Separations (Class C Grout) Option. Thus, the Transuranic Separations/Class C Grout Option is similar, has less complex separations processing, and is more cost-effective than the Transuranic Separations/Class A Option. Moreover, the impacts of this option are expected to be bounded by the remaining two options under the Separations Alternative. For these reasons, the Transuranic Separations/Class A Option was eliminated from further consideration in this EIS.

Non-Separations Alternative - Cement-Ceramic Waste Option – The Cement-Ceramic Waste Option under the Non-Separations Alternative is similar to the Direct Cement Waste Option except the liquid SBW would not be calcined directly but would be mixed with the existing calcine to form a slurry. In this option, all calcine would be retrieved and combined with the liquid SBW. The combined slurry would be recalcined in the New Waste Calcining Facility with the resulting calcine mixed into a concrete-like material. The concrete waste product would then be poured into drums, autoclaved (curing in a pressurized oven), and stored in an interim storage facility before shipment to a geologic repository. An estimated 16,000 concrete canisters would be produced. This option would require a calcine retrieval system, a major modification to the New Waste Calcining Facility to allow slurry calcination and the upgrade for compliance with the Maximum Achievable Control Technology rule, and a Grout Facility with autoclave. The final product would require an equivalency determination by EPA.

The rationale for initially considering the Cement-Ceramic Waste Option in the EIS was the potential for significant cost savings in using a greater confinement facility (such as at the Nevada Test Site) as the final repository for the resulting product. A basis for this assumption was that the cementitious waste form and the alluvial soil at the greater confinement facility were chemically compatible, and the cement waste form would be the least likely to migrate in the surrounding soil. However, the greater confinement facility for HLW disposal has not been constructed, nor has DOE approved the project for construction at this date. Moreover, DOE experiences at the Waste Isolation Pilot Plant and Yucca Mountain suggest that the development of a repository is a lengthy, costly, and high-risk undertaking. In addition, if INEEL were the only site disposing HLW at a greater confinement facility, INEEL would bear all costs associated with the development of the repository (e.g., site characterization and performance assessments associated with U.S. Nuclear Regulatory Commission licensing and EPA certification of compliance). Therefore, it is unlikely that significant cost savings at a greater confinement facility could be realized over a geologic repository where INEEL would pay only a prorated share of the development and operational costs based on its share of the waste disposed of.

Even if the Cement-Ceramic Waste Option had a high potential to reduce life cycle costs, the fact that DOE has included the Direct Cement Waste Option, which has lower technical risk than the Cement-Ceramic Waste Option, negates the need to include the Cement-Ceramic Waste Option in the EIS analysis. The Cement-Ceramic Waste Option is based on calcination of SBW/calcine slurry in the New Waste Calcining Facility, which is currently configured to process a liquid feed. To reconfigure the New Waste Calcining Facility to process an SBW/calcine slurry would be costly. Even if the New Waste Calcining Facility were modified to accept the slurry feed, no prior research and development work has been conducted to verify the feasibility of calcining the slurry. Thus, a significant technical risk would remain for this process. For these reasons the Cement-Ceramic Waste Option was eliminated from further consideration in this EIS.

Minimum INEEL Processing Alternative – The group concluded that an additional alternative, entitled the “Minimum INEEL Processing Alternative,” should be analyzed in the Idaho HLW & FD EIS. This alternative would have two options: (1) the Full Transport Option and (2) the Full Transport with Alternate SBW Treatment Option. Under either option in this alternative, DOE would perform only the minimum activities necessary to prepare the calcine for shipment to the Hanford Site for treatment. In the Full Transport Option, DOE would also solidify and package the SBW for transport to Hanford. In the Full Transport with Alternate SBW Processing Option, DOE would not ship the SBW to Hanford but would instead process the SBW through an ion-exchange column to remove the cesium and grout to create a contact-handled transuranic waste that DOE would ship to the Waste Isolation Pilot Plant.

B.6.2 EIS ADVISORY GROUP (EAG) REVIEW

Subsequent to the Alternatives Refinement Meeting, DOE convened the Idaho HLW & FD EIS Advisory Group Meeting on June 30 and July 1, 1998. The purpose of the EIS Advisory Group is to provide a forum to assess the resolution of issues related to preparation and review of this EIS. The EIS Advisory Group concluded that the alternatives resulting from the Phase I Alternatives Refinement Meeting are acceptable except that the No Action Alternative should be revised so it does not include expected Maximum Achievable Control Technology upgrades to the New Waste Calcining Facility or construction of new storage tanks. DOE subsequently decided that the alternative previously entitled the No Action Alternative would be retained but would be retitled the “Continued Current Operations” Alternative.

B.6.3 ALTERNATIVE REFINEMENT (PHASE II)

A second alternative refinement meeting was held on September 16, 1998. The intent of this second meeting was to discuss the potential Hanford alternatives for treatment of INEEL HLW and SBW. The DOE Evaluation Team concentrated on evaluating the physical characteristics of the Hanford alternatives and the timing for potential shipments of waste to Hanford for treatment. Timing of shipments is critical since it affects the treatment processes at INTEC, which would supply the waste for Hanford treatment.

The DOE Evaluation Team evaluated several options for treatment of INTEC wastes at Hanford, including (1) direct vitrification of calcine, (2) direct vitrification of separated high-activity waste, (3) calcine separations, and (4) shipping SBW/newly generated liquid waste to the Hanford Site for treatment. The DOE Evaluation Team concluded that only Option 3, "calcine separations," should be evaluated in the EIS. DOE's rationale for eliminating the other options is explained in DOE (1999) and Section 3.3 of this EIS.

Therefore, the Minimum INEEL Processing Alternative would entail shipping calcine from INEEL to Hanford, separation of this calcine at Hanford into high-activity and low-activity streams, and vitrification of both waste streams at Hanford. The vitrified high-activity waste would be shipped back to INEEL for interim storage pending shipment to a geologic repository, while the vitrified low-activity waste would be shipped back to INEEL for disposal. The existing liquid SBW and newly generated liquid wastes would be retrieved and transported to an ion exchange facility, where it would be filtered and processed through an ion exchange column. The filtered solids would be dried and disposed of at the Waste Isolation Pilot Plant as remote-handled transuranic waste. The loaded ion exchange resin would be temporarily stored at INEEL, dried and containerized, and transported to Hanford for vitrification. After ion exchange, the liquid waste would be grouted to produce a contact-handled transuranic waste for disposal at the Waste Isolation Pilot Plant.

B.6.4 STATE OF IDAHO REVIEW

As described in Section 1.3, the State of Idaho is serving as a "Cooperating Agency" in the preparation of this EIS. In fulfilling this responsibility, the State reviewed the list of waste processing alternatives. The State's review concluded that the 2006 Plan Option comes the closest to fulfilling the Settlement Agreement/Consent Order and should be analyzed in the EIS. DOE incorporated the State's recommendation and evaluated this option in the EIS but retitled it the "Planning Basis Option."

B.7 Final List of Alternatives

Therefore, as a result of all the activities discussed in this Appendix, the Idaho HLW & FD EIS analyzes the following waste processing alternatives and options:

1. No Action Alternative
2. Continued Current Operations Alternative
3. Separations Alternative

    A. Full Separations Option
    B. Planning Basis Option
    C. Transuranic Separations Option

4. Non-Separations Alternative

    A. Hot Isostatic Pressed Waste Option
    B. Direct Cement Waste Option
    C. Early Vitrification Option

5. Minimum INEEL Processing Alternative

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APPENDIX C

TECHNICAL METHODS AND DATABASES

NOTE: This appendix and the references associated with it, refer to the historically used radioactive waste terms, sodium bearing waste (SBW) and newly generated liquid waste. These terms have been used at the INEEL over the years to describe liquid radioactive wastes generated in association with high level waste and other waste management activities.

In July 1999, the Department of Energy published DOE Order 435.1 "Radioactive Waste Management." This Order establishes terms and definitions for radioactive waste. The radioactive waste terms used in the main body of this Idaho HLW & FD EIS refer to the terms specified in the Order. In most cases, this EIS parenthetically refers to the historical waste term.

To assist the reader in corresponding the historical radioactive waste terms used in this appendix with radioactive waste terms used in the main body of this EIS and the Summary, a cross-reference table has been provided in Section 1.2.2 of Volume 1 of this EIS.

APPENDIX C.1

SOCIOECONOMICS

TABLE OF CONTENTS

Section Page

List of Figures

Figures Page

TABLE OF CONTENTS (Continued)

List of Figures (Continued)

C.1 Socioeconomics

The socioeconomic impact analysis conducted for this EIS examines the potential effects of the proposed Idaho HLW & FD EIS waste processing and facility disposition alternatives on the region of influence's social and economic resources, including employment, regional income, and population. The methodology for this EIS is similar to that used in the *Programmatic Spent Nuclear Fuel Management and Idaho National Engineering Laboratory Environmental Restoration and Waste Management Programs Final Environmental Impact Statement* (SNF & INEL EIS) (DOE 1995) but uses updated data and a revised version of the Regional Input-Output Modeling System (RIMS II) model.

The analysis presented in Sections 5.2.2 and 5.3.2 evaluates the potential effects of the waste processing and facility disposition alternatives relative to the baseline socioeconomic conditions described in Section 4.3, Socioeconomics. The existing and projected economic conditions in the region of influence provide the framework for assessing the socioeconomic impacts of the alternatives. The impact analysis, as described in the following methodology section, estimates the effects of the alternatives on regional employment and earnings. Employment and earnings effects could generate possible changes in regional population and in the demand for housing and community services.

In general, the analysis indicates that each alternative would have the potential to generate changes in INEEL-related expenditures and workforce levels with possible pass-through or indirect effects on the regional economy. Since 1991, INEEL employment levels have declined about 35 percent to approximately 8,100 jobs. Long-range employment forecasts are not available for INEEL missions but indications based on budget forecasts suggest workforce levels have stabilized at current levels and will not fluctuate more than ± 5 percent (McCammon 1999). Currently, about 1,100 of these workers are associated with INTEC (Beck 1998). DOE assumes that these workers are the basis for the HLW workforce.

C.1.1 REGION OF INFLUENCE

The analysis of socioeconomic impacts is limited to a seven-county area surrounding the INEEL comprised of Bannock, Bingham, Bonneville, Butte, Clark, Jefferson, and Madison counties and the Fort Hall Indian Reservation and Trust Lands (home of the Shoshone-Bannock Tribes). This region of influence is determined according to the following criteria previously used in the programmatic SNF & INEL EIS:

- Counties that contain the residences of at least 85 percent of the current INEEL operations and construction workforce

- Counties in which the resident INEEL workforce comprises 5 percent or greater of the county's civilian labor force

C.1.2 METHODOLOGY AND KEY ASSUMPTIONS

The analysis of socioeconomic impacts considers 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 socioeconomic impacts estimated in this analysis would be generated by expenditures and employment allocated to the waste management program at INEEL, which include DOE employment as well as site-related contractors and subcontractors.

The analysis addresses both direct and indirect socioeconomic impacts. Direct impacts are changes in INEEL employment and expenditures expected to take place under each alternative and include both construction and operations phases. Direct employment impacts represent actual increases or decreases in INEEL staffing for a given project regardless of whether or not the jobs are new or reassigned from other missions. Indirect impacts include (a) the impacts to businesses in the region of influence and employment resulting from changes in DOE purchases or non-payroll expenditures and (b) the impacts to the region of influence businesses and employment that result from changes in spending by INEEL employees. The total economic impact to the region of influence is the sum of direct and indirect impacts.

To analyze socioeconomic effects, DOE used total employment and earnings multipliers, obtained from RIMS II developed specifically for the INEEL region of influence by the U.S. Bureau of Economic Analysis. RIMS II is widely used in both the private and public sector. In the private sector, analysts, consultants, and economic development practitioners use the model to estimate regional impacts of proposed projects. In the public sector, this model is used by state and Federal agencies, including the U.S. Department of Defense and the U.S. Department of Energy (BEA 1997a). In addition, several recent DOE EISs and programmatic EISs for INEEL used the RIMS II model. The model's multipliers derive from the U.S. Bureau of Economic Analysis's national input-output table, adjusted using the U.S. Bureau of Economic Analysis's most recent region-specific information describing the relationship of the regional economy to the national economy (BEA 1997b).

The indirect impacts are thus determined by applying the regional specific multiplier to direct job and INEEL expenditure estimates for each project to determine the comparable change in the regional economy. The multipliers vary by project phase. For example, the multiplier used to estimate indirect employment is higher for activities in the operational phase (approximately 30 percent higher) than it is for those in the construction or facility disposition phases. The multipliers used to estimate total earnings are slightly higher for the construction and facility disposition phases (less than 1% higher).

C.1.3 ECONOMIC ACTIVITY

The following assumptions were used as a basis for conducting the analysis:

- Construction and operations employment are treated as if they were newly created jobs for all the alternatives; in reality, a substantial amount of retraining and reassignment of existing personnel would occur.

- Construction staffing is based on project data sheets (see Appendix C.6). Impacts are assessed for the peak year of construction.

- Operations staffing is based on project data sheets (see Appendix C.6). Impacts are assessed for the peak year of operations.

- For construction and operations workers, an average annual salary of $28,040 and $32,683 respectively is assumed (IDOL 1998).

- Based on DOE budget forecasts and historical trends, the analysis assumes a stabilized INEEL workforce of about 8,100 with a ± 5 percent fluctuation (McCammon 1999).

C.1.3.1 INEEL Employment and Expenditures

Potential jobs and total earnings associated with INEEL waste management activities would be greatest during the construction phase. The maximum peak year (2013) direct and indirect employment is estimated to be about 1,770. Compared to the estimated employment pool for the region of influence in that year of 152,000 (RIMS II), in the construction sector, forecasts indicate about 6,500 to 7,000 construction workers would be in the area.

Similarly, the maximum peak work force levels for the operational phase is estimated to be about 1,470 jobs (2015). Again, compared to the estimated employment pool in the peak year of 157,000 (RIMS II) any small net increase in new jobs required could be obtained regionally.

Because regional earnings or expenditures are fundamentally related to the workforce assigned to a project, the maximum related total earnings also would occur in 2013 and 2015 for construction and operations, respectively. The estimated total regional earnings for 2013 are about $43 million; an estimated $31 million would occur in the operational peak year (2015). Both of the earnings estimates take into account indirect job creation in the region of influence.

In the case of facility disposition activities, peak year estimates are not as meaningful. During dispositioning activities, the durations of discrete project elements are relatively short, and activities do not always occur sequentially. Consequently, annual employment rather than peak year estimates were utilized for each alternative to determine the potential impacts.

C.1.3.2 Population, Housing, and Community Services

Population changes associated with the project baseline conditions and the proposed alternatives are an important determinant of other social, economic, and environmental impacts. These population changes have three key components: (1) baseline growth, (2) relocation of workers and their dependents, and (3) natural increases in population over the longterm.

As mentioned in Chapter 5, indications are that the INEEL workforce has stabilized but could vary by about 5 percent. If the variation resulted in downsizing, about 400 jobs could be lost. Consequently, the reduction of employment could result in a reduced demand for housing and rental units. Assuming all 400 individuals own or rent housing units, the amount of available housing would increase by about one-half of 1 percent (or 0.005).

The situation involving potential impacts to community services and public finance is similar to that described for population and housing. As the demand for workers in a region vary, the pressure on community services and the tax base also varies. A potential downsizing of 400 jobs as discussed in the previous section would not likely generate discernible impacts on community services and public finance within the region of influence. While the magnitude of the impacts may be small, they could result in reduced school enrollments and similar declines in demand for other community services.

C.1.4 DATA

Figures C.1-1 through C.1-16 summarize construction and operations-phase employment estimates for the various waste processing alternatives. Figures C.1-17 through C.1-24 show employment associated with disposition of new waste processing facilities required under the various alternatives. The figures depict estimated direct employment on an annual basis. The multipliers and wage rate described in Section C.1.2 of this appendix were applied to these employment estimates to estimate the total employment and expenditure potential associated with each alternative.

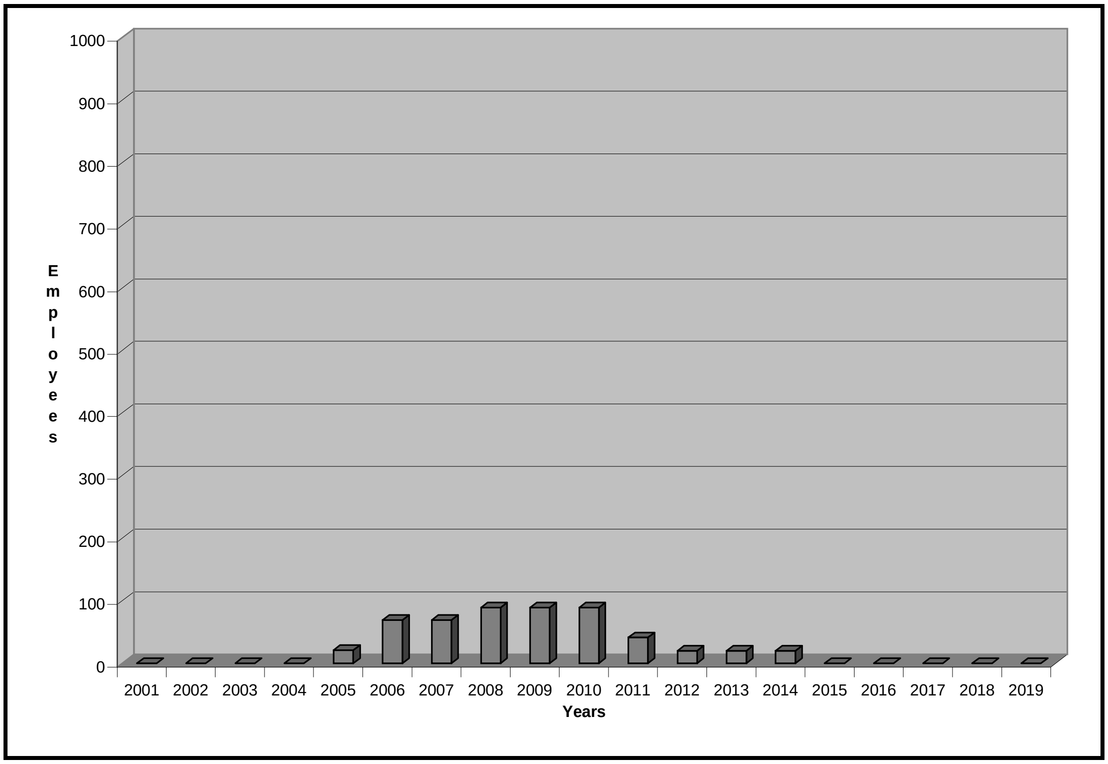

Figure C.1-1. Continued Current Operations Alternative - Construction Employment.

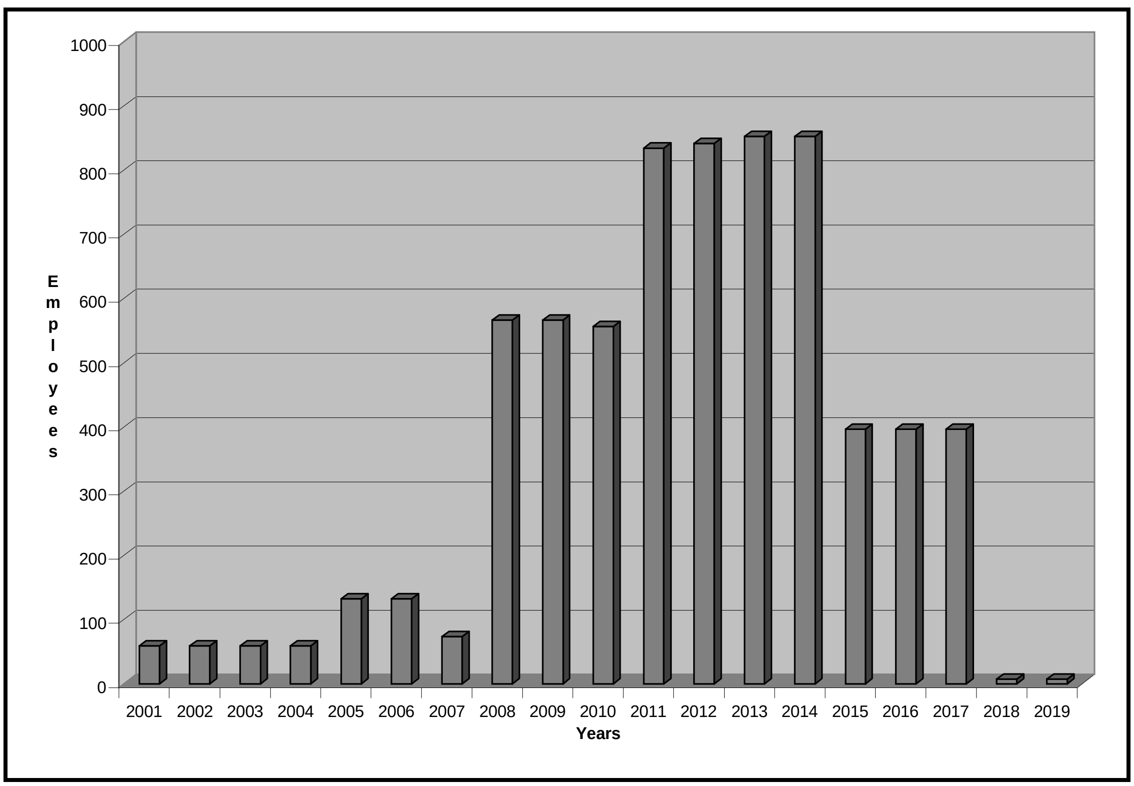

Figure C.1-2. Separations Alternative – Full Separations Option - Construction Employment.

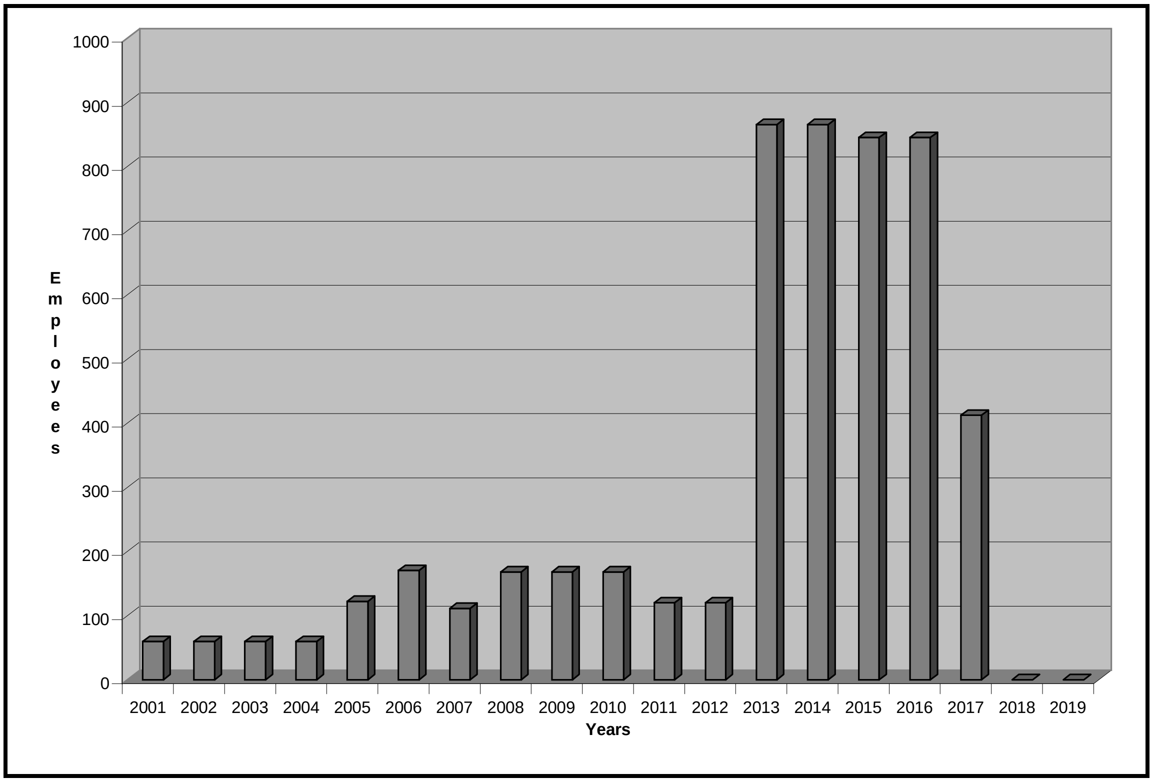

Figure C.1-3. Separations Alternative – Planning Basis Option - Construction Employment.

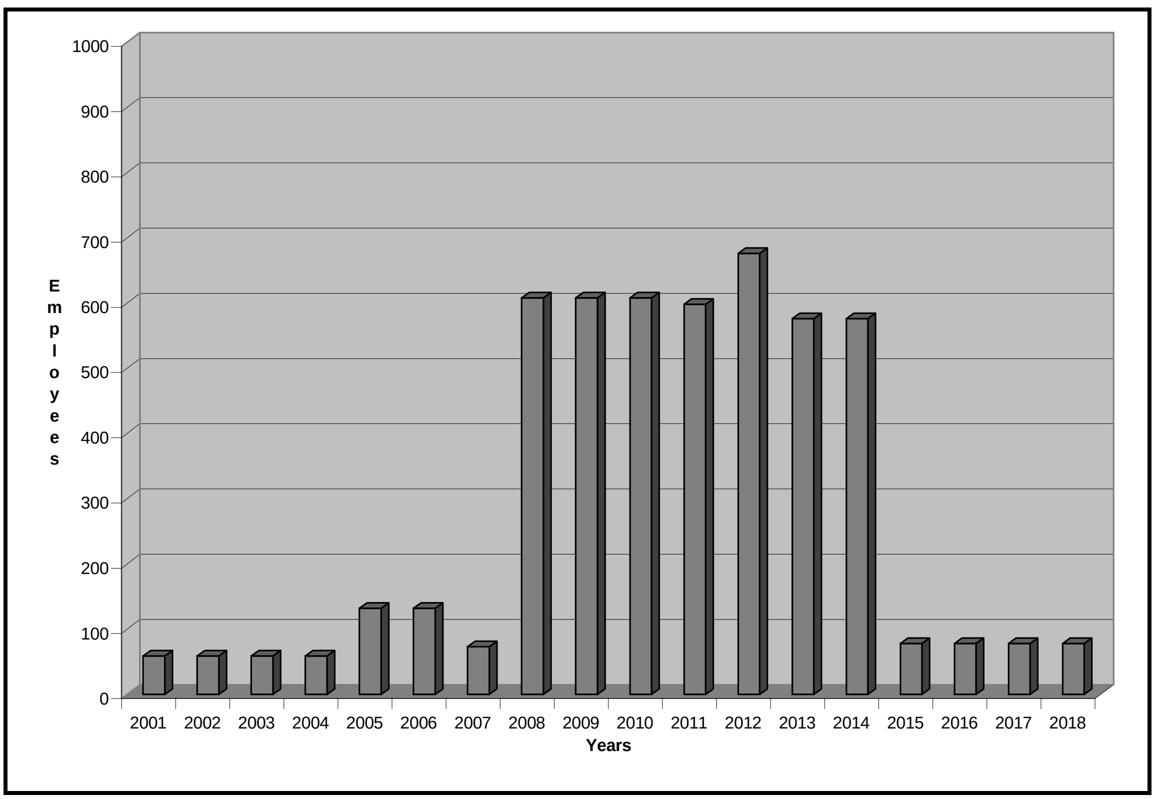

Figure C.1-4. Separations Alternative – Transuranic Separations Option - Construction Employment.

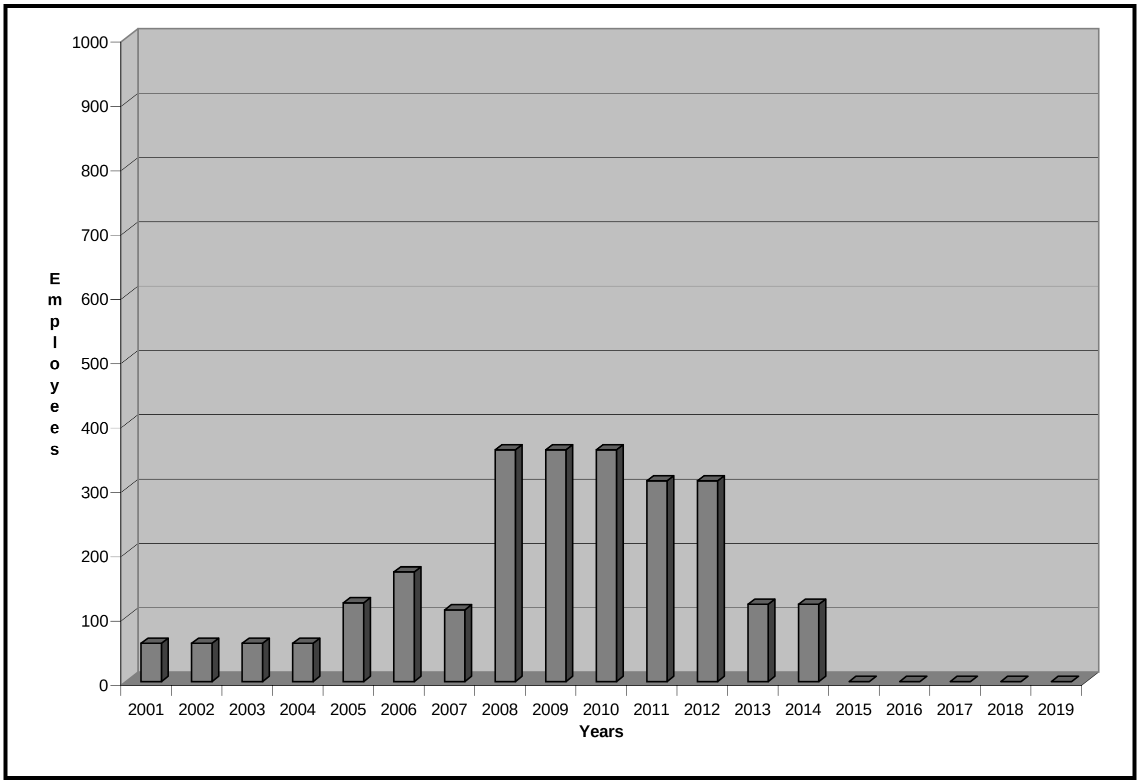

Figure C.1-5. Non-Separations Alternative – Hot Isostatic Pressed Waste Option - Construction Employment.

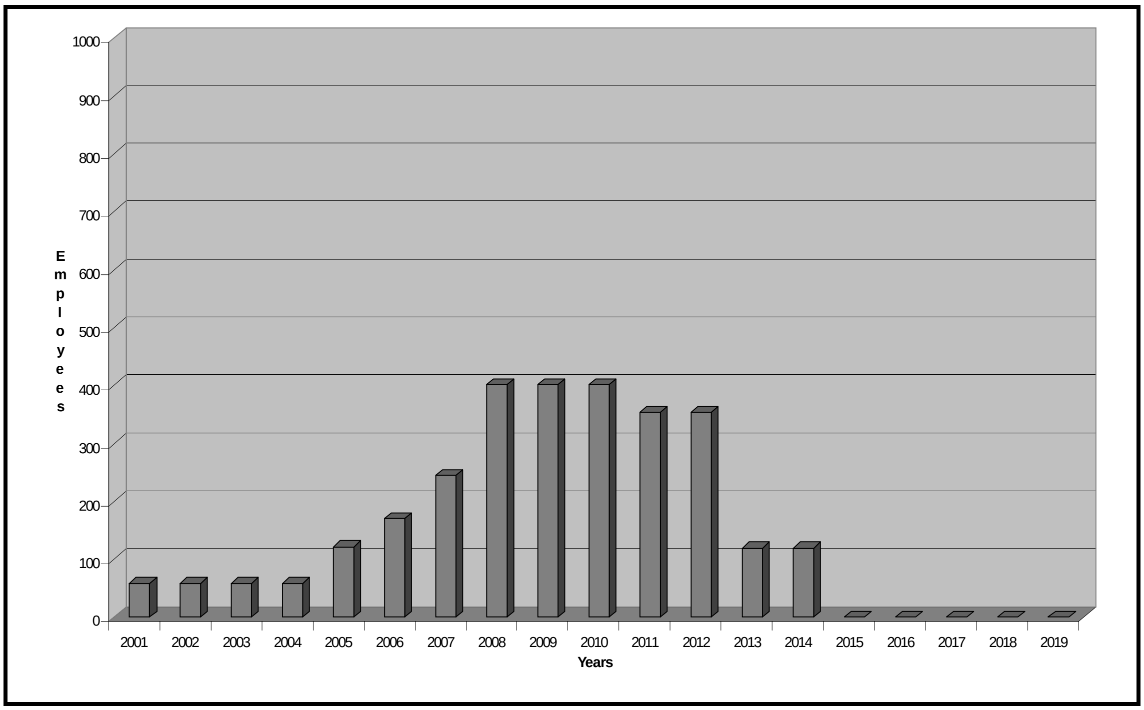

Figure C.1-6. Non-Separations Alternative – Direct Cement Waste Option - Construction Employment.

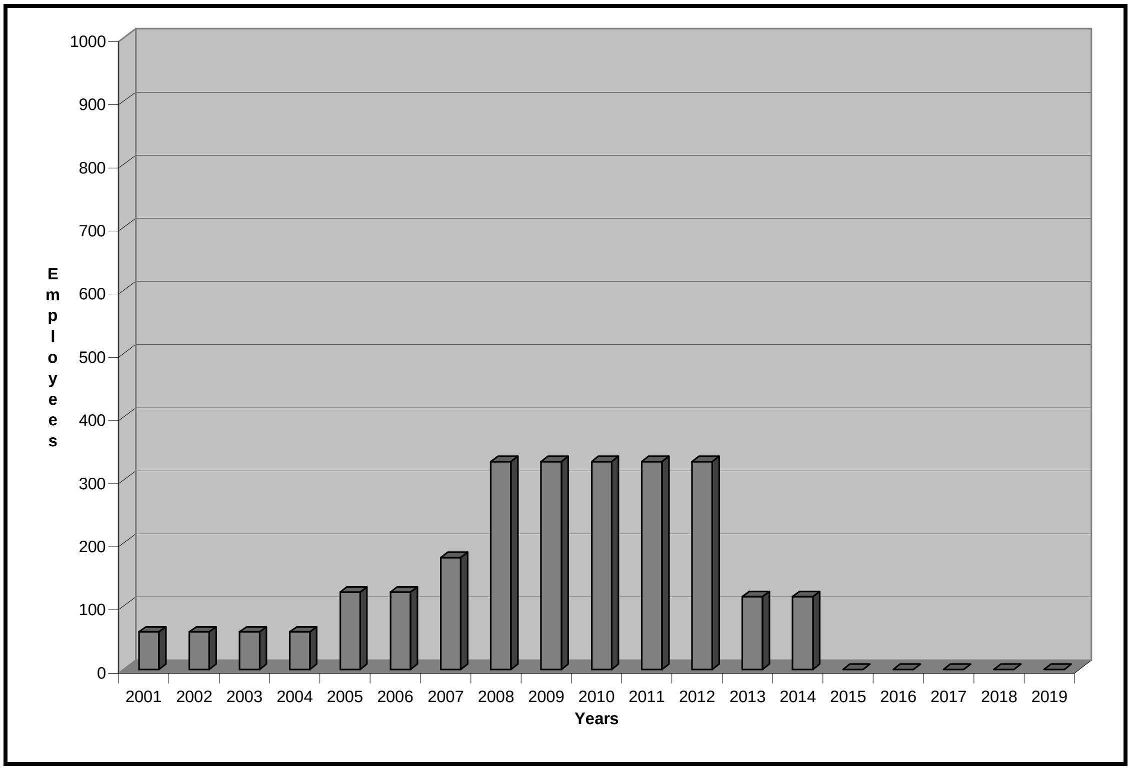

Figure C.1-7. Non-Separations Alternative – Early Vitrification Option - Construction Employment.

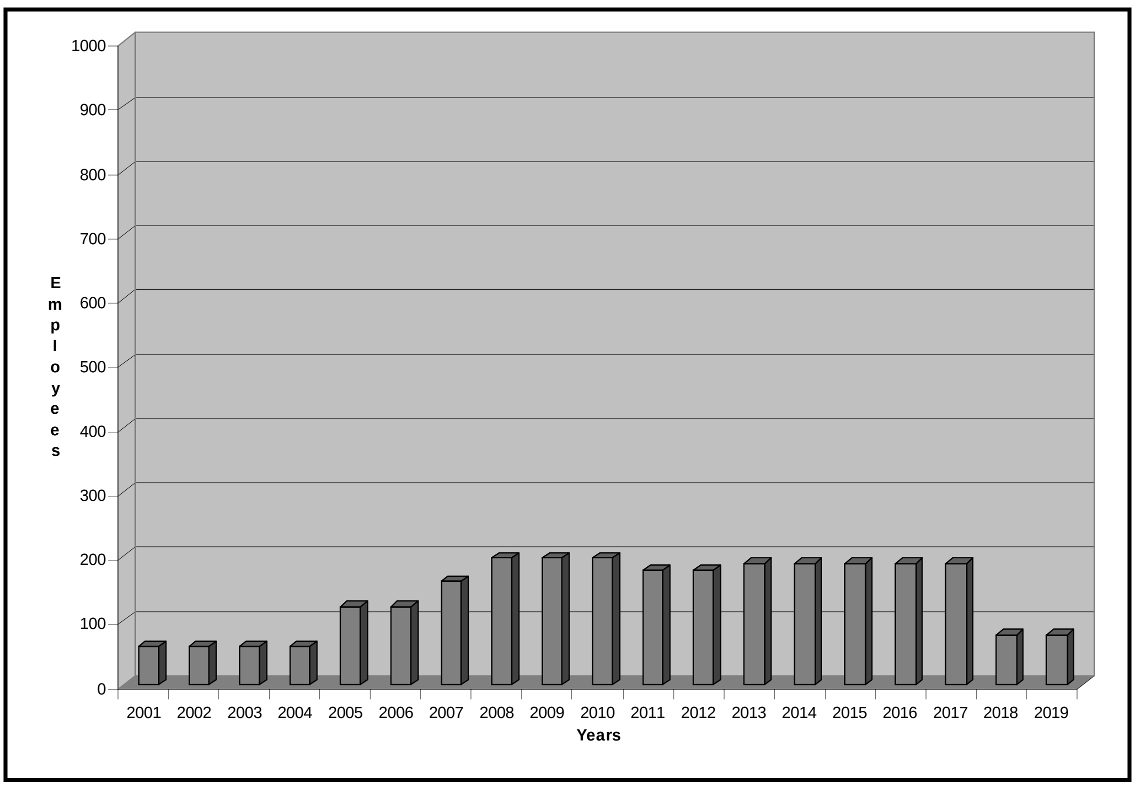

Figure C.1-8. Minimum INEEL Processing Alternative - Construction Employment.

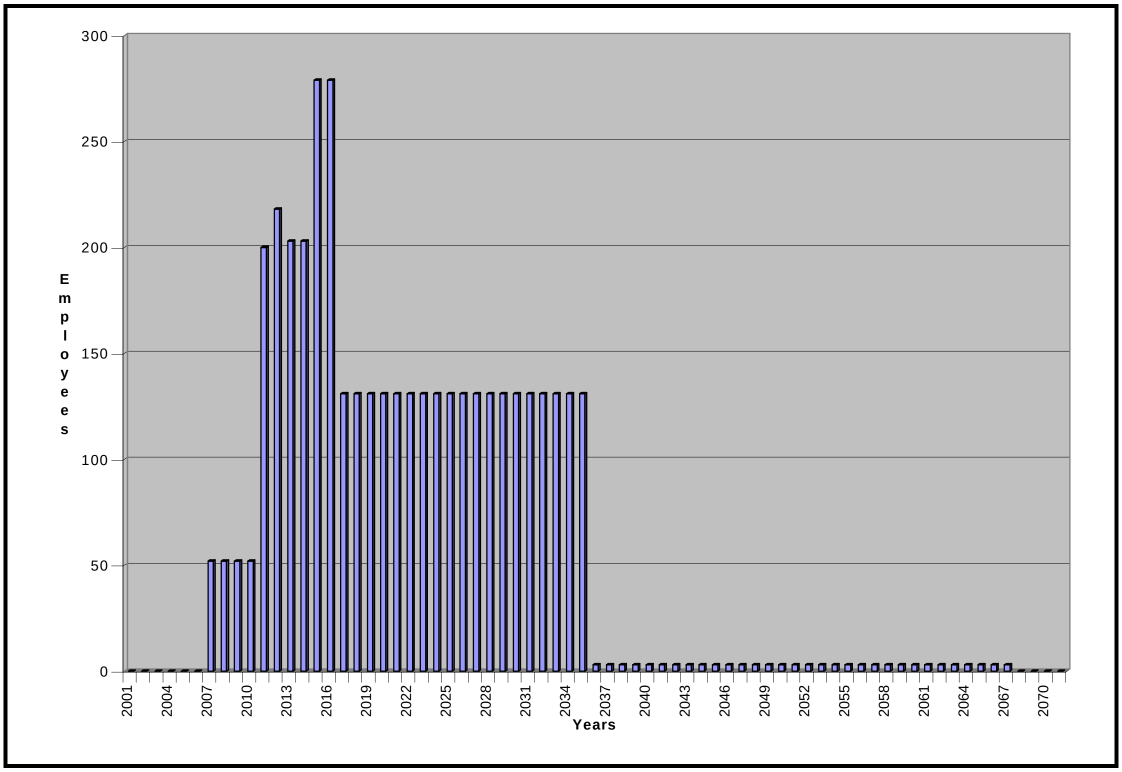

Figure C.1-9. Continued Current Operations Alternative - Operations Employment.

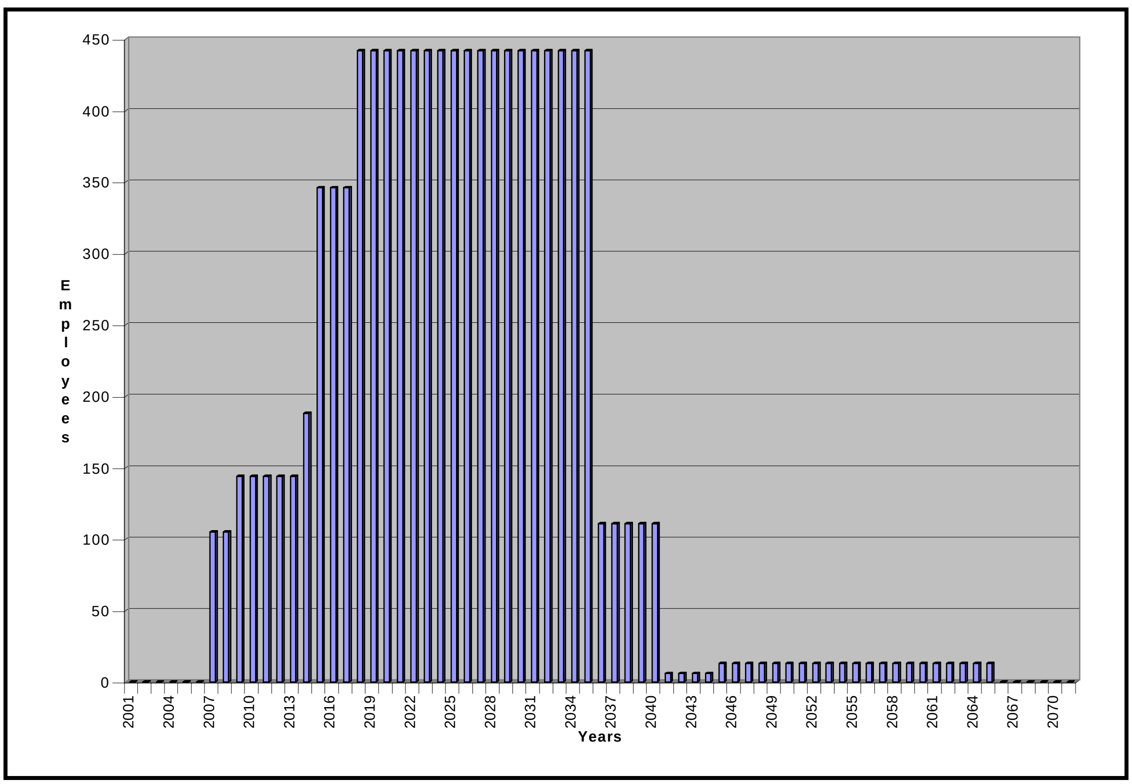

Figure C.1-10. Separations Alternative – Full Separations Option - Operations Employment.

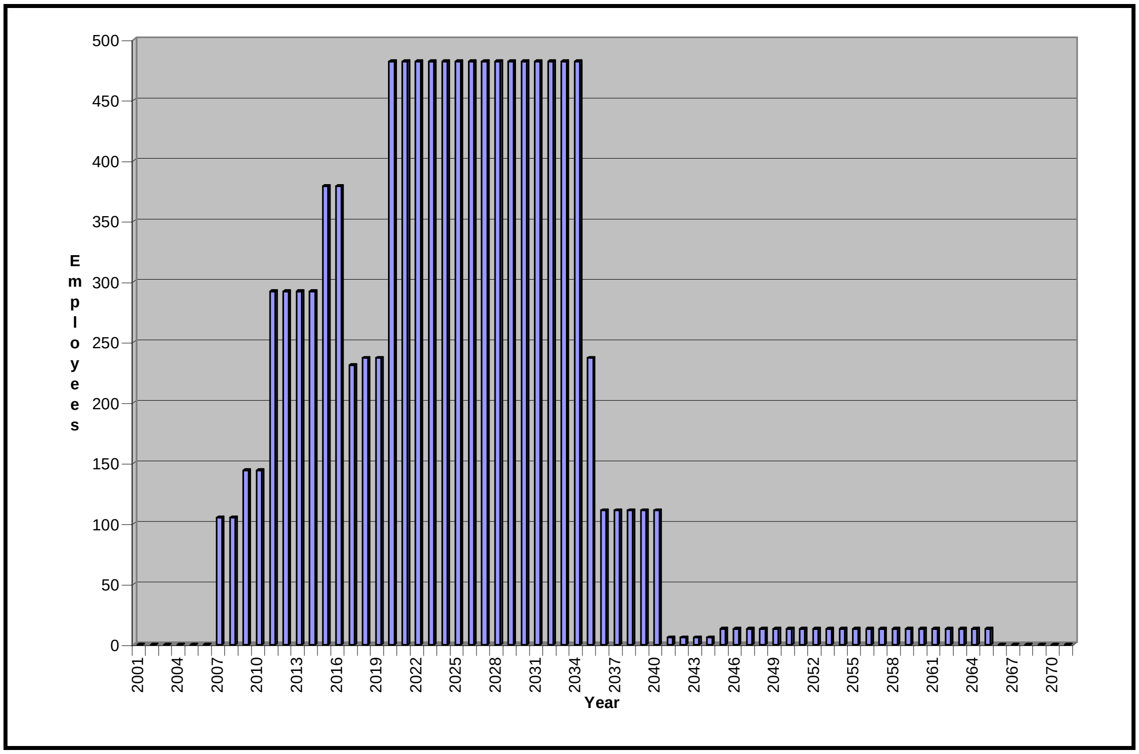

Figure C.1-11. Separations Alternative – Planning Basis Option - Operations Employment.

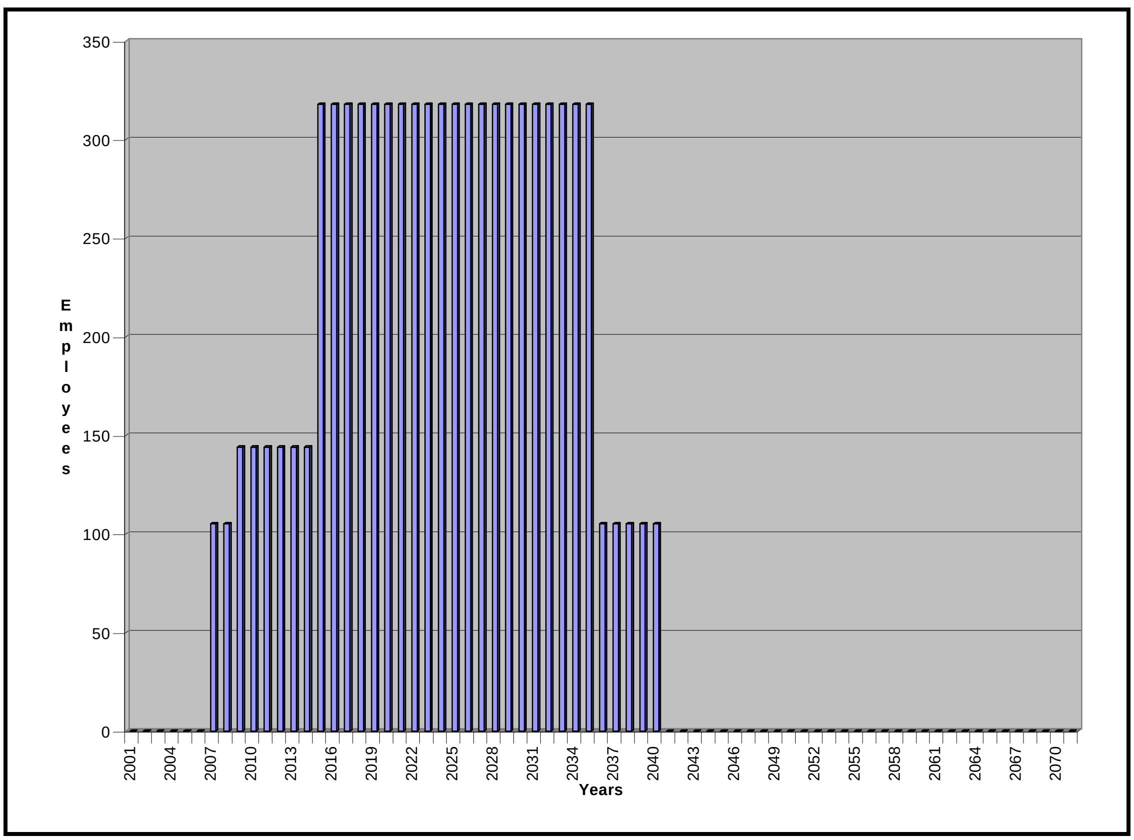

Figure C.1-12. Separations Alternative – Transuranic Separations Option - Operations Employment.

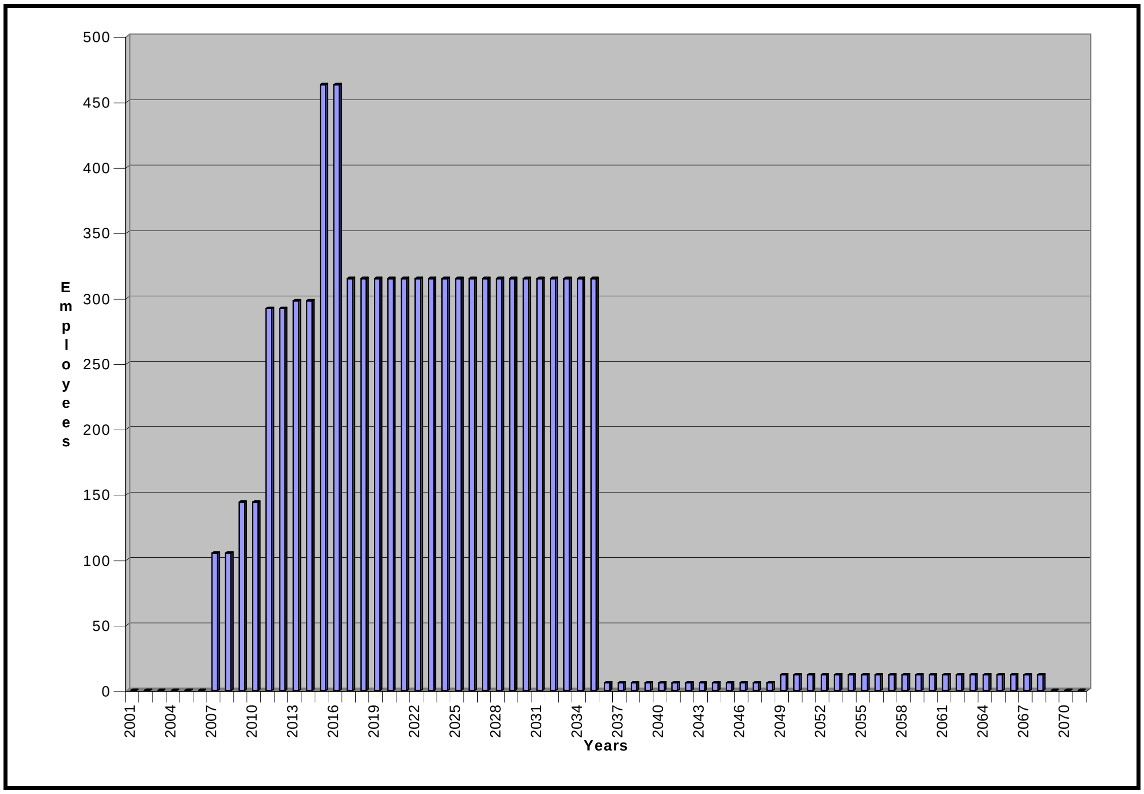

Figure C.1-13. Non-Separations Alternative – Hot Isostatic Pressed Waste Option - Operations Employment.

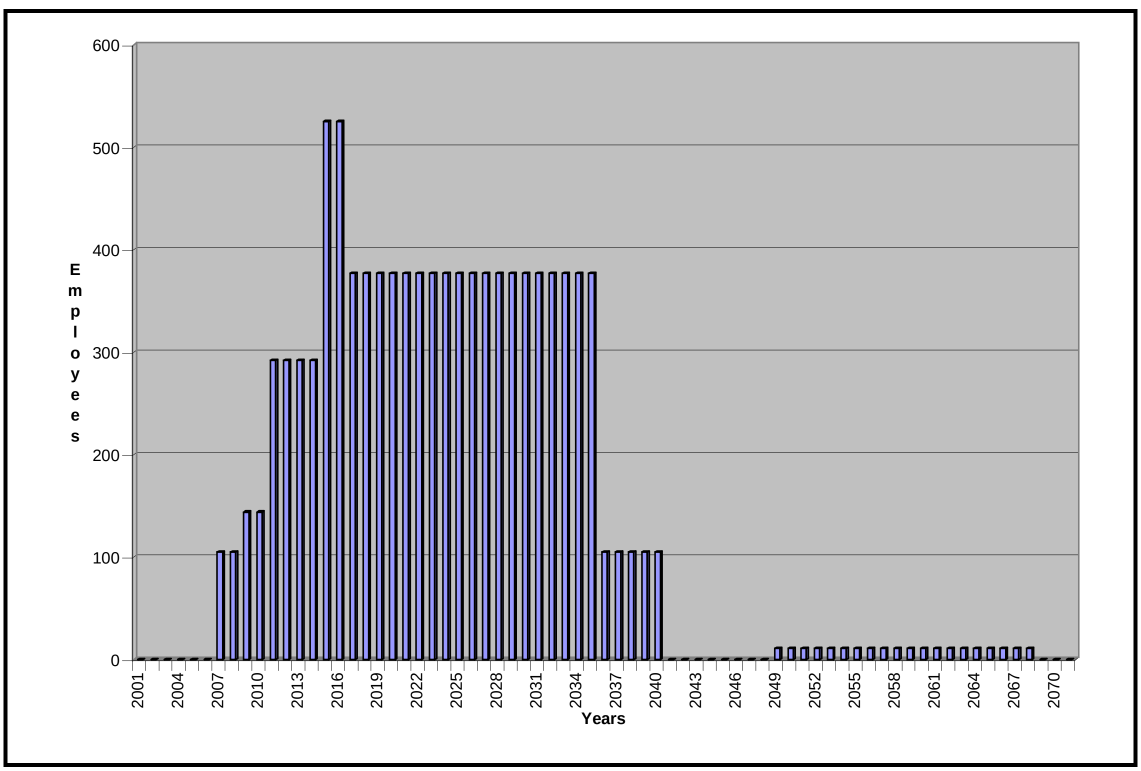

Figure C.1-14. Non-Separations Alternative – Direct Cement Waste Option - Operations Employment.

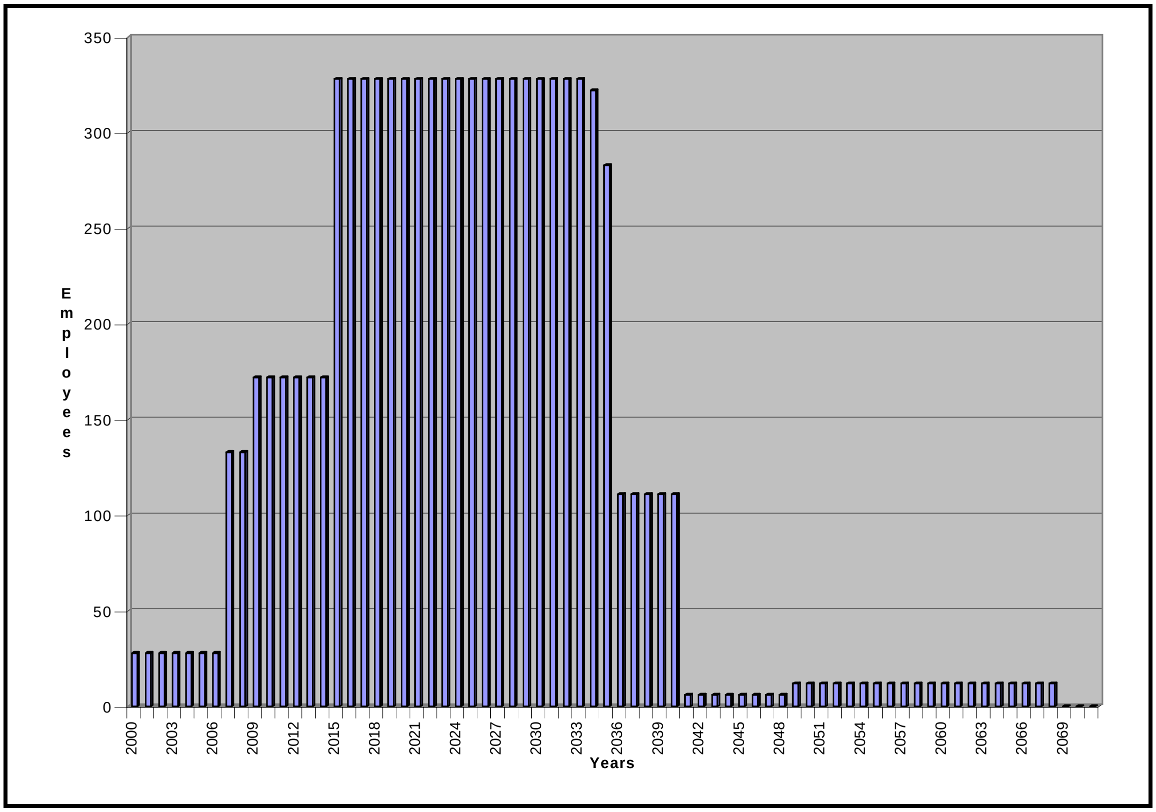

Figure C.1-15. Non-Separations Alternative – Early Vitrification Option - Operations Employment.

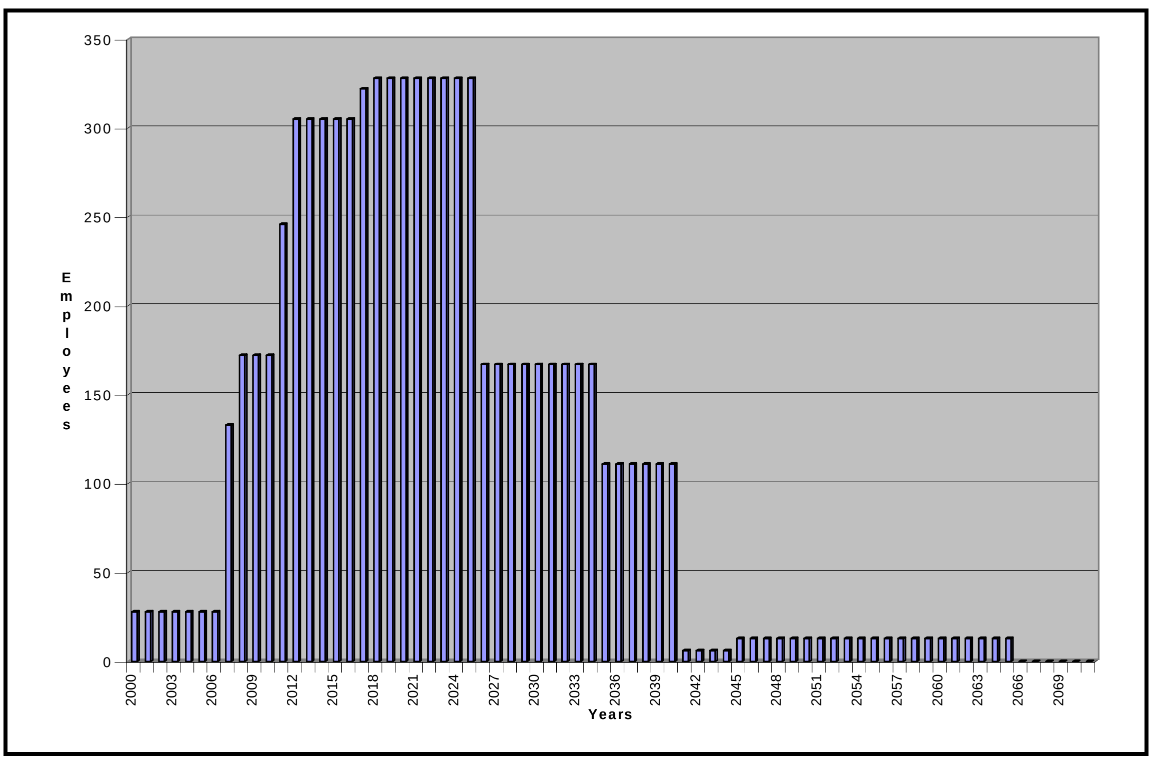

Figure C.1-16. Minimum INEEL Processing Alternative - Operations Employment.

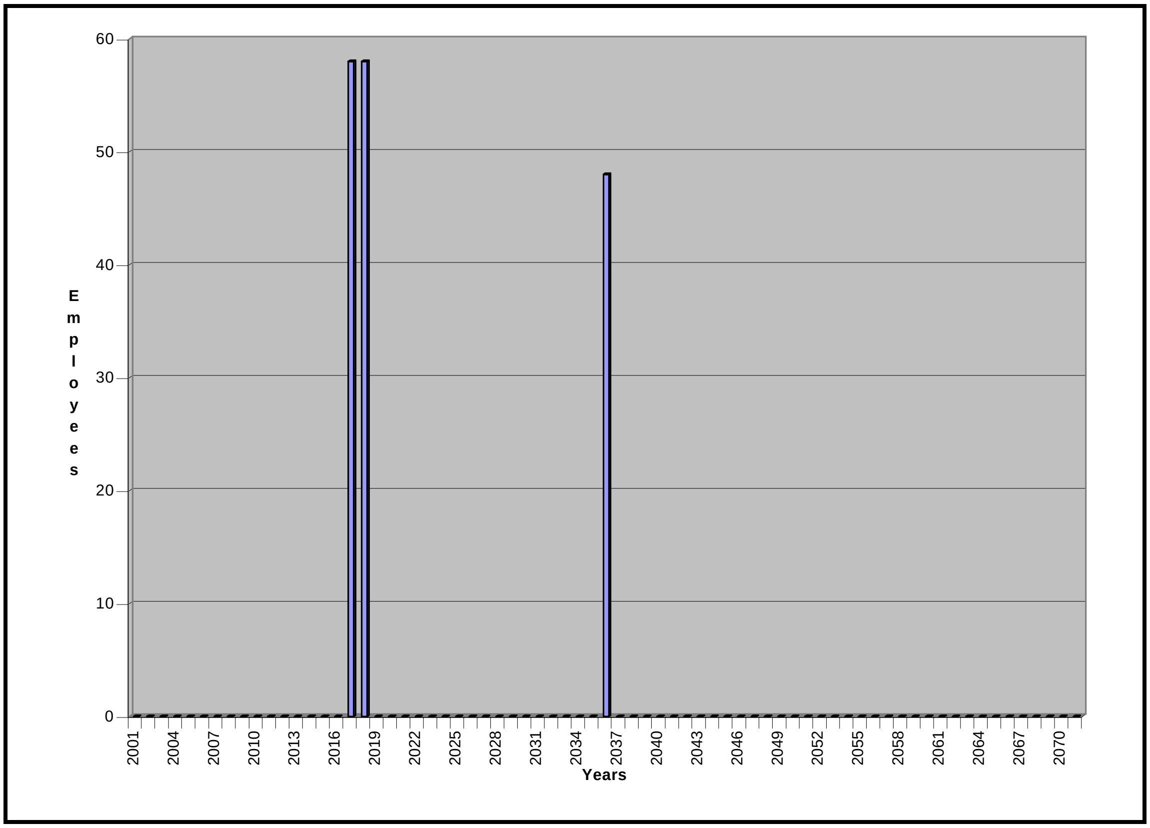

Figure C.1-17. Continued Current Operations Alternative - Facility Disposition Employment.

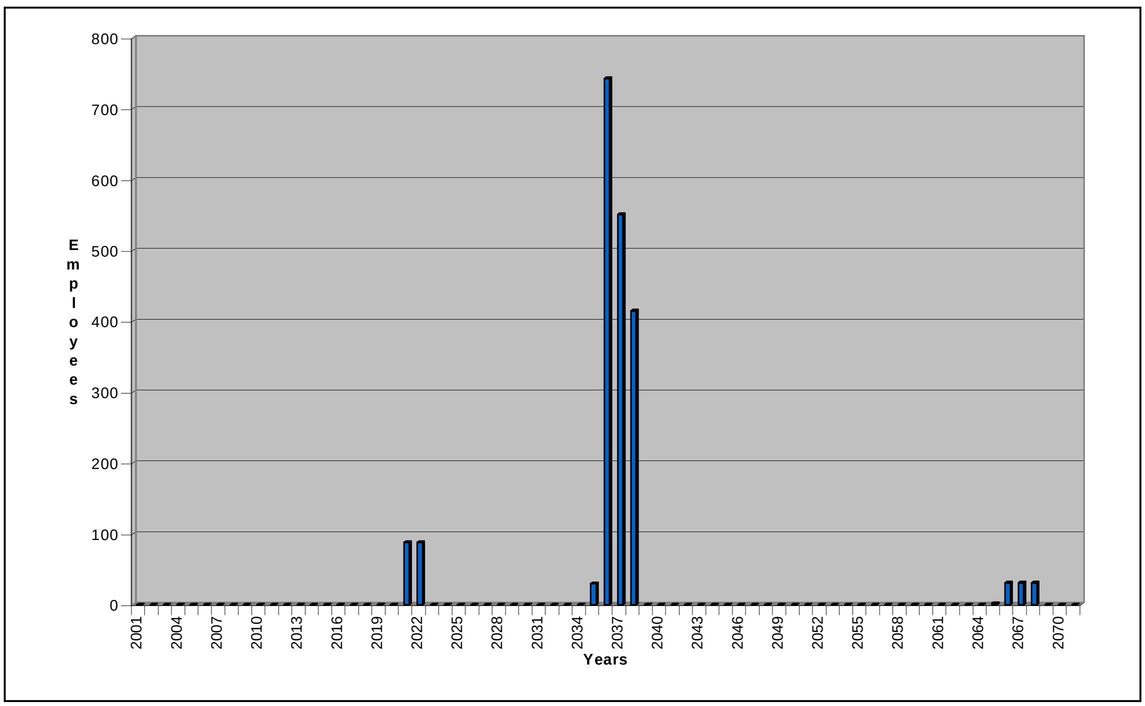

Figure C.1-18. Separations Alternative – Full Separations Option - Facility Disposition Employment.

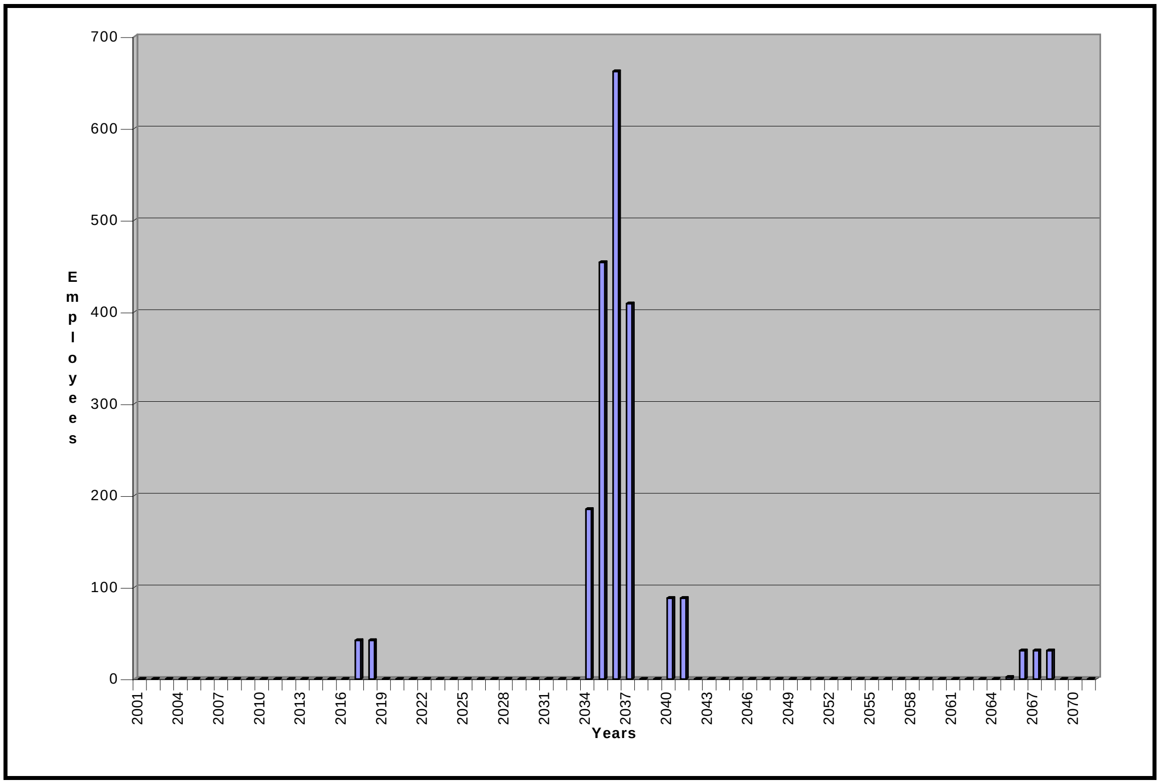

Figure C.1-19. Separations Alternative – Planning Basis Option - Facility Disposition Employment.

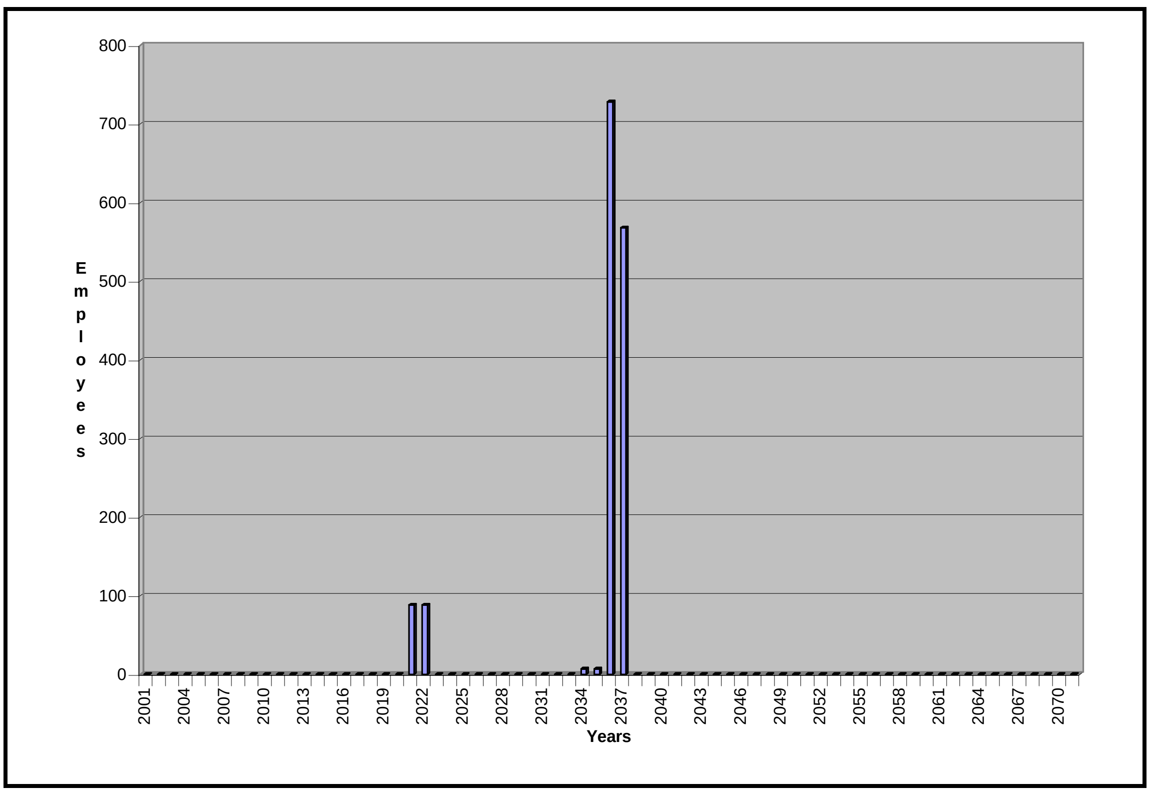

Figure C.1-20. Separations Alternative – Transuranic Separations Option - Facility Disposition Employment.

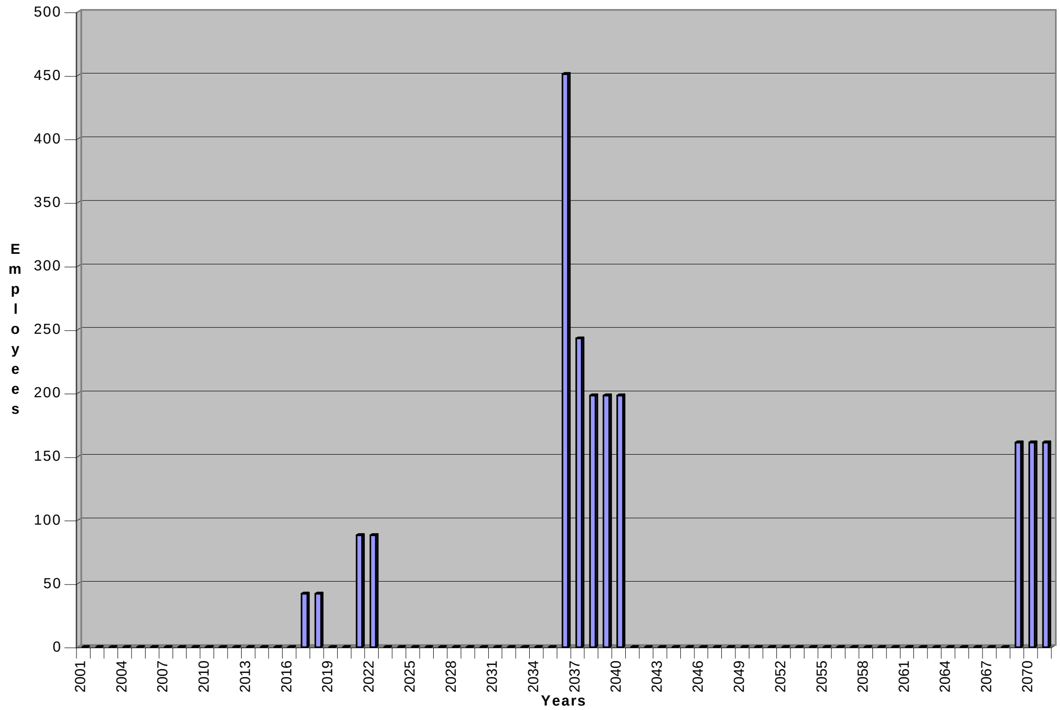

Figure C.1-21. Non-Separations Alternative – Hot Isostatic Pressed Waste Option - Facility Disposition Employment.

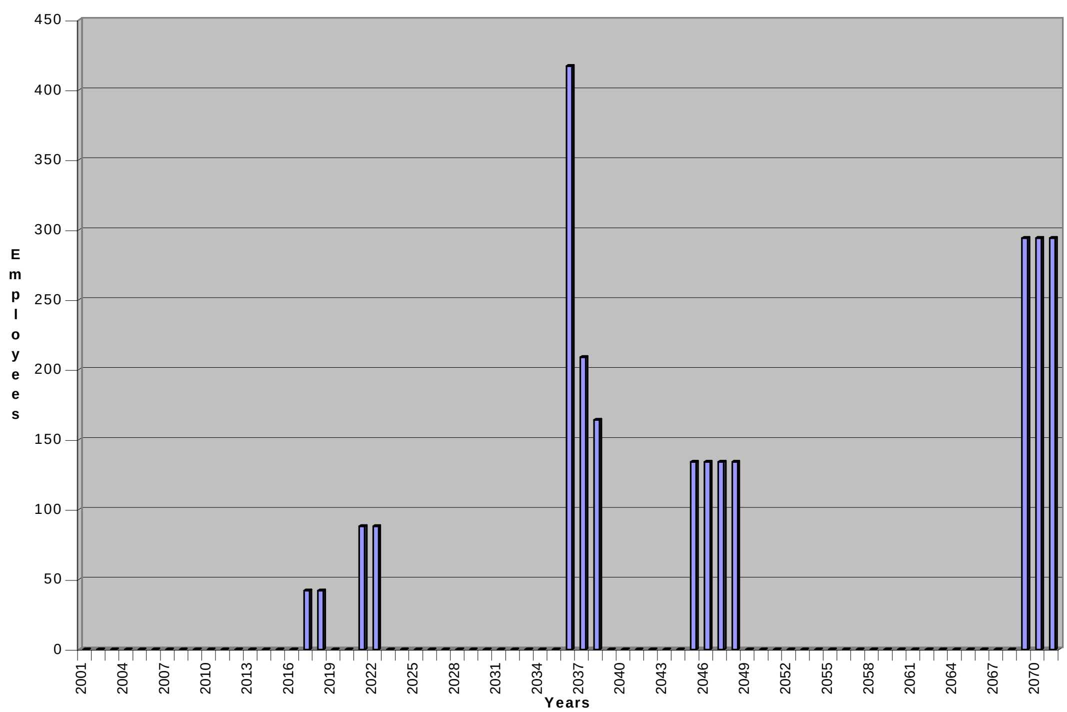

Figure C.1-22. Non-Separations Alternative – Direct Cement Waste Option - Facility Disposition Employment.

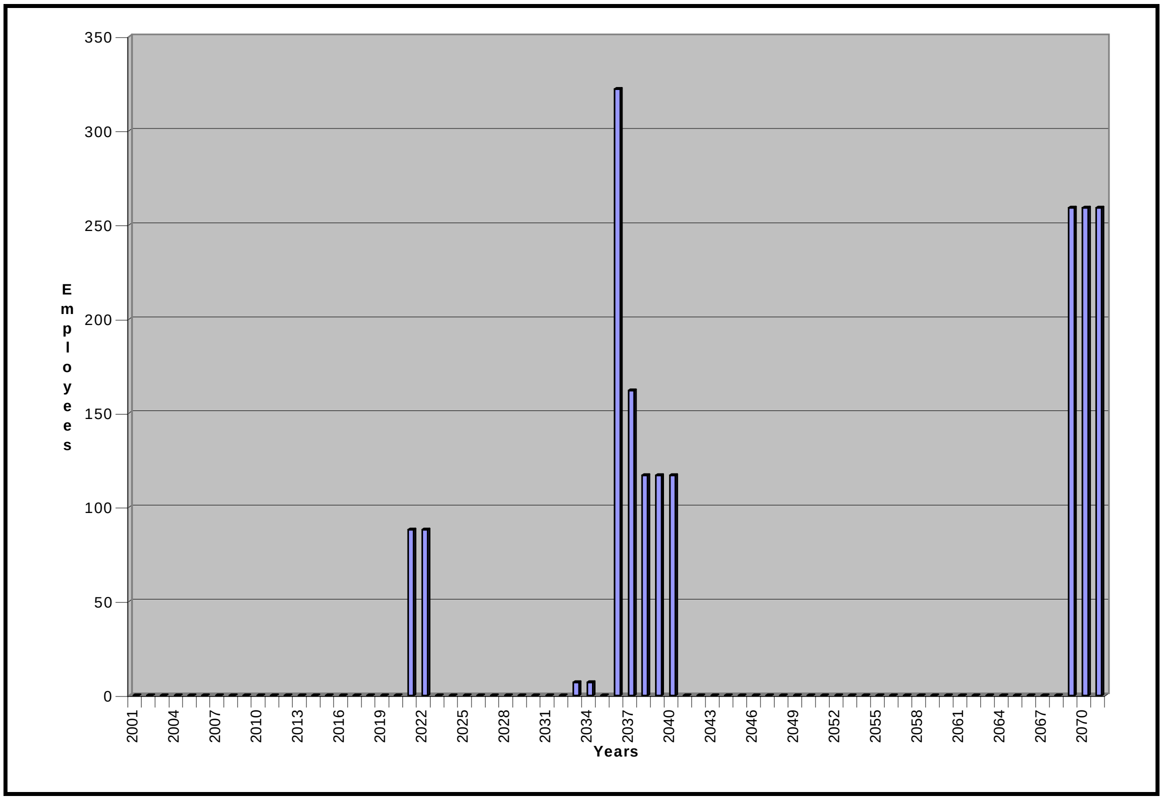

Figure C.1-23. Non-Separations Alternative – Early Vitrification Option - Facility Disposition Employment.

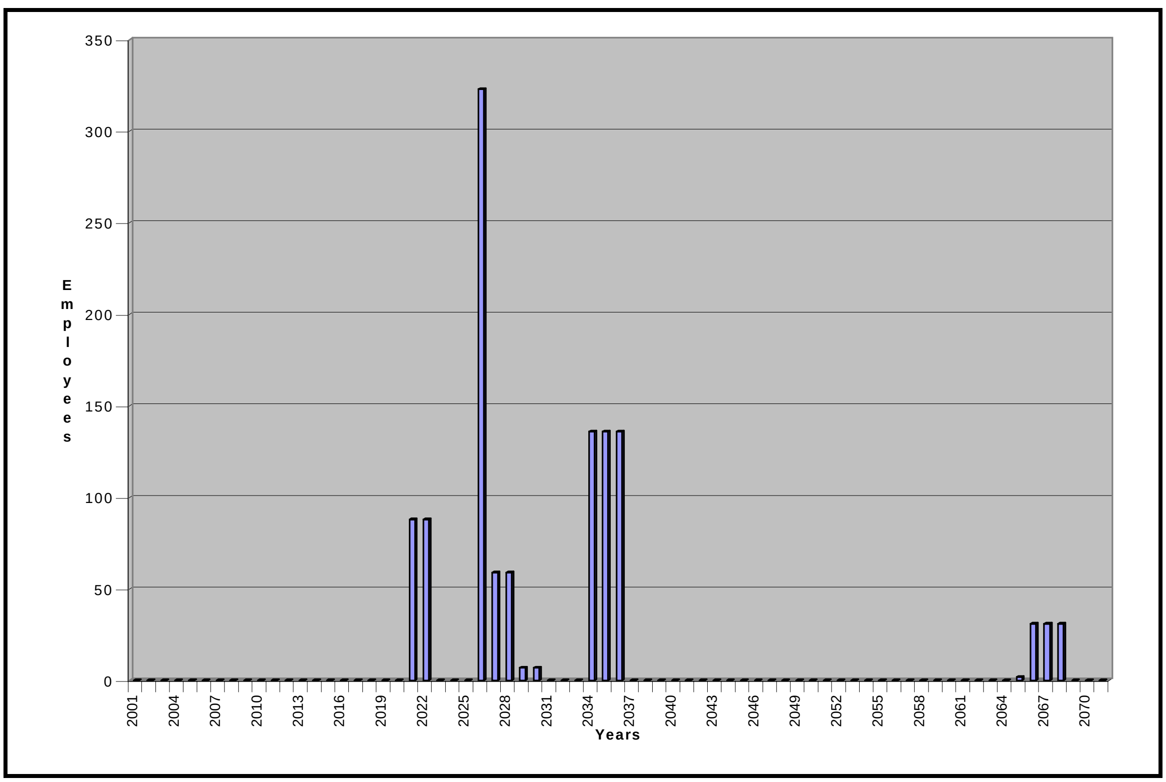

Figure C.1-24. Minimum INEEL Processing Alternative - Facility Disposition Employment.

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APPENDIX C.2

AIR RESOURCES

TABLE OF CONTENTS

Section Page

TABLE OF CONTENTS (Continued)

List of Tables

TABLE OF CONTENTS (Continued)

List of Tables (Continued)

Table Page

C.2 Air Resources

C.2.1 INTRODUCTION

The characterization of air resources and assessment of impacts of waste processing and facility disposition alternatives required an extensive program of emissions estimation, air dispersion modeling, and evaluation of results. The complexity and scope of the required analyses were driven by factors such as the large number of projects encompassed by the waste processing and facility disposition alternatives, the large number of specific air pollutants (including various radionuclides, criteria air pollutants and toxic air pollutants) that are potentially associated with these projects, and the many air-quality related criteria against which impacts should be compared. As a result, the methodology and findings described in the main body of the text are primarily of a summary nature. The purpose of this appendix is to provide supporting information and additional detail to support those findings. In particular, this appendix supports the information presented in the air resources sections pertaining to the affected environment (Section 4.7), and environmental consequences of waste processing alternatives (Section 5.2.6) and facility disposition alternatives (Section 5.3.4).

The air resource assessments performed in support of this EIS relied heavily on information contained in numerous technical reports, project-specific data summaries, and other related documents. The following are among the more important of these information sources:

- The SNF & INEL EIS (DOE 1995) was used as a source of information on existing air resource conditions and projected increases in pollutant emissions as a result of future operations not associated with waste processing. In some cases (e.g., emission rates and offsite radiation dose from existing facilities), DOE supplemented this information with more recent data. In other cases, the data or assessment results were modified to reflect current conditions. These changes are described in the sections in which they are reported.

- INEEL radiological National Emission Standards for Hazardous Air Pollutants reports for the calendar years 1995 and 1996 (DOE 1996a, 1997a) were used to establish the existing radiological conditions in terms of airborne radionuclide emissions and highest dose to an offsite receptor.

- INEEL air emissions inventory for the years 1996 and 1997 (DOE 1997b, 1998) were used to update the criteria pollutant emission rates from existing INEEL facilities. These were compared with the emission rates which were used in the SNF & INEL EIS to ensure that the current rates are within the bounds of those used in the SNF & INEL EIS as a basis for characterizing existing conditions through atmospheric dispersion modeling.

- Project data summaries (Appendix C.6) and supporting engineering design files were used as sources of information for emissions-related parameters that pertain to the construction, startup and testing, operation, and decontamination and decommissioning of the proposed projects. These documents, which were prepared specifically for this EIS, provide information such as projected operating schedules, fossil fuel usage, fugitive dust generation, and radiological and non-radiological emission rates.

This appendix attempts to integrate the descriptions of methods, assumptions, results, and other key information from the technical evaluations and summaries cited above into a single source. The remainder of this section is organized as follows:

- Section C.2.2 contains a description of air quality standards and regulations and a discussion of how they apply to sources at INEEL.

- Section C.2.3 provides supporting information on the methods and assumptions used to estimate emissions and assess baseline conditions and impacts of proposed facilities.

- Section C.2.4 provides supplemental detail on radionuclide emission rates from waste processing alternatives, as well as the potential radiation dose consequences of these emissions.

- Section C.2.5 provides supplemental detail on nonradiological pollutant emission rates from waste processing alternatives, as well as the potential environmental consequences of these emissions.

- Section C.2.6 describes radiological emissions and potential dose consequences of facility disposition alternatives.

- Section C.2.7 describes nonradiological emissions from facility disposition alternatives and potential environmental consequences of these emissions.

C.2.2 AIR QUALITY STANDARDS AND REGULATIONS

Air quality regulations have been established by Federal and State agencies to protect the public from potential harmful effects of air pollution. The Federal Clean Air Act establishes the framework to protect the nation's air resources and public health and welfare. The EPA and the State of Idaho are jointly responsible for establishing and implementing programs that meet the requirements of the Act. 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 and welfare
- 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.

Facilities planned or currently operating at INEEL are subject to air quality regulations and standards established under the Clean Air Act and by the State Department of Health and Welfare, Division of Environmental Quality, and to internal policies and requirements developed by DOE for the protection of the environment and health. At INEEL, 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 emissions 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. Air quality standards and programs applicable to INEEL operations are summarized in Table C.2-1 and are described in further detail below. This section also provides information on project design features to mitigate air quality impacts and operate within the bounds of regulatory requirements.

C.2.2.1 Ambient Air Quality Standards

The Federal Clean Air Act establishes National Ambient Air Quality Standards to protect public health and welfare. Primary standards define the ambient concentration of an air pollutant below which no adverse impact to human health is expected. A second category of standards (called secondary standards) has been established to prevent adverse impacts to public welfare, including aesthetics, property, and vegetation. Certain standards apply to long-term (annual average) conditions; others are short-term, applying to conditions that persist for periods ranging from one hour to three months, depending on the toxic properties of the 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, the State of Idaho has also established an

Table C.2-1. Overview of Federal, state, and DOE programs for air quality management.

Clean Air Act		
Federal Program	State of Idaho Administration Program	DOE Compliance Program
National Ambient Air Quality Standards • 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** • Limits deterioration of air quality and visibility in areas that are better than the National Ambient Air Quality Standards. • Requires 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** • Control airborne emissions of specific substances harmful to human health. • Specific provisions regulate hazardous air pollutants and limit radionuclide dose to a member of the public to 10 millirem per year. • Control emission of hazardous air pollutants from combustion of hazardous waste. **Clean Air Act Amendments of 1990** • Sweeping changes to the Clean Air Act, primarily to address acid rain, nonattainment of National Ambient Air Quality Standards, 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).	**Rules for the Control of Air Pollution in Idaho** Current Regulations of the State of Idaho Department of Health and Welfare (IDHW 1997) include: • **Idaho Ambient Air Quality Standards** - Similar to National Ambient Air Quality Standards but also include standards for total fluorides. • **New Source Program** - Permit to Construct is required for essentially any construction or modification of a facility that emits an air pollutant; major facilities require Prevention of Significant Deterioration analysis and Permit to Construct. • **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. **Rules and Standards for Hazardous Waste** • Includes standards for hazardous waste treatment facilities, including limits on emissions. • Consistent with Federal standards.	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 INEEL. 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 Program for DOE operations (implemented via DOE-ID Supplemental Directive 5480.1). • DOE Order 5480.4 prescribes the application of mandatory Environment, Safety, and Health 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).

additional State ambient air quality standard for fluorides in vegetation. This standard, however, is less restrictive than more recently promulgated increments for toxic air pollutants. In this EIS, “criteria air pollutant” standards are used in the regulatory compliance evaluations of projected emissions from HLW processing alternatives.

The EPA and State of Idaho have monitored ambient air quality in an attempt to define areas as either attainment (that is, the standards are not exceeded) or nonattainment of the ambient air quality standards, 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 encompasses the environs of INEEL has been classified as attainment or unclassified for all National Ambient Air Quality Standards, meaning that air pollution levels are considered healthful. The nearest nonattainment area lies some 50 miles south of the INEEL in Power and Bannock Counties, which has been designated as nonattainment for the standards related to respirable particulate matter.

C.2.2.2 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 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 INEEL are presented in Section 4.7 (see Tables 4-12 and 4-13).

The State of Idaho Department of Health and Welfare, Division of Environmental Quality administers the Prevention of Significant Deterioration Program. Proposed new sources of emissions at INEEL and modifications are evaluated to determine the expected level of emissions of all pollutants. The INEEL 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. Significance levels specified by the State of Idaho for nonradiological pollutants are presented in Table C.2-2. 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.

Table C.2-2. Significance levels specified by the State of Idaho for nonradiological pollutants.[a]

Pollutant	Significance level (tons per year)	Pollutant	Significance level (tons per year)
Carbon monoxide	100	Beryllium	4.0×10^{-4}
Nitrogen oxides	40	Mercury	0.1
Sulfur dioxide	40	Vinyl chloride	1
Particulate matter		Fluorides	3
Total particulate matter	25	Sulfuric acid mist	7
Respirable particulates[b]	15	Hydrogen sulfide (H_2S)	10
Volatile organic compounds[c]	40	Total reduced sulfur (including H_2S)	10
Lead	0.6	Reduced sulfur compounds (including H_2S)	10
Asbestos	7.0×10^{-3}		

a. From IDAPA 16.01.01.006 (IDHW 1997).
b. Airborne particulate matter with a particle diameter of 10 micrometers or less.
c. Used as a surrogate for ozone.

If an INEEL 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 reduce 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 cause exceedance of Class II increments at locations of ambient air
- Will not adversely affect visibility

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 INEEL has been granted more than 20 Prevention of Significant Deterioration permits by the Division of Environmental Quality.

C.2.2.3 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. 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 INEEL operations is contained in Title 40 of the Code of Federal Regulations 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 INEEL. 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 INEEL 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 EPA. Proposed new sources of emissions at INEEL 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 EPA. New sources are also evaluated to determine emissions monitoring requirements. The INEEL currently holds more than 25 National Emission Standards for Hazardous Air Pollutants permits granted by the EPA.

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 INEEL complies with the requirements for evaluation, control, and permitting of nonradiological hazardous air pollutants through programs that are also administered by EPA. In accordance with Title III of the 1990 Amendments to the Clean Air Act, maximum achievable control technology will be specified by the EPA for various source categories. Maximum achievable control technology will require a level of control at least as stringent as the best performing (i.e., best controlled) sources within each source category. Sources will be required to implement programs or controls to comply with the maximum achievable control technology by the scheduled implementation date. Several maximum achievable control technology standards have been promulgated or proposed. Proposed maximum achievable control technology emission standards and work practice requirements associated with combustion of hazardous waste were issued May 2, 1997 (62 FR 24212). These will apply to certain waste processing facilities, including the New Waste Calcining Facility and other facilities that include thermal treatment processes. Emissions from waste processing facilities covered by the maximum achievable control technology regulation were assumed to meet the May 1997 proposed emissions standards, which are presented in Table C.2-3. EPA recently finalized the maximum achievable control technology rule for hazardous waste combustion facilities (64 FR 52827; September 30, 1999). The final emissions standards for several hazardous air pollutants were modified from the levels EPA proposed in May 1997.

Table C.2-3. Proposed maximum achievable control technology standards for combustion of hazardous waste.

Hazardous air pollutant or surrogate	Proposed standard[a]
Dioxins and furans (nanograms per dry standard cubic meter, as 2,3,7,8-TCDD equivalent)	0.20
Mercury (micrograms per dry standard cubic meter)	40
Particulate matter[b] (milligrams per dry standard cubic meter)	34
Hydrogen chloride and chlorine (parts per million by volume as hydrogen chloride equivalents)	75
Semi-volatile metals (total lead and cadmium; micrograms per dry standard cubic meter)	100
Low-volatile metals (total antimony, arsenic, beryllium, and chromium; micrograms per dry standard cubic meter)	55
Carbon monoxide[c] (parts per million by volume)	100
Hydrocarbons[c] (parts per million by volume, as propane)	10

TCDD = Tetrachlorodibenzo-P-Dioxin.

a. All maximum achievable control technology concentrations are based on dry, standard conditions corrected to 7 percent oxygen.
b. Particulate matter is specified as a surrogate for control of non-mercury metals.
c. Pollutants are specified as surrogate indicators of good combustion control.

It is also expected that additional INEEL air emissions sources will be assigned maximum achievable control technology requirements as standards are promulgated for additional source categories, including (but not limited to) waste treatment, storage, and disposal facilities; research and development activities; industrial boiler; process heater; stationary internal combustion engine; and site remediation activities.

C.2.2.4 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, Permits to Construct and Operate must be obtained before a source can be constructed or operated. The permits specify requirements, such as monitoring, reporting and recordkeeping, or limitations on operating conditions, such as emission limits. The list of equipment or operations which are exempt from permit requirements is very specific and limited; most new INEEL sources and modifications to existing sources are subject to permit requirements.

In addition to individual source permits, the INEEL is also required to obtain a sitewide Title V operating permit, as stipulated under the 1990 Clean Air Act Amendments, which must be renewed periodically. The INEEL submitted an application for a Title V Operating Permit in July 1995. 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. The maximum achievable control technology program (Title III of the 1990 Clean Air Act Amendments which is discussed above) will be administered under the Title V program and also allow for public review and comment.

C.2.2.5 State of Idaho Rules for Toxic Air Pollutants

The Idaho Division of Environmental Quality has 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. The method used to assess cancer health risk associated with air emissions from current INEEL facilities and proposed Advanced Mixed Waste Treatment Project alternatives is summarized in Appendix E-4, Health and Safety. These rules are contained in Title 1, Chapter 1, Sections 585 and 586 of the Rules for the Control of Air Pollution in Idaho (IDHW 1997) and are implemented through the air quality permit program described above. Threshold emission levels have been established for about 700 toxic air pollutants, based on the known or suspected toxicity of these substances. Expected (uncontrolled) emissions above these screening thresholds must be evaluated using standard air dispersion modeling techniques 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 1997). 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. 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. 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. The acceptable ambient concentration for a carcinogen differs for each carcinogenic substance due to its carcinogenic potency, as defined by the EPA. 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 technology (which is similar to best available control technology) is employed to limit emissions of carcinogenic substances.

Many air contaminants do not cause cancer 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. Acceptable ambient concentrations are assigned for each of the listed non-carcinogenic toxic air pollutants 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 concentrations. However, if the acceptable ambient concentrations are 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.

C.2.2.6 Standards for Hazardous Waste and Toxic Substance Control

In addition to regulations designed specifically for air resource protection, projects which include handling or treatment of hazardous substances are required to comply with various Federal and State environmental regulatory programs, which incorporate certain requirements on releases to air. Among the most important of these requirements for hazardous waste incineration are the standards for the destruction of organic hazardous constituents in solid wastes prescribed by EPA and IDAPA 16.01.05.008 (40 CFR 264 Subpart O) (IDHW 1997). Polychlorinated biphenyl incineration must achieve the minimum 99.9999 percent destruction and removal efficiency of the Toxic Substances Control Act, while incineration of other difficult-to-destroy compounds, such as chlorobenzene and carbon tetrachloride, must achieve a minimum 99.99 percent destruction and removal efficiency. RCRA performance standards for hydrogen chloride emissions in IDAPA 16.01.05.008 require either 99 percent hydrogen chloride removal or less than 4 pounds per hour hydrogen chloride emission rate during the incineration of chlorinated wastes.

C.2.2.7 U.S. 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. 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, toxic and criteria air pollutants).

C.2.3 AIR QUALITY IMPACT ASSESSMENT METHODOLOGY

Several distinct types of evaluations 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

- Degradation of visibility assessments, which are performed for certain criteria emissions from stationary sources
- Fugitive dust and combustion product emissions associated with construction equipment and some operational 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, and specific information on related assumptions, methods, and data used in the analyses.

C.2.3.1 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. The baseline source term was compiled from INEEL emissions inventory reports (DOE 1996b, 1997b) and National Emission Standards for Hazardous Air Pollutants reports (DOE 1996a, 1997a), with projected increases as described in the SNF & INEL EIS (Section 5-7, and Appendix F-3). The source term for each of the proposed waste processing alternatives was developed using information contained in the project data summaries and supporting documentation. Emission rates were calculated for each project, and these were compiled, evaluated, and processed for use in dispersion modeling. The assumptions and methods used for specific project emission rate calculations are documented in the engineering data files which have been prepared to support each individual project. Emission rates for each alternative were determined by summing the emission rates for each project associated with that alternative. In the case of the waste processing alternatives, all facilities were assumed to operate concurrently. For some decommissioning activities, however, some corrections were applied to account for the fact that closure activities were sequential.

Process Emissions

The project data sheets and supporting documentation contain estimates of radionuclide and nonradiological pollutant emission rates for those projects that include waste handling or processing. DOE estimated these emissions for each project based on the nature of the process and the composition of process materials. The estimation method includes assumptions regarding the amount of material that could enter the process exhaust and the amount that would pass through air pollution control systems and be released to the atmosphere. Where applicable, release estimates relied on experience with facilities or processes similar to the one being evaluated.

The primary data source for radionuclide emissions from principal waste processing facilities is a report by McDonald (1999). For radionuclides other than tritium, release estimates are based on actual emissions released from existing waste processing facilities at INTEC. Emissions released during 1996 (a year in which no calcining was performed) from the waste evaporator and fractionator were used as a basis for estimating emissions from the following projects associated with proposed waste processing alternatives:

- Newly Generated Liquid Waste and Tank Farm Heel Waste Management
- Process Equipment Waste Evaporator and Liquid Effluent Treatment and Disposal Facility
- No Action Alternative.

For proposed alternatives which involve calcination, emissions are patterned after releases from the INTEC main stack during 1997 (a year in which calcining was performed). The specific projects covered by this estimation method are:

- Calcining SBW including New Waste Calcining Facility Upgrades
- Vitrification of Separated High-Activity Waste
- Denitration and Grouting of Low-Activity, Class A Waste
- Denitration and Grouting of Low-Activity, Class C Waste
- Vitrification of Calcine and SBW.

For these projects, DOE calculated emissions by multiplying the concentration of radionuclides in the 1997 offgas by the annual volume of gas that each of the proposed projects would discharge.

DOE estimated tritium emissions by dividing the current inventory of tritium in SBW (the only waste stream with a significant quantity of tritium) by the number of years that a thermal waste process would be applied to that waste.

For projects other than those listed above, DOE estimated building emissions using a general method based on the assumption that the primary radionuclides in building exhaust are present in the same proportion as in calcine or tank waste (whichever is more appropriate). The total activity is assumed for dose assessment purposes to be divided among strontium-90, cesium-137, and plutonium-239 according to the following:

	Fraction of total activity	
Radionuclide	Calcine	Tank waste
Strontium-90	0.90	0.49
Cesium-137	0.10	0.51
Plutonium-239	2.6×10^{-5}	3.3×10^{-3}

It was further assumed that for general building ventilation, these radionuclides are present at a concentration of 1 percent of the derived air concentration, which is a limit for radionuclide concentration specified in 10 CFR 835. This general method was used for estimating emissions in general building ventilation during facility operation and dispositioning, as well as for processes associated with projects other than those specified above. This latter category includes projects such as Calcine Retrieval and Transport, Mixing and Hot Isostatic Pressing, and the Direct Cement Process.

Estimates of nonradiological air pollutant releases from thermal waste treatment processes have been performed by Kimmitt (1998) using release data previously developed by Abbott et al. (1999). These estimates are consistent with EPA guidance (EPA 1994) and are based on the following factors:

- Contaminant concentrations in the waste
- Formation of products of incomplete combustion (such as dioxins and furans)
- Material flow rates
- Air pollution control system performance.

Since little data are available on contaminant levels in the waste to be treated (for example, organic content of calcine), DOE assumed that up to 5 percent of the organic contaminants in the original liquid HLW are retained in the calcine. The performance of air pollution control systems is based on vendor data and technical literature sources.

Fossil Fuel Combustion By-products

DOE estimated criteria and toxic air pollutant emissions associated with fossil fuel combustion for each project. These emission rates are based on the amount of fossil fuel that would be burned to produce an amount of steam required by the project for process use and building heating and air conditioning. A similar method was used to estimate emission from diesel fuel-burning equipment (cranes, loaders, haulers, etc.) that would be required to support project construction, operation, and decontamination and decommissioning at the end of its useful life. These calculations are documented in the Project Data Sheets for each project. In addition to the criteria pollutant emissions documented in the Project Data Sheets, the air resource assessment estimated toxic air pollutant emission rates associated with assumed fuel oil combustion rates. These estimates are based on the EPA-recommended emission factors [specified in EPA (1998)] for residual oil-fired boilers. Table C.2-4 presents the emission factors used for nonradiological pollutant releases from fuel oil combustion.

Radionuclide and Toxic Emission Screening

Numerous radionuclides or nonradiological toxic air pollutants could be present in airborne effluents from facilities associated with the waste processing alternatives. Typically, however, relatively few substances contribute significantly to the risk. DOE performed screening evaluations to identify the most significant substances, based on substance toxicity and emission rates, in an attempt to reduce the number of individual pollutants to be quantitatively assessed for impacts. The radionuclide screening was based on a screening factor (SF_{eff}) which is the product of the estimated radionuclide emission rate ($Q_,$ in curies per year) and an effective dose factor (DF_{eff}). The dose factors consider all important exposure pathways (inhalation, ingestion and external exposure) and were obtained from National Council on Radiation Protection Report No. 123 II, “Screening Models for Releases of Radionuclides to Atmosphere, Surface Water, and Ground – Work Sheets” (NCRP 1996). Thus, for each radionuclide i:

$$SF_{eff,i} = Q_i \text{ x } DF_{eff,i}$$

The radionuclides which collectively accounted for a nominal 99 percent of the effective dose were retained for release modeling and dose assessment.

The inclusion of specific toxic air pollutants in emissions estimates is based on the guidance provided in EPA (1994). The process for selection and characterization of toxics is documented in Abbott et al. (1999).

Fugitive Dust Generation

DOE estimated the amount of fugitive dust generated from construction of facilities based on the area of land that would be disturbed. The total amount of fugitive dust is estimated using the EPA-recommended factor of 1.2 tons per acre disturbed for each month of construction (EPA 1998). This same factor was

used to estimate dust generation from dispositioning facilities. In most cases, it was conservatively assumed that construction and dispositioning would persist for 12 months per year; however, some activities related to Tank Farm and bin set dispositioning assume that dust-generating activities would occur for only 6 months per year.

C.2.3.2 Radiological Assessment Methodology

This section summarizes information on the data and methods used to assess radiological conditions and dose to individuals at onsite and offsite locations due to routine emissions of radionuclides from existing and proposed INEEL facilities.

Model Selection and Application

The computer program GENII, Version 1.485 3-Dec-90 (Napier et al. 1988), was used to calculate doses from all pathways and modes of exposure likely to contribute significantly to the 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 algorithms, data, and methods for calculating doses to various tissues and organs and for determination of effective dose equivalent, based on the recommendations of the International Commission on Radiological Protection, as contained in Publications 26 and 30 (ICRP 1977, 1979). It should be noted that newer weighting factors for determination of effective dose are available in International Commission on Radiation Protection Publication 60 (ICRP 1991); however, International Commission on Radiation Protection 26/30 weighting factors are used here since these still form the basis for Federal regulations and DOE Orders (e.g., 10 CFR 20, 10 CFR 834, etc.). The newer weighting factors of International Commission on Radiation Protection 60 have not yet been adopted for use in the U.S., since their use would require a number of adjustments to existing regulations. Also, as pointed out in the Preface to Federal Guidance Report 12 (EPA 1993), for most radionuclides these dose coefficients are not very sensitive to the choice of weighting factors.

The GENII 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 Quality Assurance Program Requirements for Nuclear Facilities [ASME (1989), 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.

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 guidance issued by the EPA (EPA 1995a). This guidance is used by the INEEL in the dose assessments performed annually to assess compliance with the National Emission Standards for Hazardous Air Pollutants dose limit. In general, 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 influence the release, effectively lowering the release height to ground level. In some cases, stacks at existing facilities were modeled as individual release points; in other cases, sources were grouped together and treated as a single release point. For example, in the baseline modeling, 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 stack design for many of the proposed waste processing facilities are preliminary; however, it can be assumed that these stacks would conform to “good engineering practice” and would be tall enough to provide good dispersion. The stack parameters used for waste processing facility modeling are presented in Table C.2-5.

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 INEEL. In particular, the data files prepared for these assessments were derived from observations at INEEL weather stations over the period 1987 through 1991. Radionuclide emissions from those current or proposed facilities at INTEC having tall stacks were modeled using meteorological data from the 200-foot (61-meter) level of the Grid III monitoring station, which is located about 1.5 kilometers north of INTEC. These data are presented in a format specifically prepared for the radiological impact assessment modeling as a joint

frequency distribution of wind speed, direction, and atmospheric stability class in Table C.2-6. The data set shows the percent of time that the wind is blowing toward specific compass directions (S, SSW, SW, etc.), grouped first by atmospheric stability category and then by wind speed group. Meteorological data sets used in the baseline dose assessments for existing facilities are documented in DOE (1996a, 1997a). Meteorological data sets used in the dose assessments for future facilities not associated with waste processing alternatives are documented in Leonard (1992).

Receptor Locations

Doses were assessed for individuals located at the onsite and offsite locations of highest predicted dose and for the surrounding population, as described below.

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. 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. In the SNF & INEL EIS, radiation dose was calculated for the minimum distance from each of the major INEEL source areas to the site boundary for each of the 16 compass directions. Since this location was assessed separately for emissions from each of the major INEEL facility areas, the maximally-exposed individual receptor locations are merely points on the INEEL boundary and do not correspond to any actual residences or quarters. The maximum impacts at these points were conservatively summed to derive cumulative impacts, without consideration of the fact that the maximum impact points may be spatially separated. The actual maximally-exposed individual locations for five of the eight major INEEL facility areas (INTEC, Central Facilities Area, Radioactive Waste Management Complex, Power Burst Facility/Waste Experimental Reduction Facility, and Test Reactor Area) are all located along a segment of the southern boundary; the maximally-exposed individual locations for Naval Reactors Facility, Argonne National Laboratory-West, and Test Area North are all distantly located. Although unrealistic, this summation process served to establish the upper-bounding dose. Despite the inherent conservatism, the results obtained were low; further resolution of the actual maximally-exposed individual location and dose was not necessary.

In this EIS, the dose to the maximally-exposed individual from existing facilities (i.e., the baseline case) is taken from the annual National Emission Standards for Hazardous Air Pollutants compliance evaluations (DOE 1996a, 1997a). The highest values of the most recent two years during which no

Table C.2-6. Joint frequency distribution data set from the 61-meter level of the INEEL Grid III monitoring station for use in radiological impact assessment modeling.

INEL Grid III 61 M Level - 1987-1991

7 6 1 1 61.0[a]
1.04 2.46 4.47 6.93 9.61 13.19 19.00[b]

0.21	0.34	0.31	0.23	0.22	0.20	0.26	0.23	0.19	0.17	0.12	0.12	0.10	0.12	0.09	0.17
0.04	0.06	0.03	0.01	0.01	0.01	0.01	0.02	0.03	0.02	0.01	0.01	0.01	0.00	0.00	0.01
0.04	0.07	0.07	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.01	0.01	0.01	0.01	0.01
0.17	0.29	0.17	0.09	0.03	0.06	0.05	0.08	0.08	0.08	0.05	0.05	0.06	0.06	0.05	0.10
0.16	0.19	0.17	0.09	0.07	0.08	0.04	0.06	0.06	0.07	0.07	0.05	0.05	0.05	0.07	0.07
0.44	0.51	0.49	0.33	0.25	0.22	0.18	0.20	0.15	0.17	0.17	0.17	0.18	0.17	0.20	0.30
0.25	0.45	0.58	0.49	0.40	0.34	0.31	0.49	0.63	0.66	0.57	0.32	0.24	0.14	0.18	0.18
0.06	0.18	0.21	0.11	0.03	0.02	0.02	0.05	0.08	0.12	0.08	0.05	0.03	0.01	0.01	0.02
0.15	0.35	0.40	0.09	0.02	0.01	0.02	0.05	0.11	0.10	0.12	0.03	0.04	0.02	0.01	0.03
0.55	1.78	1.05	0.20	0.07	0.04	0.08	0.10	0.17	0.30	0.32	0.20	0.10	0.07	0.08	0.12
0.32	0.75	0.52	0.15	0.07	0.04	0.06	0.09	0.09	0.17	0.15	0.18	0.07	0.06	0.07	0.09
0.77	1.65	1.38	0.67	0.34	0.24	0.21	0.27	0.31	0.51	0.47	0.48	0.35	0.32	0.34	0.38
0.02	0.05	0.05	0.03	0.02	0.01	0.02	0.04	0.08	0.10	0.09	0.08	0.02	0.02	0.02	0.01
0.07	0.12	0.16	0.09	0.04	0.03	0.04	0.12	0.20	0.39	0.40	0.20	0.10	0.05	0.08	0.06
0.07	0.19	0.33	0.13	0.02	0.02	0.02	0.08	0.14	0.33	0.58	0.21	0.07	0.05	0.03	0.06
0.45	2.59	2.36	0.33	0.07	0.05	0.08	0.22	0.36	0.91	1.18	0.70	0.22	0.12	0.12	0.21
0.34	1.26	0.93	0.17	0.04	0.03	0.06	0.11	0.21	0.34	0.49	0.38	0.15	0.08	0.12	0.17
0.35	1.20	1.25	0.37	0.12	0.06	0.04	0.15	0.17	0.33	0.43	0.34	0.18	0.08	0.12	0.16
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00
0.06	0.07	0.08	0.03	0.02	0.01	0.02	0.07	0.10	0.23	0.46	0.27	0.10	0.04	0.05	0.04
0.67	1.47	1.60	0.35	0.06	0.03	0.08	0.26	0.40	1.28	2.95	1.78	0.44	0.16	0.08	0.40
0.15	0.80	0.80	0.16	0.03	0.01	0.06	0.13	0.13	0.33	0.88	0.69	0.11	0.02	0.01	0.08
0.05	0.20	0.25	0.07	0.01	0.01	0.00	0.02	0.02	0.01	0.10	0.11	0.01	0.01	0.00	0.01
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.00	0.00	0.00
0.64	0.61	0.74	0.16	0.02	0.01	0.04	0.16	0.29	1.10	3.53	1.98	0.38	0.12	0.07	0.26
0.03	0.12	0.17	0.07	0.00	0.00	0.01	0.03	0.03	0.06	0.37	0.28	0.04	0.01	0.00	0.00
0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.25	0.25	0.18	0.05	0.00	0.00	0.02	0.08	0.16	0.55	2.88	2.13	0.18	0.11	0.01	0.05
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.01	0.05	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.04	0.47	0.48	0.01	0.01	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

a. Starting from left, these values indicate the number of wind speed data groups in the file, number of atmospheric stability data groups in file, number of seasonal data groups in file, number of time-of-day data groups in file, and the height (in meters) at which the joint frequency data applies.
b. These values represent the average wind speed for each wind speed group, in meters per second.

calcining was performed is used. The dose from reasonably foreseeable projects is assumed to be represented by the dose calculated for the SNF & INEL Preferred Alternative (modified as described below) and the Advanced Mixed Waste Treatment Project.

The maximally-exposed individual dose from emissions associated with waste processing or facilities disposition alternatives was modeled using GENII, and then added to the baseline dose and projected increases to determine the cumulative offsite maximally-exposed individual dose.

Population Dose. Population dose is not assessed annually as part of the National Emission Standards for Hazardous Air Pollutants assessment, so the baseline dose for this EIS is based on assessments performed for the SNF & INEL EIS. In the SNF & INEL EIS, dose was assessed for the collective population residing in a circular area defined by a radius of 50 miles extending out from each major INEEL facility. Population data used were based on 1990 census data provided by the U.S. Census Bureau. For projects associated with SNF & INEL EIS alternatives and projects expected to become operational before June 1, 1995, growth projections for the counties surrounding INEEL were applied. These growth estimates are approximately 10 percent per decade. The period covered by the SNF & INEL EIS analysis extends to the year 2010, and the population doses reported in Section 5.7, Air Resources, of Volume 2 of that EIS are the highest obtained for any year throughout this period.

For this EIS, the population dose assessment applies only to the population residing within 80 kilometers of the INTEC, where waste processing and facilities disposition alternatives are proposed to be implemented. The distribution of this population by distance and direction from INTEC, based on 1990 census data, is presented in Table C.2-7. A correction factor of 1.7 (equivalent to an annual growth rate of about 1.25 percent) was then applied to this population dose assessment to account for anticipated population growth over the period 1990 to approximately 2030.

Noninvolved INEEL Worker. INEEL workers may be exposed to radiation attributable to INEEL 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 INEEL). Direct job-related occupational exposure is beyond the scope of this section and is discussed in Sections 5.2.10 and 5.38 (Health and Safety) of this EIS. A worker incidentally exposed to onsite concentrations of radionuclides is referred to here as a “noninvolved worker.” Exposures to noninvolved workers were assessed in the SNF & INEL EIS (for existing sources and future projects) and in this EIS (for proposed waste processing and facilities disposition alternatives).

The dose to the maximally-exposed noninvolved worker was assessed using the general methodology described in previous sections. However, worker dose calculations did not include the food ingestion pathway (since workers do not consume food products grown onsite), and exposure times were reduced to reflect the amount of time a worker would spend onsite (assumed to be 2,000 hours per year). As in the case of the offsite maximally-exposed individual, the maximally-exposed worker dose actually applies to a location and not a real individual. It is conservatively assumed that any location within a major INEEL facility area could be occupied by a worker on a full-time basis (i.e., 2000 hours per year). Doses were assessed for locations within INTEC and at other areas likely to receive the highest exposure: namely, Central Facilities Area, Radioactive Waste Management Complex, and Test Reactor Area. In all cases, the highest modeled dose occurred at the Central Facilities Area.

Baseline Dose and Cumulative Dose Determination

DOE assessed cumulative radiological impacts by summing the doses from existing (baseline) sources, foreseeable increases to the baseline, and doses associated with alternatives. The bases used to estimate baseline doses and foreseeable increases are described below and summarized in Table C.2-8.

Maximally-Exposed Individual. The baseline dose is determined from the 1996 National Emission Standards for Hazardous Air Pollutants evaluation as described above. It is assumed that the annual dose calculated for the SNF & INEL EIS Preferred Alternative and the Advanced Mixed Waste Treatment Project represents foreseeable increases to the baseline. However, the SNF & INEL EIS dose was modified to (a) eliminate the dose contributions that are from facilities that are no longer planned, are located at Test Area North, or are assessed under the waste processing impacts, and (b) add the dose contributions from the proposed Advanced Mixed Waste Treatment Project Preferred Alternative (Micoencapsulation Option). This results in a baseline dose of 0.031 millirem per year and a foreseeable increase of 0.13 millirem per year, resulting in a total baseline dose of 0.16 millirem per year.

Population Dose. The SNF & INEL EIS annual dose from existing sources and increases that were foreseeable at the time the analysis was performed was 0.32 person-rem, and the Preferred Alternative dose was 2.6 person-rem per year. The Idaho Waste Processing Facility (a conceptual facility which has since been replaced by the Advanced Mixed Waste Treatment Project) accounted for more than half of this dose. In addition to project-related modifications, the baseline population dose is also multiplied by 1.3 to account for estimated population growth between roughly 2010 and 2030. Upon modification, the maximum annual baseline population dose becomes 0.92 person-rem.

Table C.2-8. Calculation of total baseline dose used in cumulative dose determinations.

Category	Value	Basis
Offsite maximally-exposed individual dose in millirem per year		
Baseline	0.031	1996 National Emission Standards for Hazardous Air Pollutants dose assessment
Increases	0.58	SNF & INEL EIS Preferred Alternative
Modifications	-0.018	Waste Immobilization Facility
	-0.42	Idaho Waste Processing Facility
	-0.029	Waste Experimental Reduction Facility (incineration)
	-0.004	Facilities at Test Area North
	0.022	AMWTP Proposed Action (Microencapsulation Option)
Total baseline plus increases	0.16	
Noninvolved worker dose in millirem per year		
Baseline	0.32	SNF & INEL EIS Table 5.7-4
Increases	0.140	SNF & INEL EIS Preferred Alternative
Modifications	0.058	AMWTP Proposed Action (Microencapsulation Option)
	-0.0001	Waste Immobilization Facility
	-0.11	Idaho Waste Processing Facility
	-0.11	Waste Experimental Reduction Facility (compacting and sizing)
	-0.007	Waste Experimental Reduction Facility (incineration)
Total baseline plus increases	0.29	
Population dose in person-rem per year		
Baseline	0.32	SNF & INEL EIS Table 5.7-4
Increases	2.6	SNF & INEL EIS Preferred Alternative
Modifications	-0.097	Waste Immobilization Facility
	-1.6	Idaho Waste Processing Facility
	-0.2	Waste Experimental Reduction Facility (compacting and sizing)
	-0.230	Waste Experimental Reduction Facility (incineration)
	-0.097	Waste Immobilization Facility
	0.009	AMWTP Proposed Action (Microencapsulation Option)
Total baseline plus increases	0.705	
	1.3	Factor for population growth between 2010 and 2030
Modified baseline dose	0.92	

AMWTP = Advanced Mixed Waste Treatment Project.

Noninvolved INEEL Worker. The SNF & INEL EIS annual baseline dose for the maximally-exposed non-involved worker was 0.32 millirem and occurred at the Test Reactor Area. The maximum annual dose from the SNF & INEL EIS Preferred Alternative was 0.14 millirem and occurred at Central Facilities Area. Since DOE has determined that the maximum onsite dose from INTEC emission sources occurs at the Central Facilities Area, this EIS conservatively assumes that the baseline and Preferred Alternative dose cited above both occur in that area. Upon modification, the baseline noninvolved worker dose is 0.29 millirem per year.

C.2.3.3 Nonradiological Assessment Methodology

Air pollutant levels have been estimated by 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 EPA (EPA 1995a) and the State of Idaho (IDHW 1997) 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) are noted where applicable. The primary objective of the assessments is to estimate nonradiological pollutant concentrations and other impacts in a manner that facilitates comparison between alternative courses of action, while also providing a measure of maximum potential impact and an indication of compliance with applicable standards or guidelines. The types of pollutants assessed include the criteria pollutants and 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 INEEL. DOE did not quantitatively assess impacts related to ozone formation, although emissions of volatile organic compounds (which are precursors to ozone formation) were evaluated. EPA and Idaho Department of Health and Welfare are not aware of any simple, well-defined method to assess ozone formation potential, and ozone levels in the region are not generally recognized as problematic. This has been confirmed by recent data collected by the National Park Service at Craters of the Moon National Monument where no exceedances of the primary ozone standard have been reported (DOI 1994).

Offsite levels of carcinogenic air pollutants were evaluated on the basis of annual average emission rates and compared to annual average standards (increments) specified by the State of Idaho (IDHW 1997). For noncarcinogenic toxic air pollutants, DOE estimated maximum 24-hour levels at both offsite and public road locations and compared the results to applicable noncarcinogenic standards (IDHW 1997). Toxic air pollutants were also assessed for onsite locations because of potential worker exposure to these hazardous substances. Onsite levels of specific toxins were calculated using maximum hourly emission rates and compared to occupational exposure limits set for these substances by either the Occupational

Safety and Health Administration or the American Conference of Governmental Industrial Hygienists (the more restrictive of the two limits is used).

Model Description and Application

The EPA Industrial Source Complex-3 (ISCST-3, Version 96113) computer code (EPA 1995b) was the primary model used to evaluate impacts of waste processing alternatives. The ISC-3 model incorporates site-specific data (such as meteorological observations from INEEL weather stations), and takes into account effects such as stack tip downwash and turbulence induced by the presence of nearby structures. In addition, the model accommodates multiple sources and calculates concentrations for user-specified receptor locations. Concentrations were calculated over a range of durations, from 1-hour maximum values to annual averages. This allows for comparison of standards based on specific averaging times. In summary, dispersion modeling using ISC-3 allows for a reasonable prediction of the impacts of proposed facilities and, therefore, is ideally suited for the comparative evaluation process used in this EIS.

The analyses performed for the SNF & INEL EIS which served to establish the bounding baseline conditions for this EIS made use of some additional models as described in Appendix F-3 of the SNF & INEL EIS. These models included an earlier version of ISC (ISC-2), and SCREEN, a screening-level model which was used in some cases where a source's contribution to toxic air pollutant concentrations was expected to be minimal (that is, well below acceptable standards). The EPA-recommended Fugitive Dust Model (Winges 1991) was used to assess fugitive dust impacts. SCREEN and the Fugitive Dust Model are not used in this EIS, as it was not necessary to repeat these analyses.

Emission Parameters

The use of air dispersion models requires emission parameters, such as stack height and diameter; exhaust gas temperature and flow rate; size of area (for example, disturbed areas related to construction sources); and pollutant emission rates. The SNF & INEL EIS analysis obtained emission parameter data from the INEEL air emissions inventories discussed above, as well as from project design documents.

As discussed in Section C.2.3.2, precise stack design information was not available for all facilities at the time the analysis was performed. However, DOE considers the data used (see Table C.2-5) to be representative of projected stack conditions, and modeling results based on these data to be valid for purposes of comparative analysis. For area sources such as ground-level emissions from diesel engine equipment, modeling was performed assuming a generic source with dimensions of 100 meters by 100 meters.

Meteorological Data

DOE modeled emissions from the existing or proposed facilities at INTEC using meteorological data from the Grid III monitoring station. Elevated (tall stack) releases were modeled using observations from the 61-meter (200-foot) level, while ground-level releases were modeled using data from the 10-meter level of the Grid III monitoring station. These meteorological data sets contain 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 INEEL but are not available for the 1991 through 1992 period; therefore, default mixing heights were used. For short-term assessments, a value of 150 meters, which represents the lowest value measured at INEEL, was used (DOE 1991). For annual average evaluations, 800 meters was used. This value has been calculated by the National Oceanographic and Atmospheric Administration and is recommended for use in dispersion modeling assessments (Sagendorf 1991). Evaluations were conducted using meteorological data from each of these years, and the highest of the predicted concentrations was selected.

Receptor Locations

The ISC-3 Model is capable of determining air quality impacts at receptor locations using either a grid layout pattern or user-specified receptor points. The receptor locations for the dispersion modeling were based on receptor arrays developed for the SNF & INEL EIS (described in Appendix F-3 of that document) and for other INEEL modeling applications. The main purpose of the array is to enable the identification of the point of maximum predicted impact and the quantification of pollutant levels at that location. The array developed for this EIS includes a portion of U.S. 20 as well as a grid that starts at the southwestern INEEL boundary and extends east for about 20 kilometers. The grid contains receptor points at 1,000-meter intervals and extends to a distance of 8 kilometers south of the boundary. The array also includes discrete receptor points at Big Southern Butte, Fort Hall Indian Reservation, and along the eastern and northern boundaries of Craters of the Moon Wilderness Area. The elevation of each receptor location has been included to better account for the effects of elevated terrain.

DOE calculated ambient air concentrations for each location specified in the receptor array; however, the regulatory compliance evaluations for carcinogenic toxic air pollutants were performed only for site boundary locations (and not transportation corridors), as provided by IDAPA 16.01.01.210.03.b (IDHW 1997). Criteria and noncarcinogenic toxic air pollutants were assessed at all ambient air locations. DOE also assessed Prevention of Significant Deterioration increment consumption for Class II ambient air locations in and around INEEL and Craters of the Moon Wilderness Area, the Class I area nearest the INEEL. Class I area increments were assessed at discrete receptor locations along the eastern and northern boundaries of Craters of the Moon Wilderness Area at intervals of 500 meters.

DOE also assessed onsite concentrations of toxic air pollutants for which occupational exposure limits have been established. Preliminary modeling was performed and the results were used with those of previous assessments (including those performed for SNF & INEL EIS) to identify the onsite areas of highest impact. The area of highest onsite nonradiological impact was found to be within INTEC. This differs from the radiological assessment, which determined that a worker at Central Facilities Area would receive the highest dose. Factors which contribute to this disparity include (a) differences in dispersion models; (b) 8-hour (nonradiological) vs. annual average (radiological) averaging time; and (c) differences in stack parameters for fossil fuel combustion facilities (nonradiological) and waste processing facilities (radiological). The INTEC dose assessment used a grid centered on the main stack and extending to the INTEC area boundary. This grid used closely-spaced (50 meters) receptor points to identify the onsite location of highest impact.

Summation of Project Impacts

The ISC-3 modeling results for individual sources were summed to determine total impacts by alternative. DOE performed this process as described below.

A modeling run was performed for each source group and each applicable averaging time, assuming an emission rate of one gram per second to produce atmospheric dispersion factors (X/Q) for each receptor location. The X/Q values were then imported into computer spreadsheets which processed the results by multiplying by estimated emission rates. The results for each source group comprising the alternative/option under evaluation were then summed, and the point of maximum concentration was identified. Cumulative projected impacts were characterized by adding actual 1996 INEEL emissions (corrected to eliminate INEEL sources that have since been permanently removed from service) to those of other foreseeable sources and the option under evaluation, and then determining the maximum resulting concentrations in the manner described above. DOE believes it is more appropriate to use the actual emissions baseline for this purpose than the maximum baseline case used in the SNF & INEL EIS (and described in Section 4.7 of this EIS). This is due to the fact that most of the criteria pollutant emissions associated with waste processing alternatives are produced by burning fossil fuel to produce steam, and the steam production rate would not be significantly greater than that currently experienced at INTEC.

DOE extended this process for summation of results for Prevention of Significant Deterioration increment consumption analyses. In this case, each source group associated with an alternative is assumed to be an "increment consuming" source (i.e., a source subject to Prevention of Significant Deterioration regulation). Modeling results for sources within each alternative/option were processed and summed in the same manner as described above. For cumulative Prevention of Significant Deterioration increment consumption impacts, however, DOE also performed modeling for all existing (baseline) sources which are subject to Prevention of Significant Deterioration regulation, and for foreseeable sources not associated with HLW management alternatives. The summation of modeling results was performed for each specific receptor location to determine the maximum value and identify the point of maximum concentration.

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 C.2.2.2), potential impacts to visibility must be evaluated and shown to be acceptable in designated Class I areas and associated integral vistas. Craters of the Moon Wilderness Area, located approximately 20 miles southwest of the INTEC area (and about 12 miles from the nearest INEEL boundary), is the only Class I area in the Eastern Snake River Plain. However, recognizing the importance of the scenic views in and around the Fort Hall Indian Reservation, DOE performed additional analyses for this location.

The EPA has designed methodologies and developed computer codes to estimate potential visual impacts due to proposed emissions 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. This conservatism is achieved by the use of worst-case meteorological conditions, including extremely stable (Class F) conditions coupled with a very low wind speed (1 meter per second) persisting for 12 hours, with a wind direction that would transport the plume directly adjacent to a hypothetical observer in the Class I or scenic area. The Level 1 analysis is implemented using the computer code VISCREEN to calculate the potential visual impact of a plume of specified emissions for the specified 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 1992). 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 even more intensive in scope and designed to provide a more realistic treatment of plume visual impacts. In both the SNF & INEL EIS and this EIS, DOE used Level 1 VISCREEN analyses to ensure conservatism.

Because within a range of wavelengths, a measure of contrast must recognize both intensity and perceived color, the VISCREEN model determines whether a plume would be visible by calculating contrast (brightness) and color contrast. Contrast is calculated at three visual wavelengths 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. To address the dimension of color as well as brightness, the color contrast parameter, termed “delta E,” is used as the primary basis for determining the perceptibility of plume visual impacts in screening analyses. Delta E provides a single measure of the difference between two arbitrary colors as perceived by humans. If contrasts are different at different wavelengths, the plume is discolored. If contrasts are all zero, the plume is indistinguishable from its background.

In order to determine whether a plume has the potential to be perceptible to 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. The first criterion is a delta E value of 2.0; the second is a green contrast value of 0.05. 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. Regional haze, which is caused by multiple sources throughout a region, is not calculated or estimated with the VISCREEN model.

The EPA recommends default values for various model parameters. In this analysis, default values were used for all parameters with the exception of background ozone concentration. A value of 0.051 parts per million was assigned as a representative regional value for ozone (DOI 1994; Notar 1998a). DOE used a site-specific annual average background visual range, estimated to be 144 miles based on monitoring programs conducted by the National Park Service at Craters of the Moon Wilderness Area (Notar 1998b).

Methodology for Mobile Source Impacts

The SNF & INEL EIS contained an extensive analysis of the ambient air quality impacts at offsite receptor locations due to mobile sources associated with INEEL operations. Sources included the INEEL bus fleet operations, INEEL fleet light- and heavy-duty vehicles, privately-owned vehicles, and heavy-duty commercial vehicles servicing the INEEL facilities. These impacts were quantitatively assessed in the SNF & INEL EIS using emission factors and the computerized CALINE-3 methodology (Benson 1979). The model, which implements the recommended EPA methodology, is considered a screening-level model designed to simulate traffic flow conditions and pollutant dispersion from traffic. The model was used to predict maximum 1-hour ambient air concentrations of carbon monoxide and respirable 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 from the edge of the roadway, in accordance with EPA guidance. Modeling was conducted for 1993 to quantify the impact due to INEEL buses and traffic serving projects and activities on the INEEL at that time, the projected impact of projects planned for construction before 1995, and the projected impacts of environmental restoration and waste management alternatives given in the SNF & INEL EIS.

The impacts of mobile sources operating at INTEC in support of waste processing operations are qualitatively assessed in Section 5.2.6.7. These impacts are assumed to be bounded by the mobile source impacts assessed in the SNF & INEL EIS.

C.2.4 RADIOLOGICAL CONSEQUENCES OF WASTE PROCESSING ALTERNATIVES

This section provides detail which supplements the assessment results for airborne radionuclide emissions associated with waste processing alternatives presented in Section 5.2.6.3.

C.2.4.1 Radionuclide Emission Rates

Radionuclide emission rates for specific projects associated with proposed waste processing alternatives, estimated as described in Section C.2.3.1, are presented in Table C.2-9.

C.2.4.2 Radiation Doses

DOE has estimated radiation doses that would result from specific projects associated with waste processing alternatives. Table C.2-10 presents estimated radiation dose from airborne radionuclide emissions, averaged over an operational year, for (a) the offsite maximally-exposed individual; (b) the collective offsite population within 80 kilometers of INTEC; and (c) the maximally-exposed non-involved INEEL worker. The organ receiving the highest weighted dose, the most important exposure pathway, and the radionuclide which is the highest contributor to the effective dose are also identified. In each case, the highest predicted non-involved worker location is the Central Facilities Area.

C.2.5 NONRADIOLOGICAL CONSEQUENCES OF WASTE PROCESSING ALTERNATIVES

This section provides detail which supplements the assessment results for nonradiological air consequences of waste processing alternatives presented in Sections 5.2.6.4 through 5.2.6.6.

C.2.5.1 Air Pollutant Emission Rates

This section presents nonradiological air pollutant emission rates for specific projects associated with proposed waste processing alternatives, estimated as described in Section C.2.3.1. The following tabulations are presented:

- Table C.2-11 presents a listing of estimated emissions of total and individual criteria pollutants, total toxic air pollutants, and carbon dioxide from fossil fuel combustion. Emissions are listed for individual projects and are summed for each waste processing alternative. The primary source of these emissions is fuel combustion to generate steam. Burning fuel to operate diesel equipment also contributes to these emissions.

- Table C.2-12 presents a listing of emissions estimates for individual toxic air pollutants produced by fossil fuel combustion.

- Table C.2-13 presents estimates of toxic air pollutant, criteria pollutant, and carbon dioxide emissions resulting from chemical processes (other than fossil fuel combustion) that would be used to treat waste under the proposed alternatives.

C.2.5.2 Concentrations of Nonradiological Air Pollutants at Ambient Air Locations

The following tabulations present the results of assessments for criteria and toxic air pollutant concentrations in ambient air (general public access) locations:

- Table C.2-14 presents the maximum predicted impacts of criteria pollutant emissions at ambient air locations, including at or slightly beyond the INEEL boundary, along public roads traversing the INEEL, and at Craters of the Moon Wilderness Area. The table shows the incremental impacts of each alternative, along with the cumulative impacts when baseline levels are added.

- Table C.2-15 shows the baseline conditions used in cumulative effect determinations. These are the maximum impacts predicted for the indicated locations based on actual 1997 INEEL emissions plus other reasonably foreseeable increases. These increases include projects associated with the SNF & INEL EIS Preferred Alternative, modified to reflect current project plans.

- Table C.2-16 presents a summary of the highest predicted impacts of any single carcinogenic (and noncarcinogenic) toxic air pollutant at offsite and onsite locations. In each case, the maximum impact (in terms of percent of applicable standard) among carcinogens is for nickel, while vanadium is the highest noncarcinogen. As previously noted, toxic air pollutant increments promulgated by the State apply only to new or modified 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. For each alternative, maximum incremental impacts of carcinogenic air pollutants are projected to occur at or just beyond the southern INEEL boundary, while maximum noncarcinogenic air pollutant levels would occur along U.S. 20.

- Table C.2-17 shows the maximum predicted impacts for each carcinogenic and noncarcinogenic toxic air pollutant at ambient air locations.

C.2.5.3 Concentrations of Toxic Air Pollutants at Onsite Locations

DOE estimated maximum onsite concentrations of toxic air pollutants for which occupational exposure limits have been established. These levels are presented by waste processing alternative/option in Table C.2-18, and represent the maximum predicted levels at any point within a major INEEL facility area, averaged over an 8-hour period, to which workers might be incidentally exposed. These results are compared to occupational standards recommended by either the American Conference of Governmental

Table C.2-15. Criteria pollutant ambient air quality standards and baseline used to assess cumulative impacts at public access locations.

Pollutant	Applicable standard[a] (micrograms per cubic meter)	Averaging time	Contribution of baseline and reasonable foreseeable increases[b] (micrograms per cubic meter) Site boundary	Public roads	Craters of the Moon
Carbon monoxide	40,000	1-hour	206	420	12
	10,000	8-hour	78	66	4.2
Nitrogen dioxide	100	Annual	0.46	1.2	0.06
Sulfur dioxide	1,300	3-hour	24	38	3.8
	365	24-hour	5.3	9.9	1.2
	80	Annual	0.14	0.45	0.02
Respirable particulates	150	24-hour	12	24	1.0
	50	Annual	0.49	1.8	0.04
Lead	1.5	Quarterly	2.3×10^{-4}	5.0×10^{-4}	5.5×10^{-5}

a. Cumulative impacts are compared to the applicable standards provided, above. Primary standards are designed to protect public health. Secondary standards are designed to protect public welfare. The more stringent secondary standard was used where applicable for comparison.
b. The baseline represents the modeled pollutant concentrations based on an actual operating emissions scenario. It includes actual 1997 INEEL emissions plus the contribution of reasonably foreseeable increases.

Industrial Hygienists or the Occupational Safety and Health Administration, whichever standard is more restrictive. Unlike radiological impacts (for which the maximum dose to a non-involved worker occurs at Central Facilities Area), the maximally-impacted area for toxic air pollutants is within INTEC. This is due to differences in dispersion models, averaging time (annual average for radionuclides versus 8 hours for toxics) and height of release (elevated releases for radionuclides versus both ground-level and elevated for toxics).

C.2.5.4 Visibility Impairment Modeling Results

DOE assessed cumulative emissions of proposed waste processing sources at the INTEC for potential impacts on the visual resource at Craters of the Moon Wilderness Area and the Fort Hall Indian Reservation, in recognition of the importance of scenic views in and around each of these areas. For this assessment, the potential impact of incremental emissions was evaluated using maximum hourly emission rates of particulates and nitrogen oxides and minimum and maximum distances from the source to the Class I area and Reservation. The analysis conservatively assumes that future fossil fuel-burning equipment will not have emission controls that reduce nitrogen dioxide and particulate matter emissions. The results (Table C.2-19) show that none of the alternatives would exceed the maximum screening values of 2.0 for color shift or 0.05 for contrast; that is, none would be expected to result in perceptible changes to visual resources around Craters of the Moon or Fort Hall.

C.2.6 RADIOLOGICAL CONSEQUENCES OF FACILITIES DISPOSITION

This section provides detail which supplements the radiological assessment results for facility disposition alternatives presented in Section 5.3.4. These results are presented separately for three categories of facilities: (a) facilities associated with waste processing alternatives; (b) the Tank Farm, calcine bin sets, and related facilities; and (c) other existing INTEC facilities.

C.2.6.1 Facilities Associated with Waste Processing Alternatives

Radionuclide emissions would result from the dispositioning of facilities associated with waste processing alternatives. These emissions are temporary in nature and would persist for a few (1 to 4) years following the operating lifetime of individual facilities. Table C.2-20 presents the radionuclide release estimates for the dispositioning of these facilities, while the calculated radiation doses that would result from these emissions are presented in Table C.2-21.

C.2.6.2 Tank Farm and Bin Sets

DOE estimated emissions and doses that would result from dispositioning the Tank Farm and calcine storage bin sets under different closure scenarios. These emissions could persist for over 20 years, reflecting the lengthy process of decontaminating and closing the waste storage tanks and calcine storage bins. Table C.2-22 presents the radionuclide release estimates for these closure scenarios, while the associated radiation doses are presented in Table C.2-23.

C.2.6.3 Other Existing INTEC Facilities

DOE estimated emissions and doses that would result from dispositioning various other facilities that either currently operate or have operated in the past in support of HLW management at INTEC. These estimates are presented in Tables C.2-24 and C.2-25.

C.2.7 NONRADIOLOGICAL CONSEQUENCES OF FACILITIES DISPOSITION

This section provides detail which supplements the emissions estimates and assessment results for nonradiological air pollutants from the facilities disposition alternatives presented in Section 5.3.4. These emissions arise primarily through the operation of diesel-powered equipment (cranes, loaders, haulers, etc.). The emissions tabulations list the maximum annual and cumulative emissions for each pollutant category (criteria, toxic, and carbon dioxide). Criteria pollutant impacts are presented as

Table C.2-23. Summary of radiation dose impacts associated with airborne radionuclide emissions from dispositioning the Tank Farm and bin sets under alternative closure scenarios.

Case	Applicable Standard	Maximum annual radiation dose[a] Clean closure	Performance-based closure	Closure to landfill standards	Performance-based closure with Class A or C grout disposal
Tank Farm					
Dose to maximally-exposed offsite individual (millirem per year)	10[b]	1.2×10^{-9}	1.5×10^{-10}	1.1×10^{-9}	1.5×10^{-10}
Dose to maximally-exposed onsite noninvolved worker (millirem per year)[c]	5,000[d]	1.2×10^{-9}	1.5×10^{-10}	1.1×10^{-9}	1.5×10^{-10}
Collective dose to population within 80 kilometers of INTEC (person-rem per year)[e]	NA	3.1×10^{-8}	3.8×10^{-9}	2.8×10^{-8}	3.9×10^{-9}
Bin Sets					
Dose to maximally-exposed offsite individual (millirem per year)	10[b]	1.0×10^{-10}	1.3×10^{-10}	9.2×10^{-10}	1.3×10^{-10}
Dose to maximally-exposed onsite noninvolved worker (millirem per year)[c]	5,000[d]	2.3×10^{-11}	3.0×10^{-11}	2.2×10^{-10}	3.0×10^{-11}
Collective dose to population within 80 km of INTEC (person-rem per year)[e]	NA	5.5×10^{-9}	7.2×10^{-9}	5.1×10^{-8}	7.2×10^{-9}

a. Doses are maximum effective dose equivalents over any single year during which dispositioning occurs. Annual totals include only those projects which are projected to occur over a similar time frame.
b. EPA dose limit specified in 40 CFR 61.92; applies to effective dose equivalent from air releases only.
c. Location of highest onsite dose is Central Facilities Area.
d. Occupational dose limit per 10 CFR 835.202; applies to sum of doses from all exposure pathways.
e. A reference population of 200,000 people is used for future population dose estimates. At currently projected growth rates, this is the approximate population level that would exist around the year 2030. During 1990, this population was 118,644.

concentrations in micrograms per cubic meter at the maximally-impacted location at or beyond the INEEL boundary, along public roads, and at Craters of the Moon Wilderness Area. These are specified both for the alternative or option alone and for the cumulative effect of the alternative added to the baseline conditions. The cumulative impact is also specified as a percent of the applicable standard. Toxic impacts are presented as maximum percent of the applicable standard (for ambient air locations) or occupational exposure limit (for INEEL areas). In all cases, the INEEL area of highest predicted concentration is INTEC.

C.2.7.1 Facilities Associated with Waste Processing Alternatives

The following tables of emissions and impacts are presented for dispositioning of facilities associated with waste processing alternatives. Table C.2-26 lists the annual and cumulative emissions estimates for individual projects associated with each alternative. Table C.2-27 presents the maximum predicted impacts of criteria pollutant emissions at ambient air locations. Results include both the incremental impacts of each alternative and the cumulative impacts when baseline levels are added. Table C.2-28 presents a summary of maximum predicted toxic air pollutant impacts at ambient air and INEEL (INTEC) locations.

C.2.7.2 Tank Farm and Bin Sets

The following tables of emissions and impacts are presented for dispositioning of the Tank Farm and bin sets according to alternative closure scenarios. Table C.2-29 lists the annual and cumulative emissions estimates for each facility group by closure scenario. Table C.2-30 presents the maximum predicted impacts of criteria pollutant emissions at ambient air locations, including both the incremental impacts of each alternative and the cumulative impacts when baseline levels are added. Table C.2-31 presents a summary of maximum predicted toxic air pollutant impacts at ambient air and INEEL (INTEC) locations.

C.2.7.3 Other Existing INTEC Facilities

DOE has also assessed emissions and impacts for dispositioning other existing INTEC facilities involved in HLW management. These facilities, which have been arranged in functional groups for purposes of analysis, are listed in Table 3-2. The following tables are presented for these facilities. Table C.2-32 lists the annual and cumulative emissions estimates. Table C.2-33 presents the maximum predicted incremental and cumulative impacts of criteria pollutant emissions at ambient air locations. Table C.2-34 presents a summary of maximum predicted toxic air pollutant impacts at ambient air and INEEL (INTEC) locations.

Table C.2-33. Maximum criteria pollutant impacts from dispositioning of other existing INTEC facilities associated with HLW management

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Table C.2-4. Emission factors used for criteria and toxic air pollutants from fuel oil combustion.

Criteria pollutants and carbon dioxide	Emission factor (pounds/ 1,000 gallons)[a]	Emission factor (pounds/ 1,000 gallons)[b]	Organic compounds	Emission factor (pounds/ 1,000 gallons)[c]	Metals	Emission factor (pounds/ 1,000 gallons)[d]
	Steam generation	Diesel engines	Steam generation and diesel engines		Steam generation and diesel engines	
Sulfur dioxide [e]	71	73	Benzene	2.4×10^{-4}	Antimony	5.3×10^{-3}
Particulate matter	2.0	27	Ethylbenzene	6.4×10^{-5}	Arsenic	1.3×10^{-3}
Carbon monoxide	5.0	470	Formaldehyde	0.030	Barium	2.5×10^{-3}
Nitrogen dioxide	20	400	Naphthalene	1.1×10^{-3}	Beryllium	2.8×10^{-5}
Total organic compounds	0.25	85	1,1,1-Trichloroethane	2.4×10^{-4}	Cadmium	4.0×10^{-4}
Carbon dioxide	2.2×10^{4}	2.3×10^{4}	(methyl chloroform)			
			Toluene	6.2×10^{-3}	Chloride	0.35
			o-Xylene	1.1×10^{-4}	Chromium (total)	8.5×10^{-4}
			Acenaphthene	2.1×10^{-5}	Chromium (hexavalent)	2.5×10^{-4}
			Acenaphthylene	2.5×10^{-7}	Cobalt	6.0×10^{-3}
			Anthracene	1.2×10^{-6}	Copper	1.8×10^{-3}
			Benz(a)anthracene	4.0×10^{-6}	Fluoride	0.037
			Benzo(b,k)fluoranthene	1.5×10^{-6}	Lead	1.5×10^{-3}
			Benzo(g,h,i)perylene	2.3×10^{-6}	Manganese	3.0×10^{-3}
			Chrysene	2.4×10^{-6}	Mercury	1.1×10^{-4}
			Dibenzo(a,h)anthracene	1.7×10^{-6}	Molybdenum	7.9×10^{-4}
			Fluoranthene	4.8×10^{-6}	Nickel	0.085
			Fluorene	4.5×10^{-6}	Phosphorus	9.5×10^{-3}
			Indeno(1,2,3-cd)pyrene	2.1×10^{-6}	Selenium	6.8×10^{-4}
			Phenanthrene	1.1×10^{-5}	Vanadium	0.0318
			Pyrene	4.3×10^{-6}	Zinc	0.0291
			Chlorinated dibenzo-p-dioxins	3.1×10^{-9}		

a. Source: Tables 1.3-1, 1.3-3, and 1.3-12 of EPA (1998).
b. Source: Project Data Sheets (Appendix C.6).
c. Source: Table 1.3-8 of EPA (1998).
d. Source: Table 1.3-10 of EPA (1998).
e. Assumes 0.5 percent sulfur content of fuel.

Table C.2-5. Stack parameters for facilities associated with waste processing alternatives.

Project/Process	Stack identifier	Assumed source locations UTM coordinates[a] (meters) East	West	Elevation (meters)	Stack height (feet)	Stack diameter (feet)	Exhaust temperature (°Celcius)	Volumetric flow rate (actual cubic feet per minute)	Exit velocity (feet per minute)
Proposed facilities									
Full Separations Stack	P9A	344,035	4,826,100	1,498	130	9.50	38	166,180	2,344
Vitrification Facility Stack	P9B	344,035	4,826,100	1,498	108	10.0	38	191,467	2,438
LAWT Facility Stack	P9C	344,035	4,826,100	1,498	152	5.00	38	49,639	2,528
Transuranic Separations Stack	P49A	344,035	4,826,100	1,498	130	9.50	38	166,180	2,344
Transuranic/C LAWT Stack	P49C	344,035	4,826,100	1,498	152	5.00	38	49,639	2,528
HIP Facility Stack	P71	344,022	4,825,697	1,498	108	10.0	38	172,000	2,190
Direct Cement Facility Stack	P80	344,035	4,826,954	1,498	243	10.0	38	262,000	3,336
Early Vitrification Facility Stack	P88	344,035	4,826,954	1,498	108	10.0	38	205,407	2,615
Cs Ion Exchange Stack	P111	344,035	4,826,100	1,498	152	5.00	38	49,639	2,528
Alternate SBW Treatment Stack	P115	344,022	4,825,697	1,498	130	9.50	38	126,000	2,385
Other INTEC facilities									
INTEC main stack[b]	708-001	343,924	4,825,948	1,498	250	6.50	33	100,000	3,014
Coal-Fired Steam Generating Facility	787-001	344,120	4,825,445	1,499	150	5.83	177	74,863	2,801
Powerhouse[c]	606-Comp.	343,800	4,826,089	1,498	68	2.0	232	6,010	1,913

a. UTM coordinate system.
b. The INTEC main stack would be the release point for emissions from the following existing INTEC facilities: New Waste Calcining Facility, Process Equipment Waste Evaporator, Liquid Effluent Treatment and Disposal Facility, Tank Farm, and some of the calcine bin sets.
c. Used as a surrogate for future diesel-fuel burning equipment that could replace or supplement existing steam facilities to meet HLW processing steam demand. Stack parameters are patterned after stacks from existing fuel-burning equipment at this location.
Cs = cesium; HIP = Hot Isostatic Press; LAWT = low-activity waste treatment; TRU = transuranic; UTM = Universal Transverse Mercator.

Table C.2-7. Population distribution within 50 miles of INTEC.[a]

Distance (miles)										Sector	
0-1	1-2	2-3	3-4	4-5	5-10	10-20	20-30	30-40	40-50	total	Direction
0	0	0	0	0	0	6	22	350	2,394	2,772	S
0	0	0	0	0	0	0	0	0	29	29	SSW
0	0	0	0	0	0	0	2	0	0	2	SW
0	0	0	0	0	0	3	6	6	97	112	WSW
0	0	0	0	0	0	157	45	10	22	234	W
0	0	0	0	0	0	1,049	914	45	4	2,012	WNW
0	0	0	0	0	0	3	167	317	648	1,135	NW
0	0	0	0	0	0	52	32	11	10	105	NNW
0	0	0	0	0	0	113	46	15	6	180	N
0	0	0	0	0	0	0	0	199	38	237	NNE
0	0	0	0	0	0	0	403	663	196	1,262	NE
0	0	0	0	0	0	0	43	495	2,079	2,617	ENE
0	0	0	0	0	0	0	1	674	66,430	67,105	E
0	0	0	0	0	0	0	26	514	11,473	12,013	ESE
0	0	0	0	0	0	10	413	15,169	4,786	20,378	SE
0	0	0	0	0	0	30	135	1,528	6,758	8,451	SSE
0	0	0	0	0	0	1,423	2,255	19,996	94,970	118,664	Population total

a. Based on 1990 Census; centered on Universal Transverse Mercator (UTM) Coordinates 343,924 meters East; 4,825,948 meters North. Values are number of people residing within sector of specified distance and direction.

Table C.2-9. Radionuclide emission rates (curies per year) for projects associated with waste processing alternatives.[a]

Project identifier	P1A	P1B	P1C	P1D	P9A/P23A	P9B/P23B	P9C/P23C	P26	P26	P26	P18	P18MC	P35D or E
Radionuclide	Calcine SBW with MACT	NGLW & Heel Waste Mgmt.	PEW Evap. and LET&D	No Action Alt.	Full Seps.	Vit. Plant	Class A Grout Plant	Tank Farm Closure	Bin sets Closure	Fill with Class A Grout	New Anal. Lab.	Remote Anal. Lab. Operation	Class A Grout Packaging
Americium-241	-	-	-	-	-	-	-	7.9×10^{-12}	1.6×10^{-8}	4.1×10^{-12}	-	-	-
Cobalt-60	1.1×10^{-6}	1.3×10^{-7}	1.3×10^{-7}	1.3×10^{-7}	-	-	2.8×10^{-8}	5.4×10^{-11}	-	2.8×10^{-11}	-	-	-
Cesium-134	6.2×10^{-6}	8.2×10^{-8}	8.2×10^{-8}	8.2×10^{-8}	-	2.9×10^{-10}	-	1.6×10^{-9}	-	8.6×10^{-10}	-	-	-
Cesium-137	2.4×10^{-3}	2.4×10^{-4}	2.4×10^{-4}	2.4×10^{-4}	2.9×10^{-5}	1.2×10^{-7}	-	5.6×10^{-8}	8.6×10^{-6}	3.0×10^{-8}	5.1×10^{-8}	2.6×10^{-8}	4.5×10^{-9}
Europium-154	9.5×10^{-7}	2.0×10^{-7}	2.0×10^{-7}	2.0×10^{-7}	-	4.5×10^{-11}	-	5.1×10^{-10}	-	2.7×10^{-10}	-	-	-
Europium-155	-	-	-	-	-	-	-	2.4×10^{-10}	-	1.3×10^{-10}	-	-	-
Hydrogen-3 (tritium)	23	-	9.0	9.0	-	-	45	7.5×10^{-11}	-	4.0×10^{-11}	-	-	-
Iodine-129	0.06	0.03	0.03	0.03	7.5×10^{-7}	-	2.0×10^{-3}	5.0×10^{-13}	-	2.6×10^{-13}	-	-	-
Nickel-63	-	-	-	-	-	-	-	3.3×10^{-12}	-	1.8×10^{-12}	-	-	-
Promethium-147	-	-	-	-	-	-	-	-	-	-	-	-	-
Plutonium-238	5.0×10^{-6}	6.2×10^{-6}	6.2×10^{-6}	6.2×10^{-6}	-	2.4×10^{-10}	-	1.4×10^{-10}	1.4×10^{-7}	7.3×10^{-11}	-	-	-
Plutonium-239	5.7×10^{-7}	1.0×10^{-7}	1.0×10^{-7}	1.0×10^{-7}	-	2.7×10^{-11}	-	9.8×10^{-11}	-	5.2×10^{-11}	1.3×10^{-11}	6.4×10^{-12}	1.1×10^{-12}
Plutonium-241	-	-	-	-	-	-	-	7.7×10^{-11}	5.5×10^{-8}	4.0×10^{-11}	-	-	-
Ruthenium-106	6.3×10^{-5}	2.4×10^{-6}	2.4×10^{-6}	2.4×10^{-6}	-	-	1.6×10^{-6}	4.7×10^{-10}	-	2.5×10^{-10}	-	-	-
Antimony-125	1.0×10^{-5}	1.5×10^{-6}	1.5×10^{-6}	1.5×10^{-6}	4.8×10^{-7}	-	2.7×10^{-7}	1.1×10^{-10}	-	5.7×10^{-11}	-	-	-
Samarium-151	-	-	-	-	-	-	-	-	2.0×10^{-7}	-	-	-	-
Strontium-90 [b]	3.1×10^{-4}	2.0×10^{-5}	2.0×10^{-5}	2.0×10^{-5}	2.1×10^{-9}	1.5×10^{-8}	-	5.1×10^{-8}	1.1×10^{-5}	2.7×10^{-8}	4.5×10^{-7}	2.2×10^{-7}	3.9×10^{-8}
Technetium-99	-	-	-	-	1.8×10^{-5}	-	-	1.3×10^{-12}	3.0×10^{-9}	6.9×10^{-13}	-	-	-

Table C.2-9. (continued).

Project identifier Radionuclide	P49A TRU/ Class C Seps.	P49C Class C Grout Plant	P49D Class C Grout Packaging	P51 Tank Farm Closure	P51 Bin sets Closure	P51 Fill with Class A Grout	P59A Calcine Retrieval/ Transport	P71 HIP Waste Treat.	P80 Direct Cement. Treat.	P88 Early Vit.	P111 Treat SBW/NGLW with Cs IX	P117 Calcine/ Resin Packaging	P133 Waste Treatment Pilot Plant
Americium-241	-	-	-	7.9×10^{-12}	1.6×10^{-8}	4.1×10^{-12}	-	-	-	-	2.0×10^{-5}	-	-
Cobalt-60	-	8.1×10^{-9}	-	5.4×10^{-11}	-	2.8×10^{-11}	-	-	-	2.1×10^{-9}	9.8×10^{-6}	-	-
Cesium-134	-	4.5×10^{-8}	-	1.6×10^{-9}	-	8.6×10^{-10}	-	-	-	1.2×10^{-8}	2.1×10^{-8}	-	-
Cesium-137	2.9×10^{-5}	1.8×10^{-5}	4.5×10^{-9}	5.6×10^{-8}	8.6×10^{-6}	3.0×10^{-8}	2.0×10^{-3}	0.09	7.8×10^{-8}	4.7×10^{-6}	2.0×10^{-6}	8.6×10^{-6}	2.9×10^{-9}
Europium-154	-	-	-	5.1×10^{-10}	-	2.7×10^{-10}	-	-	-	1.8×10^{-9}	9.9×10^{-6}	-	-
Europium-155	-	-	-	2.4×10^{-10}	-	1.3×10^{-10}	-	-	-	-	-	-	-
Hydrogen-3 (tritium)	-	45	-	7.5×10^{-11}	-	4.0×10^{-11}	-	-	-	45	45	-	-
Iodine-129	7.5×10^{-7}	4.2×10^{-4}	-	5.0×10^{-13}	-	2.6×10^{-13}	-	-	-	1.0×10^{-3}	1.3×10^{-7}	-	-
Nickel-63	-	-	-	3.3×10^{-12}	-	1.8×10^{-12}	-	-	-	-	-	-	-
Promethium-147	-	-	-	-	-	-	-	-	-	-	5.2×10^{-5}	-	-
Plutonium-238	-	-	-	1.4×10^{-10}	1.4×10^{-7}	7.3×10^{-11}	3.2×10^{-5}	-	-	9.5×10^{-9}	5.2×10^{-5}	1.2×10^{-7}	-
Plutonium-239	-	-	1.1×10^{-12}	9.8×10^{-11}	-	5.2×10^{-11}	-	-	2.0×10^{-11}	1.1×10^{-9}	3.1×10^{-6}	-	7.3×10^{-13}
Plutonium-241	-	-	-	7.7×10^{-11}	5.5×10^{-8}	4.0×10^{-11}	-	-	-	-	-	-	-
Ruthenium-106	-	4.6×10^{-7}	-	4.7×10^{-10}	-	2.5×10^{-10}	-	1.1×10^{-5}	-	1.2×10^{-7}	-	-	-
Antimony-125	4.8×10^{-7}	7.5×10^{-8}	-	1.1×10^{-10}	-	5.7×10^{-11}	-	8.2×10^{-8}	-	2.0×10^{-8}	3.8×10^{-6}	-	-
Samarium-151	-	-	-	-	2.0×10^{-7}	-	-	-	-	-	2.8×10^{-5}	-	-
Strontium-90[b]	2.1×10^{-9}	2.3×10^{-6}	3.9×10^{-8}	5.1×10^{-8}	1.1×10^{-5}	2.7×10^{-8}	6.0×10^{-3}	-	6.8×10^{-7}	6.0×10^{-7}	1.6×10^{-3}	2.3×10^{-5}	2.5×10^{-8}
Technetium-99	1.8×10^{-5}	-	-	1.3×10^{-12}	3.0×10^{-9}	6.9×10^{-13}	-	1.7×10^{-4}	-	-	8.0×10^{-7}	-	-

a. See Section 3.1 for listing of project names. Source: Project Data Summaries in Appendix C.6 and backup documentation.
b. An equal amount of Yttrium-90 would also be present.
LET&D = Liquid Effluent Treatment and Disposal Facility; MACT = maximum achievable control technology; NGLW = newly-generated liquid waste; PEW = process equipment waste; TRU = transuranic.

Table C.2-10. Summary of radiation dose impacts associated with airborne radionuclide emissions from waste processing alternatives.

Case[a] (units)	Applicable Standard	No Action Alternative	Continued Current Operations Alternative	Separations Alternative: Full Separations Option	Separations Alternative: Planning Basis Option	Separations Alternative: Transuranic Separations Option	Non-Separations Alternative: Hot Isostatic Pressed Waste Option	Non-Separations Alternative: Direct Cement Waste Option	Non-Separations Alternative: Early Vitrification Option	Minimum INEEL Processing Alternative at INEEL
Dose to maximally-exposed offsite individual (millirem per year)	10[b]	6.0×10^{-4}	1.7×10^{-3}	1.2×10^{-4}	1.8×10^{-3}	6.0×10^{-5}	1.8×10^{-3}	1.7×10^{-3}	8.9×10^{-4}	9.5×10^{-4}
Controlling organ		Thyroid	Thyroid	Thyroid	Thyroid	Thyroid	Thyroid	Thyroid	Thyroid	Thyroid
Controlling pathway		Ingestion	Ingestion	Ingestion	Ingestion	Ingestion	Ingestion	Ingestion	Ingestion	Ingestion
Controlling radionuclide		I-129	I-129	I-129	I-129	H-3	I-129	I-129	I-129	I-129
Dose to maximally-exposed noninvolved worker (millirem per year)[c]	5,000[d]	7.0×10^{-6}	1.8×10^{-5}	4.4×10^{-5}	9.0×10^{-5}	3.4×10^{-5}	3.6×10^{-5}	3.0×10^{-5}	4.8×10^{-5}	1.0×10^{-4}
Controlling organ		Thyroid	Thyroid	Bone surface	Thyroid	Bone surface	Thyroid	Thyroid	Bone surface	Bone surface
Controlling pathway		Inhalation	Inhalation	Inhalation	Inhalation	Inhalation	Inhalation	Inhalation	Inhalation	Inhalation
Controlling radionuclide		I-129	I-129	Pu-238	Pu-238	Pu-238	Pu-238	Pu-238	Pu-238	Pu-238
Collective dose to population within 80 kilometers of INTEC (person-rem per year)[e,f]	N.A.	0.032	0.094	5.6×10^{-3}	0.095	3.1×10^{-3}	0.097	0.095	0.048	0.048

a. Doses are maximum values over any single year during which waste processing occurs; annual doses from waste stored on an interim basis after waste processing is completed would be much less.
b. EPA dose limit specified in 40 CFR 61.92; applies to effective dose equivalent from air releases only.
c. Location of highest INEEL onsite dose is Central Facilities Area.
d. Occupational dose limit per 10 CFR 835.202; applies to sum of doses from all exposure pathways.
e. A reference population of 200,000 people is used for future population dose estimates. At currently projected growth rates, this is the approximate population level that would exist around the year 2030. During 1990, this population was 118,644.
f. Controlling organ, pathway, and radionuclide are the same as for the maximally-exposed offsite individual.

Table C.2-11. Summary of annual average non-radiological emissions associated with fuel combustion.[a]

			Category totals			Criteria pollutants					
Alternative and project	Description	Years Units	Criteria (ton/year)	Toxic (lbs/year)	Carbon dioxide[b] (ton/year)	Sulfur dioxide (ton/year)	Respirable particulates (ton/year)	Carbon monoxide (ton/year)	Oxides of nitrogen (ton/year)	Volatile organic compounds (ton/year)	Lead (lbs/year)
No Action											
P1D	No Action Alternative	17	24	290	5.2×10^{3}	17	0.48	1.2	4.8	0.061	0.73
P1E	Bin Set 1 Calcine Transfer	1	5.9	73	1.3×10^{3}	4.3	0.12	0.3	1.2	0.015	0.18
P18MC	Remote Analytical Lab - Minimum Compliance	29	1.9	22	390	1.3	0.04	0.16	0.42	0.017	0.055
Totals			32	390	6.9×10^{3}	23	0.64	1.7	6.4	0.093	0.96
Continued Current Operations Alternative											
P1A	Calcine SBW incl. NWCF (MACT) Upgrades	6	33	290	5.2×10^{3}	17	0.73	5.8	8.6	0.9	0.73
P1B	NGLWM and TF Waste Heel Waste	21	19	230	4.1×10^{3}	14	0.38	1.0	3.9	0.056	0.58
P1E	Bin Set 1 Calcine Transfer	1	5.9	73	1.3×10^{3}	4.3	0.12	0.3	1.2	0.015	0.18
P18MC	Remote Analytical Lab - Minimum Compliance	29	1.9	22	390	1.3	0.04	0.16	0.42	0.017	0.055
Totals			60	620	1.1×10^{4}	36	1.3	7.3	14	0.98	1.5
Full Separations Option											
P59A	Calcine Retrieval and Transport	21	6	73	1.3×10^{3}	4.3	0.12	0.30	1.2	0.015	0.18
P9A	Full (early) Separations	21	180	2.1×10^{3}	3.7×10^{4}	120	3.8	14	39	1.5	5.2
P9B	Vitrification Plant	20	14	140	2.5×10^{3}	8.1	0.29	1.7	3.2	0.23	0.34
P9C	Class A Grout Plant	21	13	130	2.4×10^{3}	7.8	0.28	1.7	3.1	0.23	0.33
P24	Vitrified Product Interim Storage	47	-[c]	-	-	-	-	-	-	-	-
P18	New Analytical Lab - Full Separations	26	2.5	27	480	1.6	0.051	0.24	0.55	0.03	0.067
P118	Separations Organic Incinerator Project	21	0.047	0.053	1.0	3.3×10^{-3}	1.2×10^{-3}	0.021	0.018	3.7×10^{-3}	1.3×10^{-4}
P133	Waste Pilot Facility - Full Separations	27	2.2	27	480	1.6	0.046	0.13	0.46	0.01	0.067
and											
P35D	Class A Grout Packaging and Shipping to INEEL Landfill	21	0.11	0.13	2.4	7.8×10^{-3}	2.8×10^{-3}	0.049	0.042	8.8×10^{-3}	3.1×10^{-4}
P27	Class A/C Grout in New Landfill Facility	21	4.7	5.3	100	0.33	0.12	2.1	1.8	0.37	0.013
or											
P35E	Class A Grout Packaging and Loading for Offsite Disposal	21	0.11	0.13	2.4	7.8×10^{-3}	2.8×10^{-3}	0.049	0.042	8.8×10^{-3}	3.1×10^{-4}
Totals			220	2.5×10^{3}	4.4×10^{4}	150	4.7	21	50	2.4	6.2

Table C.2-11. Summary of annual average non-radiological emissions associated with fuel combustion (continued).

			Category totals			Criteria pollutants					
Alternative and project	Description	Years Units	Criteria (ton/year)	Toxic (lbs/year)	Carbon dioxide[b] (ton/year)	Sulfur dioxide (ton/year)	Respirable particulates (ton/year)	Carbon monoxide (ton/year)	Oxides of nitrogen (ton/year)	Volatile organic compounds (ton/year)	Lead (lbs/year)
Planning Basis Option											
P1A	Calcine SBW including. NWCF Upgrades (MACT)	6	33	290	5.2×10^{3}	17	0.73	5.8	8.6	0.90	0.73
P1B	NGLWM and TF Waste Heel Waste	21	19	230	4.1×10^{3}	14	0.38	1.0	3.9	0.056	0.58
P59A	Calcine Retrieval and Transport – Planning Basis	16	5.9	73	1.3×10^{3}	4.3	0.12	0.30	1.2	0.015	0.18
P23A	Full Separations	16	180	2.1×10^{3}	3.7×10^{4}	120	3.8	14	39	1.5	5.2
P23B	Vitrifcation Plant	15	14	140	2.5×10^{3}	8.1	0.29	1.7	3.2	0.23	0.34
P23C	Class A Grout Plant	16	13	130	2.4×10^{3}	7.8	0.28	1.7	3.1	0.23	0.33
P24	Vitrified Product Interim Storage	47	-	-	-	-	-	-	-	-	-
P18	New Analytical Lab	21	2.5	27	480	1.6	0.051	0.24	0.55	0.03	0.067
P118	Process Organic Incinerator – Planning Basis	16	0.047	0.053	1.0	3.3×10^{-3}	1.2×10^{-3}	0.021	0.018	4.0×10^{-3}	1.3×10^{-4}
P133	Waste Pilot Plant – Plan Basis	22	19	240	4.2×10^{3}	14	0.39	1.0	3.9	0.053	0.59
P35E	Class A Grout Packaging and Loading for Offsite Disposal (Planning Basis)	16	0.11	0.13	2.4	7.8×10^{-3}	2.8×10^{-3}	0.049	0.042	8.8×10^{-3}	3.1×10^{-4}
Totals			290	3.2×10^{3}	5.7×10^{4}	190	60	26	64	3.0	8.1
Transuranic Separations Option											
P59A	Calcine Retrieval and Transport	21	5.9	73	1.3×10^{3}	4.3	0.12	0.30	1.2	0.015	0.18
P49A	TRU-C Separations	21	88	980	1.8×10^{4}	58	1.8	8.1	20	0.93	2.5
P49C	Class C Grout Plant	21	13	130	2.4×10^{3}	7.8	0.28	1.7	3.1	0.23	0.33
P39A	Packaging and Loading TRU at INTEC for Shipment to WIPP	19	-	-	-	-	-	-	-	-	-
P18	New Analytical Lab – Full or TRU Separations	26	2.5	27	480	1.6	0.051	0.24	0.55	0.030	0.067
P118	Separations Organic Incinerator Project	21	.047	0.053	1.0	3.0×10^{-3}	1.2×10^{-3}	0.021	0.018	3.7×10^{-3}	1.3×10^{-4}
P133	Waste Pilot Facility – TRU Separations	27	10	120	2.1×10^{3}	6.9	0.20	0.51	2.0	0.029	0.29
and											
P49D	Class C Grout Packaging and Shipping to INEEL Landfill	21	0.11	0.13	2.4	2.8×10^{-3}	2.8×10^{-3}	0.049	0.042	8.8×10^{-3}	3.1×10^{-4}
P27	Class A/C Grout in New Landfill Facility	21	4.7	5.3	100	0.33	0.12	2.1	1.8	0.37	0.013
Totals			120	1.3×10^{3}	2.4×10^{4}	79	2.6	13	28	1.6	3.3

Table C.2-11. Summary of annual average non-radiological emissions associated with fuel combustion (continued).

Alternative and project	Description	Years Units	Category totals: Criteria (ton/year)	Category totals: Toxic (lbs/year)	Carbon dioxide[b] (ton/year)	Criteria pollutants: Sulfur dioxide (ton/year)	Criteria pollutants: Respirable particulates (ton/year)	Criteria pollutants: Carbon monoxide (ton/year)	Criteria pollutants: Oxides of nitrogen (ton/year)	Criteria pollutants: Volatile organic compounds (ton/year)	Criteria pollutants: Lead (lbs/year)
					Hot Isostatic Pressed Waste Option						
P1A	Calcine SBW incl. NWCF Upgrades (MACT)	6	33	290	5.2×10^{3}	17	0.73	5.8	8.6	0.90	0.73
P1B	NGLWM and TF Waste Heel Waste	21	19	230	4.1×10^{3}	14	0.38	1.0	3.9	0.056	0.58
P18	New Analytical Lab	21	2.5	27	480	1.6	0.051	0.24	0.55	0.03	0.067
P59A	Calcine Retrieval and Transport	21	5.9	73	1.3×10^{3}	4.3	0.12	0.3	1.2	0.015	0.18
P71	Mixing and HIPing	21	36	440	7.9×10^{3}	26	0.74	1.9	7.4	0.10	1.11
P72	HIPed HLW Interim Storage	54	-	-	-	-	-	-	-	-	-
P73A	Packaging and Loading HIPed Waste at INTEC for Shipment to NGR	20	-	-	-	-	-	-	-	-	-
P133	Waste Pilot Facility – HIP	27	0.052	0.059	1.1	3.7×10^{-3}	1.3×10^{-3}	0.023	0.02	4.1×10^{-3}	1.5×10^{-4}
Totals			97	1.1×10^{3}	1.9×10^{4}	63	2.0	9.3	22	1.1	2.7
					Direct Cement Waste Option						
P1A	Calcine SBW including NWCF Upgrades (MACT)	6	33	290	5.2×10^{3}	17	0.73	5.8	8.6	0.9	0.73
P1B	NGLWM and TF Waste Heel Waste	21	19	230	4.1×10^{3}	14	0.38	1.0	3.9	0.056	0.58
P18	New Analytical Lab	21	2.5	27	480	1.6	0.051	0.24	0.55	0.03	0.067
P59A	Calcine Retrieval and Transport	21	5.9	73	1.3×10^{3}	4.3	0.12	0.30	1.2	0.015	0.18
P71	Mixing and HIPing	21	22	270	4.9×10^{3}	16	0.45	1.2	4.6	0.066	0.68
P81	Unseparated Cementitious HLW Interim Storage	54	-	-	-	-	-	-	-	-	-
P83A	Packaging & Loading of Cement Waste at INTEC for Shipment to NGR	20	-	-	-	-	-	-	-	-	-
P133	Waste Pilot Facility – Direct Cement	27	0.052	0.059	1.1	3.7×10^{-3}	1.3×10^{-3}	0.023	0.020	4.1×10^{-3}	1.5×10^{-4}
Totals			83	900	1.6×10^{4}	53	1.7	8.6	19	1.1	2.2
					Early Vitrification Option						
P1C	PEW Evaporator and LET&D Operations	26	4.8	58	1.0×10^{3}	3.4	0.1	0.29	1.0	0.020	0.14
P18	New Analytical Lab	21	2.5	27	480	1.6	0.051	0.24	0.55	0.030	0.067
P59A	Calcine Retrieval and Transport	21	5.9	73	1.3×10^{3}	4.3	0.12	0.30	1.2	0.015	0.18
P61	Vitrified HLW Interim Storage	54	-	-	-	-	-	-	-	-	-
P62A	Packaging/Loading Vitrified HLW at INTEC for Shipment to NGR	20	-	-	-	-	-	-	-	-	-

Table C.2-11. Summary of annual average non-radiological emissions associated with fuel combustion (continued).

			Category totals			Criteria pollutants					
Alternative and project	Description	Years Units	Criteria (ton/year)	Toxic (lbs/year)	Carbon dioxide[b] (ton/year)	Sulfur dioxide (ton/year)	Respirable particulates (ton/year)	Carbon monoxide (ton/year)	Oxides of nitrogen (ton/year)	Volatile organic compounds (ton/year)	Lead (lbs/year)
Early Vitrification Option (continued)											
P88	Early Vitrification with MACT	21	27	330	5.9×10^{3}	19	0.54	1.4	5.4	0.069	0.82
P90A	Packaging & Loading Vitrified SBW at INTEC for Shipment to WIPP	18	-	-	-	-	-	-	-	-	-
P133	Waste Pilot Facility – Early Vitrification	27	0.052	0.059	1.1	3.7×10^{-3}	1.3×10^{-3}	0.023	0.02	4.1×10^{-3}	1.5×10^{-4}
Totals			40	490	8.7×10^{3}	29	0.82	2.2	8.2	0.14	1.2
Minimum INEEL Processing Alternative											
P1C	PEW Evaporator and LET&D Operations	26	4.8	58	1.0×10^{3}	3.4	0.10	0.29	1.0	0.020	0.14
P18	New Analytical Lab	21	2.5	27	480	1.6	0.051	0.24	0.55	0.03	0.067
P24	Vitrified Product Interim Storage	47	-	-	-	-	-	-	-	-	-
P27	Class A/C Grout in New Landfill Facility	21	4.7	5.3	100	0.33	0.12	2.1	1.8	0.37	0.013
P111	SBW Treatment with CsIX	17	2.1	24	430	1.4	0.043	0.14	0.44	0.013	0.061
P112A	Packaging and Loading CH-TRU for Transport to WIPP	17	-	-	-	-	-	-	-	-	-
P133	Waste Pilot Facility – Minimum INEEL Processing	17	5.8	71	1.3×10^{3}	4.2	0.12	0.32	1.2	0.019	0.18
and											
P59A	Calcine Retrieval and Transport – Minimum INEEL Processing	15	5.9	73	1.3×10^{3}	4.3	0.12	0.30	1.2	0.015	0.18
P117A	Packaging & Loading Calcine for Transport to Hanford	15	3.1	37	670	2.2	0.062	0.16	0.63	0.010	0.093
or											
P59B	Calcine Retrieval and Transport - JIT	2	-	-	-	-	-	-	-	-	-
P117B	Packaging & Loading Calcine for JIT Transport to Hanford	2	3.4	38	670	2.2	0.071	0.31	0.75	0.036	0.094
Totals			29	300	5.3×10^{3}	17	0.61	3.5	6.8	0.48	0.74

a. Emissions are from project data summaries and backup documentation.
b. Carbon dioxide has been associated with potential global warming.
c. Project is not expected to result in any usage of diesel fuel.

Table C.2-12. Projected emission rates (pounds per hour) of toxic air pollutants from combustion of fossil fuels to support waste processing operations.

				Separations Alternative			Non-Separations Alternative			Minimum INEEL Processing Alternative
Pollutant	Screening emission level[a]	No Action Alternative	Continued Current Operations Alternative	Full Separations Option	Planning Basis Option	Transuranic Separations Option	Hot Isostatic Pressed Waste Option	Direct Cement Waste Option	Early Vitrification Option	At INEEL
Carcinogens										
Arsenic	1.5×10^{-6}	9.6×10^{-5}	1.5×10^{-4}	6.2×10^{-4}	8.1×10^{-4}	3.3×10^{-4}	2.7×10^{-4}	2.2×10^{-4}	1.2×10^{-4}	7.4×10^{-5}
Benzene	8.0×10^{-4}	1.6×10^{-5}	2.5×10^{-5}	1.0×10^{-4}	1.3×10^{-4}	5.4×10^{-5}	4.3×10^{-5}	3.6×10^{-5}	2.0×10^{-5}	1.2×10^{-5}
Beryllium	2.8×10^{-5}	2.0×10^{-6}	3.2×10^{-6}	1.3×10^{-5}	1.7×10^{-5}	7.0×10^{-6}	5.6×10^{-6}	4.7×10^{-6}	2.6×10^{-6}	1.6×10^{-6}
Cadmium	3.7×10^{-6}	2.9×10^{-5}	4.6×10^{-5}	1.9×10^{-4}	2.4×10^{-4}	1.0×10^{-4}	8.0×10^{-5}	6.7×10^{-5}	3.7×10^{-5}	2.2×10^{-5}
Chromium (hexavalent)	5.6×10^{-7}	1.8×10^{-5}	2.9×10^{-5}	1.2×10^{-4}	1.5×10^{-4}	6.3×10^{-5}	5.0×10^{-5}	4.2×10^{-5}	2.3×10^{-5}	1.4×10^{-5}
Formaldehyde	5.1×10^{-4}	2.4×10^{-3}	3.9×10^{-3}	0.016	0.02	8.3×10^{-3}	6.6×10^{-3}	5.6×10^{-3}	3.0×10^{-3}	1.8×10^{-3}
Nickel	2.7×10^{-5}	6.2×10^{-3}	9.9×10^{-3}	0.04	0.052	0.021	0.017	0.014	7.8×10^{-3}	4.7×10^{-3}
Polycyclic Aromatic Hydrocarbons	1.5×10^{-10}	9.6×10^{-7}	1.5×10^{-6}	6.2×10^{-6}	8.0×10^{-6}	3.3×10^{-6}	2.6×10^{-6}	2.2×10^{-6}	1.2×10^{-6}	7.3×10^{-7}
Noncarcinogens										
Antimony	0.033	3.8×10^{-4}	6.1×10^{-4}	2.5×10^{-3}	3.2×10^{-3}	1.6×10^{-3}	1.1×10^{-3}	8.9×10^{-4}	4.8×10^{-4}	2.9×10^{-4}
Barium	0.033	1.9×10^{-4}	3.0×10^{-4}	1.2×10^{-3}	1.3×10^{-3}	6.5×10^{-4}	5.2×10^{-4}	4.3×10^{-4}	2.4×10^{-4}	1.4×10^{-4}
Chloride	0.20	0.025	0.041	0.16	0.21	0.088	0.070	0.059	0.032	0.019
Chromium (total)	0.033	6.2×10^{-5}	9.9×10^{-5}	4.0×10^{-4}	5.2×10^{-4}	2.1×10^{-4}	1.7×10^{-4}	1.4×10^{-4}	7.8×10^{-5}	4.7×10^{-5}
Cobalt	3.3×10^{-3}	4.4×10^{-4}	7.0×10^{-4}	2.8×10^{-3}	3.7×10^{-3}	1.5×10^{-3}	1.2×10^{-3}	1.0×10^{-3}	5.5×10^{-4}	3.4×10^{-4}
Copper	0.013	1.3×10^{-4}	2.1×10^{-4}	8.3×10^{-4}	1.0×10^{-3}	4.4×10^{-4}	3.5×10^{-4}	3.0×10^{-4}	1.6×10^{-4}	9.8×10^{-5}
Ethyl benzene	29	4.8×10^{-6}	7.7×10^{-6}	3.1×10^{-5}	4.0×10^{-5}	1.7×10^{-5}	1.3×10^{-5}	1.1×10^{-5}	6.0×10^{-6}	3.7×10^{-6}
Fluoride	0.17	2.7×10^{-3}	4.4×10^{-3}	0.018	0.023	9.4×10^{-3}	7.5×10^{-3}	6.3×10^{-3}	3.4×10^{-3}	2.1×10^{-3}
Lead	-	1.1×10^{-4}	1.8×10^{-4}	7.1×10^{-4}	9.2×10^{-4}	3.8×10^{-4}	3.1×10^{-4}	2.6×10^{-4}	1.4×10^{-4}	8.4×10^{-5}
Manganese	0.33	2.2×10^{-4}	3.5×10^{-4}	1.4×10^{-3}	1.7×10^{-8}	7.6×10^{-4}	6.0×10^{-4}	5.1×10^{-4}	2.8×10^{-4}	1.7×10^{-4}
Mercury	3.0×10^{-3}	8.2×10^{-6}	1.3×10^{-5}	5.3×10^{-5}	6.9×10^{-5}	2.9×10^{-5}	2.3×10^{-5}	1.9×10^{-5}	1.0×10^{-5}	6.3×10^{-6}
Molybdenum	0.33	5.7×10^{-5}	9.2×10^{-5}	3.7×10^{-4}	4.8×10^{-4}	2.0×10^{-4}	1.6×10^{-4}	1.3×10^{-4}	7.2×10^{-5}	4.4×10^{-5}
Naphthalene	3.3	8.2×10^{-5}	1.3×10^{-4}	5.3×10^{-4}	6.9×10^{-4}	2.9×10^{-4}	2.3×10^{-4}	1.9×10^{-4}	1.0×10^{-4}	6.3×10^{-5}
Phosphorus	7.0×10^{-3}	6.9×10^{-4}	1.1×10^{-3}	4.5×10^{-3}	5.8×10^{-3}	2.4×10^{-3}	1.9×10^{-3}	1.6×10^{-3}	8.7×10^{-4}	5.3×10^{-4}
Selenium	0.013	5.0×10^{-5}	8.0×10^{-5}	3.2×10^{-4}	4.2×10^{-4}	1.7×10^{-4}	1.4×10^{-4}	1.2×10^{-4}	6.3×10^{-5}	3.8×10^{-5}
Toluene	25	4.5×10^{-4}	7.2×10^{-4}	2.9×10^{-3}	3.8×10^{-3}	1.6×10^{-3}	1.2×10^{-3}	1.0×10^{-3}	5.7×10^{-4}	3.5×10^{-4}

Table C.2-12. (continued).

Pollutant	Screening emission level[a]	No Action Alternative	Continued Current Operations Alternative	Separations Alternative: Full Separations Option	Separations Alternative: Planning Basis Option	Separations Alternative: Transuranic Separations Option	Non-Separations Alternative: Hot Isostatic Pressed Waste Option	Non-Separations Alternative: Direct Cement Waste Option	Non-Separations Alternative: Early Vitrification Option	Minimum INEEL Processing Alternative: At INEEL
Noncarcinogens (continued)										
1,1,1-Trichloroethane (methyl chloroform)	130	1.7×10^{-5}	2.8×10^{-5}	1.1×10^{-4}	1.4×10^{-4}	6.0×10^{-5}	4.8×10^{-5}	4.1×10^{-5}	2.2×10^{-5}	1.3×10^{-5}
Vanadium	3.3×10^{-3}	2.3×10^{-3}	3.7×10^{-3}	0.015	0.019	8.0×10^{-3}	6.4×10^{-3}	5.4×10^{-3}	2.9×10^{-3}	1.8×10^{-3}
Xylene	29	8.0×10^{-6}	1.3×10^{-5}	5.1×10^{-5}	6.6×10^{-5}	2.8×10^{-5}	2.2×10^{-5}	1.8×10^{-5}	1.0×10^{-5}	6.1×10^{-6}
Zinc	0.067	2.1×10^{-3}	3.4×10^{-3}	0.014	0.018	7.4×10^{-3}	5.9×10^{-3}	4.9×10^{-3}	2.7×10^{-3}	1.6×10^{-3}

a. Screening emission level listed in Rules for Control of Air Pollution in Idaho (IDHW 1997). Proposed new source emission rates exceeding these levels should be assessed for potential impacts on human health.

Table C.2-13. Projected emission rates (pounds per hour) of toxic air pollutants from chemical processing operations.[a]

				Separations Alternative			Non-Separations Alternative			Minimum INEEL Processing Alternative
Pollutant	Screening emission level[b]	No Action Alternative	Continued Current Operations Alternative	Full Separations Option	Planning Basis Option	Transuranic Separations Option	Hot Isostatic Pressed Waste Option	Direct Cement Waste Option	Early Vitrification Option	At INEEL
Carcinogens										
Acetaldehyde	3.0×10^{-3}	-	4.1×10^{-7}	3.0×10^{-9}	4.1×10^{-7}	3.0×10^{-9}	4.2×10^{-7}	4.1×10^{-7}	2.6×10^{-9}	-
Arsenic	1.5×10^{-6}	-	-	3.4×10^{-9}	3.4×10^{-9}	3.4×10^{-9}	7.8×10^{-9}	3.8×10^{-13}	2.9×10^{-9}	-
Benzene	8.0×10^{-4}	-	5.0×10^{-7}	1.8×10^{-9}	5.0×10^{-7}	1.8×10^{-9}	5.0×10^{-7}	5.0×10^{-7}	6.0×10^{-7}	-
Benzo(a)pyrene	1.5×10^{-10}	-	2.8×10^{-9}	5.2×10^{-11}	2.9×10^{-9}	5.2×10^{-11}	2.9×10^{-9}	2.8×10^{-9}	1.2×10^{-6}	-
Beryllium	2.8×10^{-5}	-	6.2×10^{-12}	2.3×10^{-11}	2.9×10^{-11}	2.3×10^{-11}	5.9×10^{-11}	6.2×10^{-12}	2.6×10^{-11}	-
1,3-Butadiene	2.4×10^{-5}	-	2.1×10^{-8}	1.5×10^{-10}	2.1×10^{-8}	1.5×10^{-10}	2.1×10^{-8}	2.1×10^{-8}	1.3×10^{-10}	-
Cadmium	3.7×10^{-6}	-	-	3.9×10^{-8}	3.9×10^{-8}	3.9×10^{-8}	9.0×10^{-8}	4.3×10^{-12}	3.4×10^{-8}	7.3×10^{-9}
Carbon tetrachloride	4.4×10^{-4}	-	1.3×10^{-9}	4.9×10^{-12}	1.3×10^{-9}	4.9×10^{-12}	1.3×10^{-9}	1.3×10^{-9}	6.0×10^{-7}	-
Chloroform	2.8×10^{-4}	-	1.3×10^{-9}	4.9×10^{-12}	1.3×10^{-9}	4.9×10^{-12}	1.3×10^{-9}	1.3×10^{-9}	6.0×10^{-7}	-
Chromium (hexavalent)	5.6×10^{-7}	-	-	8.1×10^{-10}	8.1×10^{-10}	8.1×10^{-10}	1.9×10^{-9}	9.0×10^{-14}	6.9×10^{-10}	1.4×10^{-10}
1,2-Dichloroethane	2.5×10^{-4}	-	1.3×10^{-9}	4.9×10^{-12}	1.3×10^{-9}	4.9×10^{-12}	1.3×10^{-9}	1.3×10^{-9}	6.0×10^{-7}	-
Dioxins and furans	1.5×10^{-10}	-	3.1×10^{-11}	5.6×10^{-13}	3.2×10^{-11}	5.6×10^{-13}	3.2×10^{-11}	3.1×10^{-11}	4.9×10^{-13}	-
Formaldehyde	5.1×10^{-4}	-	6.3×10^{-7}	4.7×10^{-9}	6.3×10^{-7}	4.7×10^{-9}	6.4×10^{-7}	6.3×10^{-7}	5.3×10^{-7}	-
Hydrazine	2.3×10^{-6}	-	4.6×10^{-8}	3.4×10^{-10}	4.6×10^{-8}	3.4×10^{-10}	4.7×10^{-8}	4.6×10^{-8}	2.1×10^{-5}	-
Methylene chloride	1.6×10^{-3}	-	1.3×10^{-9}	4.9×10^{-12}	1.3×10^{-9}	4.9×10^{-12}	1.3×10^{-9}	1.3×10^{-9}	6.0×10^{-7}	-
Nickel	2.7×10^{-5}	-	-	2.0×10^{-8}	2.0×10^{-8}	2.0×10^{-8}	4.7×10^{-8}	2.3×10^{-12}	1.8×10^{-8}	3.3×10^{-9}
Polycyclic aromatic hydrocarbons	1.5×10^{-10}	-	2.1×10^{-8}	3.6×10^{-10}	2.2×10^{-8}	3.6×10^{-10}	2.3×10^{-8}	2.2×10^{-8}	3.1×10^{-10}	-
Paradioxane	0.71	-	1.0×10^{-6}	1.1×10^{-8}	1.0×10^{-6}	1.1×10^{-8}	1.0×10^{-6}	1.0×10^{-6}	4.6×10^{-4}	-
Perchloroethylene	9.1×10^{-5}	-	1.3×10^{-9}	4.9×10^{-12}	1.3×10^{-9}	4.9×10^{-12}	1.3×10^{-9}	1.3×10^{-9}	6.0×10^{-7}	-
Thiourea	1.2×10^{-5}	-	5.6×10^{-11}	2.0×10^{-9}	2.1×10^{-9}	2.0×10^{-9}	4.8×10^{-9}	1.2×10^{-9}	2.7×10^{-8}	-
1,1,2-Trichloroethane	4.2×10^{-4}	-	1.3×10^{-9}	9.8×10^{-12}	1.3×10^{-9}	9.8×10^{-12}	1.3×10^{-9}	1.3×10^{-9}	6.0×10^{-7}	-
Trichloroethylene	5.1×10^{-4}	-	1.3×10^{-9}	9.8×10^{-12}	1.3×10^{-9}	9.8×10^{-12}	1.3×10^{-9}	1.3×10^{-9}	6.0×10^{-7}	-
Noncarcinogens										
Acetonitrile	4.5	-	1.3×10^{-8}	4.7×10^{-11}	1.3×10^{-8}	4.7×10^{-11}	1.3×10^{-8}	1.3×10^{-8}	5.8×10^{-6}	-
Acrolein	0.017	-	4.9×10^{-8}	3.6×10^{-10}	4.9×10^{-8}	3.6×10^{-10}	5.0×10^{-8}	4.9×10^{-8}	3.1×10^{-10}	-
Antimony	0.033	-	8.7×10^{-10}	3.2×10^{-10}	1.2×10^{-9}	3.2×10^{-10}	1.6×10^{-9}	8.7×10^{-10}	1.2×10^{-9}	-
Barium	0.033	-	-	1.4×10^{-9}	1.4×10^{-9}	1.4×10^{-9}	3.2×10^{-9}	1.6×10^{-13}	1.2×10^{-9}	-
Bromoform	0.33	-	1.3×10^{-9}	4.9×10^{-12}	1.3×10^{-9}	4.9×10^{-12}	1.3×10^{-9}	1.3×10^{-9}	6.0×10^{-7}	-

Table C.2-13. Projected emission rates (pounds per hour) of toxic air pollutants from chemical processing operations (continued).

				Separations Alternative			Non-Separations Alternative			Minimum INEEL Processing Alternative
Pollutant	Screening emission level[b]	No Action Alternative	Continued Current Operations Alternative	Full Separations Option	Planning Basis Option	Transuranic Separations Option	Hot Isostatic Pressed Waste Option	Direct Cement Waste Option	Early Vitrification Option	At INEEL
Noncarcinogens (continued)										
Carbon disulfide	2.0	-	1.1×10^{-7}	7.9×10^{-10}	1.1×10^{-7}	7.9×10^{-10}	1.1×10^{-7}	1.1×10^{-7}	4.9×10^{-5}	-
Chloride	0.2	-	0.030	2.5×10^{-5}	0.030	2.5×10^{-5}	0.030	0.030	0.010	0.010
Chlorobenzene	23	-	1.3×10^{-9}	4.9×10^{-12}	1.3×10^{-9}	4.9×10^{-12}	1.3×10^{-9}	1.3×10^{-9}	6.0×10^{-7}	-
Chromium (total)	0.033	-	-	2.7×10^{-8}	2.7×10^{-8}	2.7×10^{-8}	6.3×10^{-8}	3.0×10^{-12}	2.3×10^{-8}	4.6×10^{-9}
Cobalt	3.3×10^{-3}	-	-	-	-	-	-	-	-	-
Copper	0.013	-	-	-	-	-	-	-	-	-
Diethyl phthalate	0.33	-	3.6×10^{-10}	6.6×10^{-12}	3.7×10^{-10}	6.6×10^{-12}	3.8×10^{-10}	3.6×10^{-10}	1.6×10^{-7}	-
Di-n-butyl phthalate	0.33	-	5.1×10^{-11}	9.4×10^{-13}	5.2×10^{-11}	9.4×10^{-13}	5.3×10^{-11}	5.2×10^{-11}	2.3×10^{-8}	-
di-n-octyl phthalate	0.33	-	5.1×10^{-13}	1.9×10^{-11}	2.0×10^{-11}	1.9×10^{-11}	4.4×10^{-11}	1.1×10^{-11}	2.5×10^{-10}	-
2,4-Dinitrophenol,	-	-	2.2×10^{-8}	2.4×10^{-10}	2.2×10^{-8}	2.4×10^{-10}	2.3×10^{-8}	2.2×10^{-8}	1.0×10^{-5}	-
Ethyl benzene	29	-	-	-	-	-	-	-	-	-
Fluoride	0.17	-	0.060	1.0×10^{-3}	0.060	1.0×10^{-3}	0.060	0.060	0.060	2.7×10^{-8}
Lead	-	-	9.6×10^{-8}	3.5×10^{-8}	1.3×10^{-7}	3.5×10^{-8}	1.8×10^{-7}	9.6×10^{-8}	1.3×10^{-7}	6.4×10^{-9}
Manganese	0.33	-	-	-	-	-	-	-	-	-
Mercury	3.0×10^{-3}	-	1.4×10^{-6}	5.4×10^{-5}	5.5×10^{-5}	5.4×10^{-5}	1.2×10^{-4}	3.0×10^{-5}	4.6×10^{-5}	5.0×10^{-9}
Methyl ethyl ketone	39	-	4.6×10^{-8}	1.7×10^{-10}	4.6×10^{-8}	1.7×10^{-10}	4.6×10^{-8}	4.6×10^{-8}	2.1×10^{-5}	-
Molybdenum	0.33	-	-	-	-	-	-	-	-	-
Naphthalene	3.3	-	4.8×10^{-8}	5.3×10^{-10}	4.9×10^{-8}	5.3×10^{-10}	4.9×10^{-8}	4.8×10^{-8}	1.2×10^{-6}	-
Pentachlorophenol	0.023	-	2.7×10^{-9}	5.0×10^{-11}	2.8×10^{-9}	5.0×10^{-11}	2.8×10^{-9}	2.7×10^{-9}	1.2×10^{-6}	-
Phenol	1.3	-	4.6×10^{-8}	6.8×10^{-10}	4.7×10^{-8}	6.8×10^{-10}	4.8×10^{-8}	4.6×10^{-8}	2.1×10^{-5}	-
Phosphorus	7.0×10^{-3}	-	-	-	-	-	-	-	-	-
Propylene (propene)	-	-	1.4×10^{-6}	1.0×10^{-8}	1.4×10^{-6}	1.0×10^{-8}	1.4×10^{-6}	1.4×10^{-6}	8.7×10^{-9}	-
Pyridine	1.0	-	3.9×10^{-6}	7.2×10^{-8}	4.0×10^{-6}	7.2×10^{-8}	4.1×10^{-6}	3.9×10^{-6}	2.0×10^{-3}	-
Selenium	0.013	-	4.3×10^{-10}	1.6×10^{-10}	5.9×10^{-10}	1.6×10^{-10}	7.9×10^{-10}	4.3×10^{-10}	5.7×10^{-10}	-
Silver	1.0×10^{-3}	-	-	5.3×10^{-10}	5.3×10^{-10}	5.3×10^{-10}	1.2×10^{-9}	5.8×10^{-14}	4.5×10^{-10}	6.0×10^{-11}
Thallium	7.0×10^{-3}	-	4.4×10^{-10}	1.6×10^{-9}	2.0×10^{-9}	1.6×10^{-9}	4.2×10^{-9}	4.4×10^{-10}	1.8×10^{-9}	-
Toluene	25	-	2.2×10^{-7}	8.1×10^{-10}	2.2×10^{-7}	8.1×10^{-10}	2.2×10^{-7}	2.2×10^{-7}	6.0×10^{-7}	-
1,2,4-Trichlorobenzene	2.5	-	8.1×10^{-11}	3.0×10^{-11}	1.1×10^{-10}	3.0×10^{-11}	1.5×10^{-10}	9.8×10^{-11}	3.7×10^{-8}	-

Table C.2-13. Projected emission rates (pounds per hour) of toxic air pollutants from chemical processing operations (continued).

Pollutant	Screening emission level[b]	No Action Alternative	Continued Current Operations Alternative	Separations Alternative: Full Separations Option	Separations Alternative: Planning Basis Option	Separations Alternative: Transuranic Separations Option	Non-Separations Alternative: Hot Isostatic Pressed Waste Option	Non-Separations Alternative: Direct Cement Waste Option	Non-Separations Alternative: Early Vitrification Option	Minimum INEEL Processing Alternative: At INEEL
Noncarcinogens (continued)										
1,1,1-Trichloroethane (methyl chloroform)	130	-	1.3×10^{-9}	9.8×10^{-12}	1.3×10^{-9}	9.8×10^{-12}	1.3×10^{-9}	1.3×10^{-9}	6.0×10^{-7}	-
Vanadium	3.0×10^{-3}	-	-	-	-	-	-	-	-	-
Xylene	29	-	1.5×10^{-7}	5.6×10^{-10}	1.5×10^{-7}	5.6×10^{-10}	1.5×10^{-7}	1.5×10^{-7}	4.8×10^{-10}	-
Zinc	0.067	-	-	-	-	-	-	-	-	-
Others										
Carbon dioxide	-	-	-	450	450	450	-	-	-	-
Carbon monoxide	-	-	0.19	2.0×10^{-3}	0.19	2.0×10^{-3}	0.20	0.19	0.28	-
Oxides of nitrogen	-	-	3.9	2.9	6.8	2.9	16	3.9	0.76	-
Particulate matter	-	-	1.5×10^{-6}	5.2×10^{-5}	5.4×10^{-5}	5.2×10^{-5}	1.2×10^{-4}	3.1×10^{-5}	4.7×10^{-5}	-
Sulfur dioxide	-	-	9.8	8.3	18	8.3	9.8	9.8	4.8	-
Total hydrocarbons	-	-	6.1×10^{-6}	8.8×10^{-8}	6.2×10^{-6}	8.8×10^{-8}	6.3×10^{-6}	6.1×10^{-6}	2.0×10^{-3}	-

a. Chemical process emissions do not include emissions formed by combustion of fossil fuels (see previous table).
b. Screening emission level listed in Rules for Control of Air Pollution in Idaho (IDHW 1997). Proposed new source emission rates exceeding these levels should be assessed for potential impacts on human health.

Table C.2-14. Cumulative impacts at public access locations of criteria pollutant emissions for project alternatives.

Pollutant	Averaging time	Impact of alternative (micrograms per cubic meter) Site boundary	Impact of alternative Public roads	Impact of alternative Craters of the Moon	Cumulative impact (micrograms per cubic meter)[a,b] Site boundary	Cumulative impact Public roads	Cumulative impact Craters of the Moon	Percent of standard Site boundary	Percent of standard Public roads	Percent of standard Craters of the Moon
No Action Alternative										
Carbon monoxide	1-hour	0.50	1.1	0.030	210	420	12	0.50	1.0	0.030
	8-hour	0.22	0.47	0.010	78	66	4.2	0.80	0.70	0.040
Nitrogen dioxide	Annual	0.02	0.06	1.0×10^{-3}	0.48	1.3	0.060	0.50	1.3	0.060
Sulfur dioxide	3-hour	5.1	9.2	0.30	29	48	4.0	2.2	3.7	0.30
	24-hour	1.1	2.2	0.070	6.4	12	1.3	1.8	3.3	0.40
	Annual	0.060	0.20	4.0×10^{-3}	0.20	0.65	0.020	0.30	0.8	0.030
Respirable particulates[c]	24-hour	0.030	0.060	2.0×10^{-3}	12	24	1.0	7.8	16	0.60
	Annual	2.0×10^{-3}	6.0×10^{-3}	1.2×10^{-4}	0.49	1.8	0.040	1.0	3.5	0.10
Lead	Quarterly	1.1×10^{-6}	3.0×10^{-6}	1.1×10^{-7}	2.3×10^{-4}	5.0×10^{-4}	5.5×10^{-5}	0.020	0.030	4.0×10^{-3}
Continued Current Operations Alternative										
Carbon monoxide	1-hour	3.1	8.7	0.63	210	430	13	0.50	1.1	0.030
	8-hour	1.3	3.2	0.11	79	69	4.3	0.80	0.70	0.040
Nitrogen dioxide	Annual	0.06	0.15	6.0×10^{-3}	0.50	1.4	0.06	0.50	1.4	0.060
Sulfur dioxide	3-hour	9.4	17	1.0	33	55	4.8	2.5	4.2	0.40
	24-hour	2.0	3.9	0.24	7.3	14	1.5	2.0	3.8	0.40
	Annual	0.15	0.39	0.010	0.29	0.8	0.030	0.40	1.0	0.040
Respirable particulates	24-hour	0.070	0.15	5.0×10^{-3}	12	25	1.0	7.9	16	0.60
	Annual	3.0×10^{-3}	0.010	2.4×10^{-4}	0.49	1.8	0.040	1.0	3.5	0.090
Lead	Quarterly	1.8×10^{-6}	4.9×10^{-6}	1.7×10^{-7}	2.3×10^{-4}	5.0×10^{-4}	5.5×10^{-5}	0.020	0.03	4.0×10^{-3}
Full Separations Option										
Carbon monoxide	1-hour	8.0	22	1.4	214	440	14	0.50	1.1	0.030
	8-hour	3.4	8.2	0.30	82	74	4.5	0.80	0.70	0.040
Nitrogen dioxide	Annual	0.16	0.47	0.01	0.62	1.7	0.070	0.6	1.7	0.070
Sulfur dioxide	3-hour	36	63	2.1	59	101	5.9	4.5	7.8	0.50
	24-hour	7.4	15	0.49	13	25	1.7	3.5	6.8	0.50
	Annual	0.49	1.4	0.030	0.63	1.8	0.050	0.80	2.3	0.060
Respirable particulates	24-hour	0.23	0.50	0.020	12	25	1.0	8.0	17	0.60
	Annual	0.010	0.040	8.6×10^{-4}	0.50	1.8	0.04	1.0	3.6	0.090
Lead	Quarterly	7.2×10^{-6}	2.0×10^{-5}	6.8×10^{-7}	2.4×10^{-4}	5.1×10^{-4}	5.6×10^{-5}	0.020	0.030	4.0×10^{-3}
Planning Basis Option										
Carbon monoxide	1-hour	10	27	1.7	220	450	14	0.50	1.1	0.040
	8-hour	4.2	10	0.33	82	76	4.5	0.80	0.80	0.050
Nitrogen dioxide	Annual	0.19	0.58	0.020	0.70	1.8	0.070	0.70	1.8	0.070
Sulfur dioxide	3-hour	42	76	3.2	66	110	6.9	5.0	8.8	0.50
	24-hour	8.9	18	0.77	14	28	2.0	3.9	7.7	0.60
	Annual	0.57	1.7	0.040	0.70	2.1	0.060	0.90	2.6	0.080
Respirable particulates	24-hour	0.28	0.61	0.020	12	25	1.0	8.0	17	0.70
	Annual	0.020	0.050	1.0×10^{-3}	0.51	1.8	0.040	1.0	3.6	0.090
Lead	Quarterly	8.7×10^{-6}	2.4×10^{-5}	8.2×10^{-7}	2.4×10^{-4}	5.2×10^{-4}	5.6×10^{-5}	0.020	0.030	4.0×10^{-3}

Table C.2-14. Cumulative impacts at public access locations of criteria pollutant emissions for project alternatives (continued).

Pollutant	Averaging time	Impact of alternative (micrograms per cubic meter)			Cumulative impact (micrograms per cubic meter)[a,b]			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
Transuranic Separations Option										
Carbon monoxide	1-hour	5.1	14	0.96	210	430	13	0.50	1.1	0.030
	8-hour	2.2	5.3	0.18	80	71	4.4	0.80	0.70	0.040
Nitrogen dioxide	Annual	0.10	0.27	7.0×10^{-3}	0.56	1.5	0.06	0.60	1.5	0.060
Sulfur dioxide	3-hour	19	33	1.2	42	71	5.0	3.3	5.5	0.40
	24-hour	3.9	7.8	0.30	9.3	18	1.5	2.5	4.8	0.40
	Annual	0.29	0.74	0.02	0.43	1.2	0.04	0.50	1.5	0.040
Respirable particulates	24-hour	0.12	0.27	9.0×10^{-3}	12	25	1.0	7.9	16	0.60
	Annual	7.0×10^{-3}	0.02	4.5×10^{-4}	0.50	1.8	0.04	1.0	3.5	0.090
Lead	Quarterly	3.6×10^{-6}	9.8×10^{-6}	3.4×10^{-7}	2.3×10^{-4}	5.0×10^{-4}	5.5×10^{-5}	0.020	0.030	4.0×10^{-3}
Hot Isostatic Pressed Waste Option										
Carbon monoxide	1-hour	3.8	10	0.67	210	430	13	0.50	1.1	0.030
	8-hour	1.6	3.8	0.13	80	69	4.3	0.80	0.70	0.040
Nitrogen dioxide	Annual	0.14	0.32	0.020	0.60	1.5	0.070	0.60	1.5	0.070
Sulfur dioxide	3-hour	16	28	1.3	39	66	5.1	3.0	5.0	0.40
	24-hour	3.3	6.7	0.33	8.6	17	1.6	2.4	5.0	0.40
	Annual	0.22	0.63	0.020	0.36	1.1	0.030	0.50	1.4	0.040
Respirable particulates	24-hour	0.10	0.22	7.0×10^{-3}	12	25	1.0	7.9	16	0.64
	Annual	6.0×10^{-3}	0.020	3.8×10^{-4}	0.50	1.8	0.040	1.0	3.5	0.090
Lead	Quarterly	3.1×10^{-6}	8.6×10^{-6}	3.0×10^{-7}	2.3×10^{-4}	5.0×10^{-4}	5.5×10^{-5}	0.020	0.03	4.0×10^{-3}
Direct Cement Waste Option										
Carbon monoxide	1-hour	3.6	10	0.66	210	430	13	0.50	1.1	0.030
	8-hour	1.5	3.6	0.12	80	69	4.3	0.80	0.70	0.040
Nitrogen dioxide	Annual	0.07	0.20	6.0×10^{-3}	0.50	1.4	0.060	0.50	1.4	0.060
Sulfur dioxide	3-hour	13	24	1.2	37	62	5.0	2.8	5.0	0.39
	24-hour	2.8	5.7	0.30	8.2	16	1.5	2.2	4.3	0.40
	Annual	0.20	0.54	0.020	0.34	1.0	0.030	0.40	1.2	0.040
Respirable particulates	24-hour	0.090	0.20	6.0×10^{-3}	12	25	1.0	7.9	16	0.60
	Annual	5.0×10^{-3}	0.020	3.3×10^{-4}	0.49	1.8	0.040	1.0	3.5	0.090
Lead	Quarterly	2.6×10^{-6}	7.3×10^{-6}	2.5×10^{-7}	2.3×10^{-4}	5.0×10^{-4}	5.5×10^{-5}	0.020	0.030	4.0×10^{-3}
Early Vitrification Option										
Carbon monoxide	1-hour	1.4	2.5	0.090	210	421	12	0.50	1.1	0.030
	8-hour	0.41	0.77	0.030	79	66	4.2	0.80	0.70	0.040
Nitrogen dioxide	Annual	0.030	0.090	2.0×10^{-3}	0.50	1.3	0.06	0.50	1.3	0.060
Sulfur dioxide	3-hour	8.2	14	0.54	32	53	4.3	2.4	4.1	0.30
	24-hour	1.7	3.4	0.12	7.1	13	1.4	1.9	3.6	0.40
	Annual	0.14	0.33	9.0×10^{-3}	0.28	0.78	0.030	0.40	1.0	0.030
Respirable particulates	24-hour	0.040	0.080	0.00	12	24	1.0	7.9	16	0.6
	Annual	2.0×10^{-3}	7.0×10^{-3}	1.5×10^{-4}	0.49	1.8	0.040	1.0	3.5	0.090
Lead	Quarterly	1.5×10^{-6}	4.0×10^{-6}	1.4×10^{-7}	2.3×10^{-4}	5.0×10^{-4}	5.5×10^{-5}	0.020	0.030	4.0×10^{-3}

Table C.2-14. Cumulative impacts at public access locations of criteria pollutant emissions for project alternatives (continued).

Pollutant	Averaging time	Impact of alternative (micrograms per cubic meter)			Cumulative impact (micrograms per cubic meter)[a,b]			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
Minimum INEEL Processing Alternative										
Carbon monoxide	1-hour	1.5	4.3	0.31	210	423	13	0.50	1.1	0.030
	8-hour	0.63	1.6	0.060	79	67	4.3	0.80	0.70	0.040
Nitrogen dioxide	Annual	0.020	0.05	1.0×10^{-3}	0.50	1.3	0.060	0.50	1.3	0.060
Sulfur dioxide	3-hour	3.4	6.1	0.18	27	45	4.0	2.1	3.4	0.30
	24-hour	0.71	1.5	0.040	6.0	11	1.3	1.7	3.1	0.35
	Annual	0.040	0.13	3.0×10^{-3}	0.18	0.58	0.020	0.20	0.70	0.020
Respirable particulates	24-hour	0.030	0.06	2.0×10^{-3}	12	24	1.0	7.8	16	0.60
	Annual	1.0×10^{-3}	5.0×10^{-3}	1.0×10^{-4}	0.50	1.8	0.040	1.0	3.5	0.090
Lead	Quarterly	7.2×10^{-7}	2.0×10^{-6}	6.8×10^{-8}	2.3×10^{-4}	5.0×10^{-4}	5.5×10^{-5}	0.020	0.030	4.0×10^{-3}

a. Cumulative impacts are assessed as the sum of the baseline plus the impacts of proposed projects. Baseline and standards are provided in Table C.2-15.
b. This summation is conservative since in most cases the highest concentration for each (baseline and alternative) would occur at different locations.
c. Values do not include contributions of fugitive dust.

Table C.2-16. Summary of maximum toxic air pollutant concentrations at onsite and offsite locations by waste processing alternative.

	Highest percentage of applicable standard and identification of controlling pollutant[a,b]								
			Separations Alternative			Non-Separations Alternative			Minimum INEEL Processing Alternative
Receptor	No Action Alternative	Continued Current Operations Alternative	Full Separations Option	Planning Basis Option	Transuranic Separations Option	Hot Isostatic Pressed Waste Option	Direct Cement Waste Option	Early Vitrification Option	At INEEL
Carcinogens: Maximum impact due to nickel									
INEEL boundary areas	1.8	2.9	12	14	5.8	5.1	4.3	2.4	1.2
Craters of the Moon	0.12	0.19	0.75	0.90	0.37	0.33	0.28	0.15	0.080
INEEL facility area[c]	0.03	0.13	0.30	0.37	0.21	0.14	0.14	0.04	0.060
Noncarcinogens: Maximum impact due to vanadium									
INEEL boundary areas	0.020	0.030	0.14	0.17	0.070	0.060	0.050	0.030	0.010
Craters of the Moon	1.0×10^{-3}	2.0×10^{-3}	8.0×10^{-3}	9.0×10^{-3}	4.0×10^{-3}	3.0×10^{-3}	3.0×10^{-3}	2.0×10^{-3}	8.0×10^{-4}
Public road locations	0.040	0.060	0.26	0.31	0.13	0.11	0.10	0.05	0.03
INEEL facility area[c]	0.02	0.10	0.22	0.28	0.15	0.11	0.10	0.03	0.05

a. Applicable ambient air standards are specified in IDHW (1997) for carcinogenic air pollutants and noncarcinogenic toxic air pollutant increments. It should be noted that these standards apply only to new sources; for existing sources, they are used here as reference values for purposes of comparison.
b. Applicable standard for onsite levels is the 8-hour occupational exposure limit established by either the American Conference of Government Industrial Hygienists or the Occupational Safety and Health Administration; the lower of the two is used.
c. Location of highest onsite impacts is within INTEC.

Table C.2-17. Concentrations of toxic air pollutants (micrograms per cubic meters) at ambient air locations under waste processing alternatives.

Pollutant	Averaging time	Idaho Standard (micrograms per cubic meter)[a]	No Action Alternative	Continued Current Operations Alternative	Separations Alternative: Full Separations Option	Separations Alternative: Planning Basis Option	Separations Alternative: Transuranic Separations Option	Non-Separations Alternative: Hot Isostatic Pressed Waste Option	Non-Separations Alternative: Direct Cement Waste Option	Non-Separations Alternative: Early Vitrification Option	Minimum INEEL Processing Alternative	Maximum concentration as a percent of standard
Maximum Concentrations (micrograms per cubic meter) at or Beyond the Site Boundary												
Carcinogens												
Acetaldehyde	Annual	0.45	-	2.3×10^{-9}	3.8×10^{-11}	2.3×10^{-9}	3.7×10^{-11}	2.3×10^{-9}	2.3×10^{-9}	3.2×10^{-11}	-	<0.001
Arsenic	Annual	2.3×10^{-4}	1.2×10^{-6}	1.9×10^{-6}	7.7×10^{-6}	9.3×10^{-6}	3.8×10^{-6}	3.4×10^{-6}	2.8×10^{-6}	1.6×10^{-6}	7.7×10^{-7}	4.0
Benzene	Annual	0.12	1.9×10^{-7}	3.1×10^{-7}	1.2×10^{-6}	1.5×10^{-6}	6.2×10^{-7}	5.5×10^{-7}	4.6×10^{-7}	2.6×10^{-7}	1.3×10^{-7}	0.001
Benzo(a)pyrene	Annual	3.0×10^{-4}	-	1.5×10^{-11}	6.7×10^{-13}	1.6×10^{-11}	6.5×10^{-13}	1.6×10^{-11}	1.6×10^{-11}	1.5×10^{-8}	-	0.005
Beryllium	Annual	4.0×10^{-3}	2.5×10^{-8}	4.0×10^{-8}	1.6×10^{-7}	2.0×10^{-7}	8.1×10^{-8}	7.1×10^{-8}	6.0×10^{-8}	3.3×10^{-8}	1.6×10^{-8}	0.005
1,3-Butadiene	Annual	4.0×10^{-3}	-	1.2×10^{-10}	1.9×10^{-12}	1.2×10^{-10}	1.9×10^{-12}	1.2×10^{-10}	1.2×10^{-10}	1.6×10^{-12}	-	<0.001
Cadmium	Annual	5.6×10^{-4}	3.6×10^{-7}	5.7×10^{-7}	2.3×10^{-6}	2.8×10^{-6}	1.2×10^{-6}	1.0×10^{-6}	8.5×10^{-7}	4.8×10^{-7}	2.3×10^{-7}	0.5
Carbon tetrachloride	Annual	0.067	-	7.2×10^{-12}	6.3×10^{-14}	7.2×10^{-12}	6.1×10^{-14}	7.2×10^{-12}	7.2×10^{-12}	7.4×10^{-9}	-	<0.001
Chloroform	Annual	0.043	-	7.2×10^{-12}	6.3×10^{-14}	7.2×10^{-12}	6.1×10^{-14}	7.2×10^{-12}	7.2×10^{-12}	7.4×10^{-9}	-	<0.001
Chromium (hexavalent)	Annual	8.3×10^{-5}	2.2×10^{-7}	3.6×10^{-7}	1.4×10^{-6}	1.7×10^{-6}	7.2×10^{-7}	6.3×10^{-7}	5.3×10^{-7}	3.0×10^{-7}	1.4×10^{-7}	2.0
1,2-Dichloroethane	Annual	0.038	-	7.2×10^{-12}	6.3×10^{-14}	7.2×10^{-12}	6.1×10^{-14}	7.2×10^{-12}	7.2×10^{-12}	7.4×10^{-9}	-	<0.001
Dioxins and furans	Annual	2.2×10^{-8}	-	1.7×10^{-13}	7.2×10^{-15}	1.7×10^{-13}	7.0×10^{-15}	1.8×10^{-13}	1.7×10^{-13}	6.1×10^{-15}	-	<0.001
Formaldehyde	Annual	0.077	3.0×10^{-5}	4.7×10^{-5}	1.9×10^{-4}	2.3×10^{-4}	9.6×10^{-5}	8.4×10^{-5}	7.1×10^{-5}	4.0×10^{-5}	1.9×10^{-5}	0.30
Hydrazine	Annual	3.4×10^{-4}	-	2.5×10^{-10}	4.4×10^{-12}	2.6×10^{-10}	4.2×10^{-12}	2.6×10^{-10}	2.5×10^{-10}	2.6×10^{-7}	-	0.08
Methylene chloride	Annual	0.28	-	7.2×10^{-12}	6.3×10^{-14}	7.2×10^{-12}	6.1×10^{-14}	7.2×10^{-12}	7.2×10^{-12}	7.4×10^{-9}	-	<0.001
Nickel	Annual	4.0×10^{-3}	7.6×10^{-5}	1.2×10^{-4}	4.9×10^{-4}	5.9×10^{-4}	2.5×10^{-4}	2.1×10^{-4}	1.8×10^{-4}	1.0×10^{-4}	4.9×10^{-5}	14
Polycyclic aromatic hydrocarbons	Annual	3.0×10^{-4}	5.6×10^{-8}	8.9×10^{-8}	3.6×10^{-7}	4.4×10^{-7}	1.8×10^{-7}	1.6×10^{-7}	1.3×10^{-7}	7.4×10^{-8}	3.6×10^{-8}	0.1
Paradioxane	Annual	0.71	-	-	-	-	-	-	-	-	-	<0.001
Perchloroethylene	Annual	0.014	-	7.2×10^{-12}	6.3×10^{-14}	7.2×10^{-12}	6.1×10^{-14}	7.2×10^{-12}	7.2×10^{-12}	7.4×10^{-9}	-	<0.001
Thiourea	Annual	2.0×10^{-3}	-	3.1×10^{-13}	2.6×10^{-11}	1.1×10^{-11}	2.5×10^{-11}	2.6×10^{-11}	6.4×10^{-12}	3.3×10^{-10}	-	<0.001
1,1,2-Trichloroethane	Annual	0.062	-	7.2×10^{-12}	1.3×10^{-13}	7.2×10^{-12}	1.2×10^{-13}	7.3×10^{-12}	7.2×10^{-12}	7.4×10^{-9}	-	<0.001
Trichloroethylene	Annual	0.077	-	7.2×10^{-12}	1.3×10^{-13}	7.2×10^{-12}	1.2×10^{-13}	7.3×10^{-12}	7.2×10^{-12}	7.4×10^{-9}	-	<0.001
Noncarcinogens												
Acetonitrile	24 Hour	3,350	-	8.8×10^{-10}	7.6×10^{-12}	8.8×10^{-10}	7.2×10^{-12}	8.9×10^{-10}	8.8×10^{-10}	7.4×10^{-7}	-	<0.001
Acrolein	24 Hour	13	-	3.3×10^{-9}	5.8×10^{-11}	3.3×10^{-9}	5.5×10^{-11}	3.4×10^{-9}	3.3×10^{-9}	4.0×10^{-11}	-	<0.001
Antimony	24 Hour	25	8.8×10^{-5}	1.4×10^{-4}	5.7×10^{-4}	6.9×10^{-4}	2.9×10^{-4}	2.5×10^{-4}	2.1×10^{-4}	1.2×10^{-4}	5.8×10^{-5}	0.003
Barium	24 Hour	25	4.3×10^{-5}	7.0×10^{-5}	2.8×10^{-4}	3.4×10^{-4}	1.4×10^{-4}	1.2×10^{-4}	1.0×10^{-4}	5.7×10^{-5}	2.8×10^{-5}	0.001
Bromoform	24 Hour	250	-	8.8×10^{-11}	7.9×10^{-13}	8.8×10^{-11}	7.5×10^{-13}	8.9×10^{-11}	8.8×10^{-11}	7.7×10^{-8}	-	<0.001
Carbon disulfide	24 Hour	1,500	-	7.5×10^{-9}	1.3×10^{-10}	7.5×10^{-9}	1.2×10^{-10}	7.6×10^{-9}	7.5×10^{-9}	6.3×10^{-6}	-	<0.001
Chloride	24 Hour	150	6.0×10^{-3}	0.010	0.040	0.050	0.020	0.020	0.020	0.010	5.0×10^{-3}	0.03
Chlorobenzene	24 Hour	17,500	-	8.8×10^{-11}	7.9×10^{-13}	8.8×10^{-11}	7.5×10^{-13}	8.9×10^{-11}	8.8×10^{-11}	7.7×10^{-8}	-	<0.001
Chromium (total)	24 Hour	25	1.4×10^{-5}	2.3×10^{-5}	9.2×10^{-5}	1.1×10^{-4}	4.6×10^{-5}	4.0×10^{-5}	3.4×10^{-5}	1.9×10^{-5}	4.6×10^{-5}	<0.001
Cobalt	24 Hour	3.0	1.0×10^{-4}	1.6×10^{-4}	6.6×10^{-4}	7.9×10^{-4}	3.3×10^{-4}	2.9×10^{-4}	2.4×10^{-4}	1.3×10^{-4}	3.3×10^{-4}	0.03
Copper	24 Hour	10	3.0×10^{-5}	4.8×10^{-5}	1.9×10^{-4}	2.3×10^{-4}	9.6×10^{-5}	8.4×10^{-5}	7.1×10^{-5}	3.9×10^{-5}	9.6×10^{-5}	0.002
Diethyl phthalate	24 Hour	250	-	2.4×10^{-11}	1.1×10^{-12}	2.5×10^{-11}	1.0×10^{-12}	2.5×10^{-11}	2.5×10^{-11}	2.0×10^{-8}	1.0×10^{-12}	<0.001
Di-n-butyl phthalate	24 Hour	250	-	3.5×10^{-12}	1.5×10^{-13}	3.5×10^{-12}	1.4×10^{-13}	3.6×10^{-12}	3.5×10^{-12}	2.9×10^{-9}	1.4×10^{-13}	<0.001
Di-n-octyl phthalate	24 Hour	250	-	3.5×10^{-14}	3.9×10^{-11}	1.5×10^{-9}	3.7×10^{-11}	1.5×10^{-9}	1.5×10^{-9}	1.3×10^{-6}	3.7×10^{-11}	<0.001

Table C.2-17. Concentrations of toxic air pollutants (micrograms per cubic meters) at ambient air locations under waste processing alternatives (continued).

					Separations Alternative			Non-Separations Alternative				
Pollutant	Averaging time	Idaho Standard (micrograms per cubic meter)[a]	No Action Alternative	Continued Current Operations Alternative	Full Separations Option	Planning Basis Option	Transuranic Separations Option	Hot Isostatic Pressed Waste Option	Direct Cement Waste Option	Early Vitrification Option	Minimum INEEL Processing Alternative	Maximum concentration as a percent of standard
Maximum Concentrations (micrograms per cubic meter) at or Beyond the Site Boundary Noncarcinogens (continued)												
2,4-Dinitrophenol	24 Hour	-	-	1.5×10^{-9}	3.1×10^{-12}	1.3×10^{-12}	2.9×10^{-12}	2.9×10^{-12}	7.1×10^{-13}	3.1×10^{-11}	2.9×10^{-12}	-
Ethyl benzene	24 Hour	22,000	1.1×10^{-6}	1.8×10^{-6}	7.1×10^{-6}	8.6×10^{-6}	3.6×10^{-6}	3.1×10^{-6}	2.6×10^{-6}	1.5×10^{-6}	3.6×10^{-6}	<0.001
Fluoride	24 Hour	125	6.3×10^{-4}	4.0×10^{-3}	4.0×10^{-3}	7.0×10^{-3}	3.0×10^{-3}	4.7×10^{-3}	4.5×10^{-3}	7.7×10^{-3}	2.1×10^{-3}	0.006
Lead	24 Hour	-	2.5×10^{-5}	4.1×10^{-5}	1.6×10^{-4}	2.0×10^{-4}	8.2×10^{-5}	7.2×10^{-5}	6.1×10^{-5}	3.4×10^{-5}	8.2×10^{-5}	-
Manganese	24 Hour	50	5.0×10^{-5}	8.1×10^{-5}	3.3×10^{-4}	3.9×10^{-4}	1.6×10^{-4}	1.4×10^{-4}	1.2×10^{-4}	6.7×10^{-5}	1.6×10^{-4}	<0.001
Mercury	24 Hour	5	1.9×10^{-6}	3.1×10^{-6}	1.6×10^{-5}	1.6×10^{-5}	1.1×10^{-5}	1.1×10^{-5}	5.4×10^{-6}	7.2×10^{-6}	1.1×10^{-5}	<0.001
Methyl ethyl ketone	24 Hour	29,500	-	3.1×10^{-9}	2.7×10^{-11}	3.1×10^{-9}	2.6×10^{-11}	3.1×10^{-9}	3.1×10^{-9}	2.7×10^{-6}	2.6×10^{-11}	<0.001
Molybdenum	24 Hour	250	1.3×10^{-5}	2.1×10^{-5}	8.6×10^{-5}	1.0×10^{-4}	4.3×10^{-5}	3.8×10^{-5}	3.2×10^{-5}	1.8×10^{-5}	4.3×10^{-5}	<0.001
Naphthalene	24 Hour	2,500	1.9×10^{-5}	3.1×10^{-5}	1.2×10^{-4}	1.5×10^{-4}	6.2×10^{-5}	5.4×10^{-5}	4.6×10^{-5}	2.5×10^{-5}	6.2×10^{-5}	<0.001
Pentachlorophenol	24 Hour	25	-	1.8×10^{-10}	8.1×10^{-12}	1.9×10^{-10}	7.7×10^{-12}	1.9×10^{-10}	1.8×10^{-10}	1.5×10^{-7}	7.7×10^{-12}	<0.001
Phenol	24 Hour	950	-	3.1×10^{-9}	1.4×10^{-10}	3.2×10^{-9}	1.3×10^{-10}	3.2×10^{-9}	3.1×10^{-9}	2.7×10^{-6}	1.3×10^{-10}	<0.001
Phosphorus	24 Hour	5	1.6×10^{-4}	2.6×10^{-4}	1.0×10^{-3}	1.2×10^{-3}	5.2×10^{-4}	4.5×10^{-4}	3.8×10^{-4}	2.1×10^{-4}	5.2×10^{-4}	0.02
Propylene (propene)	24 Hour	-	-	9.5×10^{-8}	1.6×10^{-9}	9.6×10^{-8}	1.5×10^{-9}	9.6×10^{-8}	9.5×10^{-8}	1.1×10^{-9}	1.5×10^{-9}	-
Pyridine	24 Hour	750	-	2.6×10^{-7}	1.2×10^{-8}	2.7×10^{-7}	1.1×10^{-8}	2.8×10^{-7}	2.7×10^{-7}	2.3×10^{-4}	1.1×10^{-8}	<0.001
Selenium	24 Hour	10	1.1×10^{-5}	1.8×10^{-5}	7.4×10^{-5}	9.0×10^{-5}	3.7×10^{-5}	3.3×10^{-5}	2.8×10^{-5}	1.5×10^{-5}	3.7×10^{-5}	<0.001
Silver	24 Hour	5	-	-	8.5×10^{-11}	3.6×10^{-11}	8.1×10^{-11}	8.1×10^{-11}	3.9×10^{-15}	5.7×10^{-11}	8.1×10^{-11}	<0.001
Thallium	24 Hour	5	-	3.0×10^{-11}	2.6×10^{-10}	1.4×10^{-10}	2.5×10^{-10}	2.9×10^{-10}	3.0×10^{-11}	2.4×10^{-10}	2.5×10^{-10}	<0.001
Toluene	24 Hour	18,750	1.0×10^{-4}	1.7×10^{-4}	6.8×10^{-4}	8.2×10^{-4}	3.4×10^{-4}	3.0×10^{-4}	2.5×10^{-4}	1.4×10^{-4}	3.4×10^{-4}	<0.001
1,2,4-Trichlorobenzene	24 Hour	1,850	-	5.5×10^{-12}	4.8×10^{-12}	7.5×10^{-12}	4.6×10^{-12}	1.0×10^{-11}	6.6×10^{-12}	4.7×10^{-9}	4.6×10^{-12}	<0.001
1,1,1-Trichloroethane (methyl chloroform)	24 Hour	95,500	4.0×10^{-6}	6.4×10^{-6}	2.6×10^{-5}	3.1×10^{-5}	1.3×10^{-5}	1.1×10^{-5}	9.5×10^{-6}	5.3×10^{-6}	1.3×10^{-5}	<0.001
Vanadium	24 Hour	3	5.3×10^{-4}	8.6×10^{-4}	3.0×10^{-3}	4.0×10^{-3}	1.7×10^{-3}	2.0×10^{-3}	1.0×10^{-3}	7.1×10^{-4}	2.0×10^{-3}	0.2
Xylene	24 Hour	21,750	1.8×10^{-6}	3.0×10^{-6}	1.2×10^{-5}	1.4×10^{-5}	5.9×10^{-6}	5.2×10^{-6}	4.4×10^{-6}	2.4×10^{-6}	5.9×10^{-6}	<0.001
Zinc	24 Hour	500	4.9×10^{-4}	7.9×10^{-4}	3.0×10^{-3}	4.0×10^{-3}	1.6×10^{-3}	1.0×10^{-3}	1.0×10^{-3}	6.5×10^{-4}	2.0×10^{-3}	<0.001
Maximum Concentrations (micrograms per cubic meter) at Public Highways Noncarcinogens[b]												
Acetonitrile	24 Hour	3,350	-	1.0×10^{-9}	7.3×10^{-12}	1.0×10^{-9}	7.2×10^{-12}	1.0×10^{-9}	1.0×10^{-9}	9.4×10^{-7}	-	<0.001
Acrolein	24 Hour	13	-	3.9×10^{-9}	5.6×10^{-11}	3.9×10^{-9}	5.5×10^{-11}	3.9×10^{-9}	3.9×10^{-9}	5.0×10^{-11}	-	<0.001
Antimony	24 Hour	25	1.6×10^{-4}	2.7×10^{-4}	1.0×10^{-3}	1.0×10^{-3}	5.3×10^{-4}	4.7×10^{-4}	3.9×10^{-4}	2.2×10^{-4}	1.1×10^{-4}	0.005
Barium	24 Hour	25	8.0×10^{-5}	1.3×10^{-4}	5.2×10^{-4}	6.3×10^{-4}	2.6×10^{-4}	2.3×10^{-4}	1.9×10^{-4}	1.1×10^{-4}	5.3×10^{-5}	0.003
Bromoform	24 Hour	250	-	1.0×10^{-10}	7.7×10^{-13}	1.0×10^{-10}	7.5×10^{-13}	1.0×10^{-10}	1.0×10^{-10}	9.7×10^{-8}	-	<0.001
Carbon disulfide	24 Hour	1,500	-	8.7×10^{-9}	1.2×10^{-10}	8.8×10^{-9}	1.2×10^{-10}	8.9×10^{-9}	8.7×10^{-9}	7.9×10^{-6}	-	<0.001
Chloride	24 Hour	150	0.01	0.02	0.07	0.09	0.04	0.03	0.03	0.02	8.0×10^{-3}	0.06
Chlorobenzene	24 Hour	17,500	-	1.0×10^{-10}	7.7×10^{-13}	1.0×10^{-10}	7.5×10^{-13}	1.0×10^{-10}	1.0×10^{-10}	9.7×10^{-8}	-	<0.001
Chromium (total)	24 Hour	25	2.6×10^{-5}	4.3×10^{-5}	1.7×10^{-4}	2.1×10^{-4}	8.6×10^{-5}	7.5×10^{-5}	6.3×10^{-5}	3.5×10^{-5}	1.7×10^{-5}	<0.001
Cobalt	24 Hour	3	1.9×10^{-4}	3.0×10^{-4}	1.0×10^{-3}	1.0×10^{-3}	6.1×10^{-4}	5.3×10^{-4}	4.5×10^{-4}	2.5×10^{-4}	1.2×10^{-4}	0.06
Copper	24 Hour	10	5.5×10^{-5}	8.9×10^{-5}	3.6×10^{-4}	4.3×10^{-4}	1.8×10^{-4}	1.6×10^{-4}	1.3×10^{-4}	7.3×10^{-5}	3.6×10^{-5}	0.004
Diethyl phthalate	24 Hour	250	-	2.9×10^{-11}	1.0×10^{-12}	2.9×10^{-11}	1.0×10^{-12}	3.0×10^{-11}	2.9×10^{-11}	2.6×10^{-8}	-	<0.001

Table C.2-17. Concentrations of toxic air pollutants (micrograms per cubic meters) at ambient air locations under waste processing alternatives (continued).

					Separations Alternative			Non-Separations Alternative				
Pollutant	Averaging time	Idaho Standard (micrograms per cubic meter)[a]	No Action Alternative	Continued Current Operations Alternative	Full Separations Option	Planning Basis Option	Transuranic Separations Option	Hot Isostatic Pressed Waste Option	Direct Cement Waste Option	Early Vitrification Option	Minimum INEEL Processing Alternative	Maximum concentration as a percent of standard
Maximum Concentrations (micrograms per cubic meter) at Public Highways												
Noncarcinogens (continued)												
Di-n-butyl phthalate	24 Hour	250	-	4.0×10^{-12}	1.5×10^{-13}	4.1×10^{-12}	1.4×10^{-13}	4.2×10^{-12}	4.1×10^{-12}	3.7×10^{-9}	-	<0.001
Di-n-octyl phthalate	24 Hour	250	-	4.0×10^{-14}	3.7×10^{-11}	1.8×10^{-9}	3.7×10^{-11}	1.8×10^{-9}	1.8×10^{-9}	1.6×10^{-6}	-	<0.001
2,4-Dinitrophenol	24 Hour	-	-	1.7×10^{-9}	3.0×10^{-12}	1.5×10^{-12}	2.9×10^{-12}	3.4×10^{-12}	8.3×10^{-13}	4.0×10^{-11}	-	-
Ethyl benzene	24 Hour	22,000	2.0×10^{-6}	3.3×10^{-6}	1.3×10^{-5}	1.6×10^{-5}	6.7×10^{-6}	5.8×10^{-6}	4.9×10^{-6}	2.7×10^{-6}	1.4×10^{-6}	<0.001
Fluoride	24 Hour	125	1.0×10^{-3}	6.0×10^{-3}	8.0×10^{-3}	0.01	4.0×10^{-3}	7.0×10^{-3}	6.0×10^{-3}	0.01	7.7×10^{-4}	0.009
Lead	24 Hour	-	4.7×10^{-5}	7.6×10^{-5}	3.1×10^{-4}	3.7×10^{-4}	1.5×10^{-4}	1.3×10^{-4}	1.1×10^{-4}	6.2×10^{-5}	3.1×10^{-5}	-
Manganese	24 Hour	50	9.3×10^{-5}	1.5×10^{-4}	6.1×10^{-4}	7.4×10^{-4}	3.1×10^{-4}	2.7×10^{-4}	2.3×10^{-4}	1.2×10^{-4}	6.2×10^{-5}	0.001
Mercury	24 Hour	5	3.5×10^{-6}	5.8×10^{-6}	2.6×10^{-5}	3.0×10^{-5}	1.5×10^{-5}	1.6×10^{-5}	9.6×10^{-6}	1.0×10^{-5}	2.3×10^{-6}	<0.001
Methyl ethyl ketone	24 Hour	29,500	-	3.6×10^{-9}	2.7×10^{-11}	3.7×10^{-9}	2.6×10^{-11}	3.7×10^{-9}	3.7×10^{-9}	3.4×10^{-6}	-	<0.001
Molybdenum	24 Hour	250	2.4×10^{-5}	4.0×10^{-5}	1.6×10^{-4}	1.9×10^{-4}	8.0×10^{-5}	7.0×10^{-5}	5.9×10^{-5}	3.3×10^{-5}	1.6×10^{-5}	<0.001
Naphthalene	24 Hour	2,500	3.5×10^{-5}	5.7×10^{-5}	2.3×10^{-4}	2.8×10^{-4}	1.1×10^{-4}	1.0×10^{-4}	8.5×10^{-5}	4.7×10^{-5}	2.3×10^{-5}	<0.001
Pentachlorophenol	24 Hour	25	-	2.1×10^{-10}	7.8×10^{-12}	2.2×10^{-10}	7.6×10^{-12}	2.2×10^{-10}	2.2×10^{-10}	1.9×10^{-7}	-	<0.001
Phenol	24 Hour	950	-	3.6×10^{-9}	1.4×10^{-10}	3.7×10^{-9}	1.3×10^{-10}	3.8×10^{-9}	3.7×10^{-9}	3.4×10^{-6}	-	<0.001
Phosphorus	24 Hour	5	2.9×10^{-4}	4.8×10^{-4}	1.9×10^{-3}	2.3×10^{-3}	9.6×10^{-4}	8.4×10^{-4}	7.1×10^{-4}	3.9×10^{-4}	2.0×10^{-4}	0.05
Propylene (propene)	24 Hour	-	-	1.1×10^{-7}	1.6×10^{-9}	1.1×10^{-7}	1.5×10^{-9}	1.1×10^{-7}	1.1×10^{-7}	1.4×10^{-9}	-	-
Pyridine	24 Hour	750	-	3.1×10^{-7}	1.1×10^{-8}	3.1×10^{-7}	1.1×10^{-8}	3.2×10^{-7}	3.1×10^{-7}	2.9×10^{-4}	-	<0.001
Selenium	24 Hour	10	2.1×10^{-5}	3.5×10^{-5}	1.4×10^{-4}	1.7×10^{-4}	7.0×10^{-5}	6.1×10^{-5}	5.1×10^{-5}	2.8×10^{-5}	1.4×10^{-5}	0.002
Silver	24 Hour	5	-	-	8.3×10^{-11}	4.2×10^{-11}	8.1×10^{-11}	9.5×10^{-11}	4.6×10^{-15}	7.3×10^{-11}	9.1×10^{-12}	<0.001
Thallium	24 Hour	5	-	3.5×10^{-11}	2.5×10^{-10}	1.6×10^{-10}	2.4×10^{-10}	3.4×10^{-10}	3.5×10^{-11}	3.0×10^{-10}	-	<0.001
Toluene	24 Hour	18,750	1.9×10^{-4}	3.1×10^{-4}	1.3×10^{-3}	1.5×10^{-3}	6.3×10^{-4}	5.5×10^{-4}	4.7×10^{-4}	2.6×10^{-4}	1.3×10^{-4}	<0.001
1,2,4-Trichlorobenzene	24 Hour	1,850	-	6.4×10^{-12}	4.7×10^{-12}	8.8×10^{-12}	4.6×10^{-12}	1.2×10^{-11}	7.8×10^{-12}	6.0×10^{-9}	-	<0.001
1,1,1-Trichloroethane (methyl chloroform)	24 Hour	95,500	7.3×10^{-6}	1.2×10^{-5}	4.8×10^{-5}	5.8×10^{-5}	2.4×10^{-5}	2.1×10^{-5}	1.8×10^{-5}	9.9×10^{-6}	4.9×10^{-6}	<0.001
Vanadium	24 Hour	3	9.9×10^{-4}	2.0×10^{-3}	7.0×10^{-3}	8.0×10^{-3}	3.0×10^{-3}	3.0×10^{-3}	2.0×10^{-3}	1.0×10^{-3}	6.6×10^{-4}	0.3
Xylene	24 Hour	21,750	3.4×10^{-6}	5.5×10^{-6}	2.2×10^{-5}	2.7×10^{-5}	1.1×10^{-5}	9.7×10^{-6}	8.2×10^{-6}	4.5×10^{-6}	2.3×10^{-6}	<0.001
Zinc	24 Hour	500	9.0×10^{-4}	1.0×10^{-3}	6.0×10^{-3}	7.0×10^{-3}	3.0×10^{-3}	3.0×10^{-3}	2.0×10^{-3}	1.0×10^{-3}	6.0×10^{-4}	0.001
Maximum Concentrations (micrograms per cubic meter) at Craters of the Moon												
Carcinogens												
Acetaldehyde	Annual	0.45	-	3.8×10^{-10}	3.0×10^{-12}	3.8×10^{-10}	3.0×10^{-12}	3.8×10^{-10}	3.8×10^{-10}	2.8×10^{-12}	-	<0.001
Arsenic	Annual	2.3×10^{-4}	7.6×10^{-8}	1.2×10^{-7}	4.9×10^{-7}	5.9×10^{-7}	2.5×10^{-7}	2.1×10^{-7}	1.8×10^{-7}	1.0×10^{-7}	5.0×10^{-8}	0.3
Benzene	Annual	0.12	1.2×10^{-8}	2.0×10^{-8}	7.9×10^{-8}	9.6×10^{-8}	4.0×10^{-8}	3.5×10^{-8}	3.0×10^{-8}	1.7×10^{-8}	8.0×10^{-9}	<0.001
Benzo(a)pyrene	Annual	3.0×10^{-4}	-	2.6×10^{-12}	5.2×10^{-14}	2.6×10^{-12}	5.2×10^{-14}	2.7×10^{-12}	2.6×10^{-12}	1.3×10^{-9}	-	<0.001
Beryllium	Annual	0.004	1.6×10^{-9}	2.6×10^{-9}	1.0×10^{-8}	1.2×10^{-8}	5.2×10^{-9}	4.5×10^{-9}	3.8×10^{-9}	2.1×10^{-9}	1.0×10^{-9}	<0.001
1,3-Butadiene	Annual	0.004	-	1.9×10^{-11}	1.5×10^{-13}	2.0×10^{-11}	1.5×10^{-13}	2.0×10^{-11}	1.9×10^{-11}	1.4×10^{-13}	-	<0.001
Cadmium	Annual	5.6×10^{-4}	2.3×10^{-8}	3.7×10^{-8}	1.5×10^{-7}	1.8×10^{-7}	7.4×10^{-8}	6.5×10^{-8}	5.5×10^{-8}	3.0×10^{-8}	1.5×10^{-8}	0.03
Carbon tetrachloride	Annual	0.067	-	1.2×10^{-12}	4.9×10^{-15}	1.2×10^{-12}	4.9×10^{-15}	1.2×10^{-12}	1.2×10^{-12}	6.4×10^{-10}	-	<0.001
Chloroform	Annual	0.043	-	1.2×10^{-12}	4.9×10^{-15}	1.2×10^{-12}	4.9×10^{-15}	1.2×10^{-12}	1.2×10^{-12}	6.4×10^{-10}	-	<0.001

Table C.2-17. Concentrations of toxic air pollutants (micrograms per cubic meters) at ambient air locations under waste processing alternatives (continued).

Pollutant	Averaging time	Idaho Standard (micrograms per cubic meter)[a]	No Action Alternative	Continued Current Operations Alternative	Separations Alternative: Full Separations Option	Separations Alternative: Planning Basis Option	Separations Alternative: Transuranic Separations Option	Non-Separations Alternative: Hot Isostatic Pressed Waste Option	Non-Separations Alternative: Direct Cement Waste Option	Non-Separations Alternative: Early Vitrification Option	Minimum INEEL Processing Alternative	Maximum concentration as a percent of standard
Maximum Concentrations (micrograms per cubic meter) at Craters of the Moon												
Carcinogens (continued)												
Chromium (hexavalent)	Annual	8.3×10^{-5}	1.4×10^{-8}	2.3×10^{-8}	9.2×10^{-8}	1.1×10^{-7}	4.6×10^{-8}	4.0×10^{-8}	3.4×10^{-8}	1.9×10^{-8}	9.3×10^{-9}	0.1
1,2-Dichloroethane	Annual	0.038	-	1.2×10^{-12}	4.9×10^{-15}	1.2×10^{-12}	4.9×10^{-15}	1.2×10^{-12}	1.2×10^{-12}	6.4×10^{-10}	-	<0.001
Dioxins and furans	Annual	2.2×10^{-8}	-	2.9×10^{-14}	5.6×10^{-16}	2.9×10^{-14}	5.6×10^{-16}	3.0×10^{-14}	2.9×10^{-14}	5.2×10^{-16}	-	<0.001
Formaldehyde	Annual	0.077	1.9×10^{-6}	3.0×10^{-6}	1.2×10^{-5}	1.5×10^{-5}	6.1×10^{-6}	5.4×10^{-6}	4.5×10^{-6}	2.5×10^{-6}	1.2×10^{-6}	0.02
Hydrazine	Annual	3.4×10^{-4}	-	4.2×10^{-11}	3.4×10^{-13}	4.3×10^{-11}	3.4×10^{-13}	4.3×10^{-11}	4.3×10^{-11}	2.2×10^{-8}	-	0.007
Methylene chloride	Annual	0.28	-	1.2×10^{-12}	4.9×10^{-15}	1.2×10^{-12}	4.9×10^{-15}	1.2×10^{-12}	1.2×10^{-12}	6.4×10^{-10}	-	<0.001
Nickel	Annual	0.004	4.8×10^{-6}	7.8×10^{-6}	3.1×10^{-5}	3.8×10^{-5}	1.6×10^{-5}	1.4×10^{-5}	1.2×10^{-5}	6.4×10^{-6}	3.2×10^{-6}	1.0
Polycyclic aromatic hydrocarbons	Annual	3.0×10^{-4}	3.6×10^{-9}	5.7×10^{-9}	2.3×10^{-8}	2.8×10^{-8}	1.2×10^{-8}	1.0×10^{-8}	8.5×10^{-9}	4.7×10^{-9}	2.3×10^{-9}	0.009
Paradioxane	Annual	0.71	-	-	-	-	-	-	-	-	-	<0.001
Perchloroethylene	Annual	0.014	-	1.2×10^{-12}	4.9×10^{-15}	1.2×10^{-12}	4.9×10^{-15}	1.2×10^{-12}	1.2×10^{-12}	6.4×10^{-10}	-	<0.001
Thiourea	Annual	0.002	-	5.2×10^{-14}	2.0×10^{-12}	1.9×10^{-12}	2.0×10^{-12}	4.4×10^{-12}	1.1×10^{-12}	2.9×10^{-11}	-	<0.001
1,1,2-Trichloroethane	Annual	0.062	-	1.2×10^{-12}	9.8×10^{-15}	1.2×10^{-12}	9.8×10^{-15}	1.2×10^{-12}	1.2×10^{-12}	6.4×10^{-10}	-	<0.001
Trichloroethylene	Annual	0.077	-	1.2×10^{-12}	9.8×10^{-15}	1.2×10^{-12}	9.8×10^{-15}	1.2×10^{-12}	1.2×10^{-12}	6.4×10^{-10}	-	<0.001
Noncarcinogens												
Acetonitrile	24 Hour	3,350	-	1.8×10^{-10}	4.5×10^{-13}	1.8×10^{-10}	4.6×10^{-13}	1.8×10^{-10}	1.8×10^{-10}	5.4×10^{-8}	-	<0.001
Acrolein	24 Hour	13	-	6.8×10^{-10}	3.5×10^{-12}	6.9×10^{-10}	3.5×10^{-12}	6.9×10^{-10}	6.8×10^{-10}	2.9×10^{-12}	-	<0.001
Antimony	24 Hour	25	4.9×10^{-6}	8.0×10^{-6}	3.2×10^{-5}	3.9×10^{-5}	1.6×10^{-5}	1.4×10^{-5}	1.2×10^{-5}	6.5×10^{-6}	3.3×10^{-6}	<0.001
Barium	24 Hour	25	2.4×10^{-6}	3.9×10^{-6}	1.6×10^{-5}	1.9×10^{-5}	7.8×10^{-6}	6.8×10^{-6}	5.8×10^{-6}	3.2×10^{-6}	1.6×10^{-6}	<0.001
Bromoform	24 Hour	250	-	1.8×10^{-11}	4.7×10^{-14}	1.8×10^{-11}	4.7×10^{-14}	1.8×10^{-11}	1.8×10^{-11}	5.6×10^{-9}	-	<0.001
Carbon disulfide	24 Hour	1,500	-	1.5×10^{-9}	7.6×10^{-12}	1.5×10^{-9}	7.7×10^{-12}	1.6×10^{-9}	1.5×10^{-9}	4.6×10^{-7}	-	<0.001
Chloride	24 Hour	150	3.2×10^{-4}	8.9×10^{-4}	2.0×10^{-3}	3.0×10^{-3}	1.0×10^{-3}	1.0×10^{-3}	1.0×10^{-3}	7.3×10^{-4}	3.2×10^{-4}	0.002
Chlorobenzene	24 Hour	17,500	-	1.8×10^{-11}	4.7×10^{-14}	1.8×10^{-11}	4.7×10^{-14}	1.8×10^{-11}	1.8×10^{-11}	5.6×10^{-9}	-	<0.001
Chromium (total)	24 Hour	25	7.9×10^{-7}	1.3×10^{-6}	5.1×10^{-6}	6.2×10^{-6}	2.6×10^{-6}	2.3×10^{-6}	1.9×10^{-6}	1.0×10^{-6}	5.3×10^{-7}	<0.001
Cobalt	24 Hour	3	5.6×10^{-6}	9.1×10^{-6}	3.7×10^{-5}	4.4×10^{-5}	1.8×10^{-5}	1.6×10^{-5}	1.4×10^{-5}	7.4×10^{-6}	3.7×10^{-6}	0.002
Copper	24 Hour	10	1.6×10^{-6}	2.7×10^{-6}	1.1×10^{-5}	1.3×10^{-5}	5.4×10^{-6}	4.7×10^{-6}	4.0×10^{-6}	2.2×10^{-6}	1.1×10^{-6}	<0.001
Diethyl phthalate	24 Hour	250	-	5.0×10^{-12}	6.4×10^{-14}	5.1×10^{-12}	6.4×10^{-14}	5.2×10^{-12}	5.0×10^{-12}	1.5×10^{-9}	-	<0.001
Di-n-butyl phthalate	24 Hour	250	-	7.1×10^{-13}	9.1×10^{-15}	7.2×10^{-13}	9.1×10^{-15}	7.4×10^{-13}	7.2×10^{-13}	2.1×10^{-10}	-	<0.001
Di-n-octyl phthalate	24 Hour	250	-	7.1×10^{-15}	2.3×10^{-12}	3.1×10^{-10}	2.3×10^{-12}	3.1×10^{-10}	3.1×10^{-10}	9.3×10^{-8}	-	<0.001
2,4-Dinitrophenol	24 Hour	-	-	3.1×10^{-10}	1.8×10^{-13}	2.7×10^{-13}	1.8×10^{-13}	6.0×10^{-13}	1.5×10^{-13}	2.3×10^{-12}	-	-
Ethyl benzene	24 Hour	22,000	6.1×10^{-8}	1.0×10^{-7}	4.0×10^{-7}	4.8×10^{-7}	2.0×10^{-7}	1.7×10^{-7}	1.5×10^{-7}	8.1×10^{-8}	4.1×10^{-8}	<0.001
Fluoride	24 Hour	125	3.5×10^{-5}	8.5×10^{-4}	2.4×10^{-4}	1.0×10^{-3}	1.3×10^{-4}	8.9×10^{-4}	8.8×10^{-4}	5.6×10^{-4}	2.3×10^{-5}	<0.001
Lead	24 Hour	-	1.4×10^{-6}	2.3×10^{-6}	9.2×10^{-6}	1.1×10^{-5}	4.6×10^{-6}	4.0×10^{-6}	3.4×10^{-6}	1.9×10^{-6}	9.4×10^{-7}	-
Manganese	24 Hour	50	2.8×10^{-6}	4.6×10^{-6}	1.8×10^{-5}	2.2×10^{-5}	9.2×10^{-6}	8.0×10^{-6}	6.8×10^{-6}	3.7×10^{-6}	1.9×10^{-6}	<0.001
Mercury	24 Hour	5	1.1×10^{-7}	1.9×10^{-7}	1.1×10^{-6}	1.6×10^{-6}	8.7×10^{-7}	2.0×10^{-6}	6.8×10^{-7}	5.2×10^{-7}	7.0×10^{-8}	<0.001
Methyl ethyl ketone	24 Hour	29,500	-	6.4×10^{-10}	1.6×10^{-12}	6.4×10^{-10}	1.6×10^{-12}	6.4×10^{-10}	6.4×10^{-10}	2.0×10^{-7}	-	<0.001
Molybdenum	24 Hour	250	7.3×10^{-7}	1.2×10^{-6}	4.8×10^{-6}	5.8×10^{-6}	2.4×10^{-6}	2.1×10^{-6}	1.8×10^{-6}	9.7×10^{-7}	4.9×10^{-7}	<0.001
Naphthalene	24 Hour	2,500	1.1×10^{-6}	1.7×10^{-6}	6.9×10^{-6}	8.3×10^{-6}	3.4×10^{-6}	3.0×10^{-6}	2.5×10^{-6}	1.4×10^{-6}	7.0×10^{-7}	<0.001

Table C.2-17. Concentrations of toxic air pollutants (micrograms per cubic meters) at ambient air locations under waste processing alternatives (continued).

Pollutant	Averaging time	Idaho Standard (micrograms per cubic meter)[a]	No Action Alternative	Continued Current Operations Alternative	Separations Alternative: Full Separations Option	Separations Alternative: Planning Basis Option	Separations Alternative: Transuranic Separations Option	Non-Separations Alternative: Hot Isostatic Pressed Waste Option	Non-Separations Alternative: Direct Cement Waste Option	Non-Separations Alternative: Early Vitrification Option	Minimum INEEL Processing Alternative	Maximum concentration as a percent of standard
Maximum Concentrations (micrograms per cubic meter) at Craters of the Moon Noncarcinogens (continued)												
Pentachlorophenol	24 Hour	25	-	3.7×10^{-11}	4.8×10^{-13}	3.8×10^{-11}	4.8×10^{-13}	3.9×10^{-11}	3.8×10^{-11}	1.1×10^{-8}	-	<0.001
Phenol	24 Hour	950	-	6.4×10^{-10}	8.5×10^{-12}	6.5×10^{-10}	8.5×10^{-12}	6.6×10^{-10}	6.4×10^{-10}	2.0×10^{-7}	-	<0.001
Phosphorus	24 Hour	5	8.8×10^{-6}	1.4×10^{-5}	5.8×10^{-5}	6.9×10^{-5}	2.9×10^{-5}	2.5×10^{-5}	2.1×10^{-5}	1.2×10^{-5}	5.9×10^{-6}	0.001
Propylene (propene)	24 Hour	-	-	1.9×10^{-8}	9.6×10^{-11}	2.0×10^{-8}	9.7×10^{-11}	2.0×10^{-8}	2.0×10^{-8}	8.1×10^{-11}	-	-
Pyridine	24 Hour	750	-	5.4×10^{-8}	6.9×10^{-10}	5.5×10^{-8}	7.0×10^{-10}	5.7×10^{-8}	5.5×10^{-8}	1.7×10^{-5}	-	<0.001
Selenium	24 Hour	10	6.3×10^{-7}	1.0×10^{-6}	4.2×10^{-6}	5.0×10^{-6}	2.1×10^{-6}	1.8×10^{-6}	1.5×10^{-6}	8.4×10^{-7}	4.3×10^{-7}	<0.001
Silver	24 Hour	5	-	-	5.1×10^{-12}	7.4×10^{-12}	5.1×10^{-12}	1.7×10^{-11}	8.1×10^{-16}	4.2×10^{-12}	5.8×10^{-13}	<0.001
Thallium	24 Hour	5	-	6.1×10^{-12}	1.5×10^{-11}	2.8×10^{-11}	1.6×10^{-11}	5.9×10^{-11}	6.1×10^{-12}	1.7×10^{-11}	-	<0.001
Toluene	24 Hour	18,750	5.8×10^{-6}	9.4×10^{-6}	3.8×10^{-5}	4.6×10^{-5}	1.9×10^{-5}	1.7×10^{-5}	1.4×10^{-5}	7.7×10^{-6}	3.9×10^{-6}	<0.001
1,2,4-Trichlorobenzene	24 Hour	1,850	-	1.1×10^{-12}	2.9×10^{-13}	1.5×10^{-12}	2.9×10^{-13}	2.1×10^{-12}	1.4×10^{-12}	3.4×10^{-10}	-	<0.001
1,1,1-Trichloroethane (Methyl chloroform)	24 Hour	95,500	2.2×10^{-7}	3.6×10^{-7}	1.4×10^{-6}	1.7×10^{-6}	7.2×10^{-7}	6.3×10^{-7}	5.3×10^{-7}	3.0×10^{-7}	1.5×10^{-7}	<0.001
Vanadium	24 Hour	3	3.0×10^{-5}	4.8×10^{-5}	1.9×10^{-4}	2.3×10^{-4}	9.7×10^{-5}	8.5×10^{-5}	7.2×10^{-5}	3.9×10^{-5}	2.0×10^{-5}	0.009
Xylene	24 Hour	21,750	1.0×10^{-7}	1.7×10^{-7}	6.6×10^{-7}	8.0×10^{-7}	3.3×10^{-7}	2.9×10^{-7}	2.5×10^{-7}	1.3×10^{-7}	6.8×10^{-8}	<0.001
Zinc	24 Hour	500	2.7×10^{-5}	4.4×10^{-5}	1.8×10^{-4}	2.1×10^{-4}	8.9×10^{-5}	7.7×10^{-5}	6.6×10^{-5}	3.6×10^{-5}	1.8×10^{-5}	<0.001

a. Applicable ambient air standards are specified in IDHW (1997) for carcinogenic air pollutants and noncarcinogenic toxic air pollutant increments. It should be noted that these standards apply only to new sources; for existing sources, they are used here as reference values for purposes of comparison.
b. Carcinogenic impacts are not evaluated at public highways.

Table C.2-18. Concentrations of toxic air pollutants at major INEEL facility areas from emissions under waste processing alternatives.

				Separations Alternative			Non-Separations Alternative				
	Occupational Exposure Limit (micrograms per cubic meter)[a]	No Action Alternative	Continued Current Operations Alternative	Full Separations Option	Planning Basis Option	Transuranic Separations Option	Hot Isostatic Pressed Waste Option	Direct Cement Waste Option	Early Vitrification Option	Minimum INEEL Processing Alternative	Maximum concentration as a percent of standard
Maximum Onsite Concentrations (micrograms per cubic meter)[b]											
Carcinogens											
Acetaldehyde	45,000	-	2.2×10^{-7}	3.0×10^{-9}	2.2×10^{-7}	2.4×10^{-9}	2.2×10^{-7}	2.2×10^{-7}	1.6×10^{-9}	-	<0.001
Arsenic	10	4.9×10^{-4}	2.0×10^{-3}	5.0×10^{-3}	6.0×10^{-3}	3.0×10^{-3}	2.0×10^{-3}	2.0×10^{-3}	6.6×10^{-4}	1.0×10^{-3}	0.06
Benzene	3,000	7.9×10^{-5}	3.2×10^{-4}	7.6×10^{-4}	9.4×10^{-4}	5.2×10^{-4}	3.6×10^{-4}	3.5×10^{-4}	1.1×10^{-4}	1.6×10^{-4}	<0.001
Benzo(a)pyrene	200	-	1.5×10^{-9}	5.3×10^{-11}	1.5×10^{-9}	4.2×10^{-11}	1.6×10^{-9}	1.5×10^{-9}	7.5×10^{-7}	-	<0.001
Beryllium	2	1.0×10^{-5}	4.2×10^{-5}	9.8×10^{-5}	1.2×10^{-4}	6.8×10^{-5}	4.6×10^{-5}	4.5×10^{-5}	1.4×10^{-5}	2.1×10^{-5}	0.006
1,3-Butadiene	4,400	-	1.1×10^{-8}	1.5×10^{-10}	1.1×10^{-8}	1.2×10^{-10}	1.2×10^{-8}	1.1×10^{-8}	8.2×10^{-11}	-	<0.001
Cadmium	2	1.5×10^{-4}	6.0×10^{-4}	1.0×10^{-3}	2.0×10^{-3}	1.0×10^{-3}	6.6×10^{-4}	6.5×10^{-4}	2.0×10^{-4}	3.0×10^{-4}	0.09
Carbon tetrachloride	12,600	-	7.0×10^{-10}	5.0×10^{-12}	7.0×10^{-10}	4.0×10^{-12}	7.1×10^{-10}	7.0×10^{-10}	3.8×10^{-7}	-	<0.001
Chloroform	9,780	-	7.0×10^{-10}	5.0×10^{-12}	7.0×10^{-10}	4.0×10^{-12}	7.1×10^{-10}	7.0×10^{-10}	3.8×10^{-7}	-	<0.001
Chromium (hexavalent)	50	9.2×10^{-5}	3.7×10^{-4}	8.8×10^{-4}	1.0×10^{-3}	6.0×10^{-4}	4.1×10^{-4}	4.0×10^{-4}	1.2×10^{-4}	1.9×10^{-4}	0.002
1,2-Dichloroethane	4,000	-	7.0×10^{-10}	5.0×10^{-12}	7.0×10^{-10}	4.0×10^{-12}	7.1×10^{-10}	7.0×10^{-10}	3.8×10^{-7}	-	<0.001
Dioxins and furans	ALARA	-	1.7×10^{-11}	5.7×10^{-13}	1.7×10^{-11}	4.6×10^{-13}	1.7×10^{-11}	1.7×10^{-11}	3.1×10^{-13}	-	-
Formaldehyde	925	0.01	0.05	0.12	0.15	0.08	0.05	0.05	0.02	0.03	0.02
Hydrazine	100	-	2.5×10^{-8}	3.4×10^{-10}	2.5×10^{-8}	2.8×10^{-10}	2.5×10^{-8}	2.5×10^{-8}	1.3×10^{-5}	-	<0.001
Methylene chloride	174,000	-	7.0×10^{-10}	5.0×10^{-12}	7.0×10^{-10}	4.0×10^{-12}	7.1×10^{-10}	7.0×10^{-10}	3.8×10^{-7}	-	<0.001
Nickel	100	0.03	0.13	0.30	0.37	0.21	0.14	0.14	0.04	0.06	0.4
Polycyclic aromatic hydrocarbons	200	2.3×10^{-5}	9.4×10^{-5}	2.2×10^{-4}	2.7×10^{-4}	1.5×10^{-4}	1.0×10^{-4}	1.0×10^{-4}	3.1×10^{-5}	4.8×10^{-5}	<0.001
Paradioxane	90,000	-	-	-	-	-	-	-	-	-	<0.001
Perchloroethylene	170,000	-	7.0×10^{-10}	5.0×10^{-12}	7.0×10^{-10}	4.0×10^{-12}	7.1×10^{-10}	7.0×10^{-10}	3.8×10^{-7}	-	<0.001
Thiourea	-	-	3.0×10^{-11}	2.0×10^{-9}	1.1×10^{-9}	1.6×10^{-9}	2.6×10^{-9}	6.2×10^{-10}	1.7×10^{-8}	-	-
1,1,2-Trichloroethane	45,000	-	7.0×10^{-10}	9.9×10^{-12}	7.1×10^{-10}	8.0×10^{-12}	7.1×10^{-10}	7.0×10^{-10}	3.8×10^{-7}	-	<0.001
Trichloroethylene	269,000	-	7.0×10^{-10}	9.9×10^{-12}	7.1×10^{-10}	8.0×10^{-12}	7.1×10^{-10}	7.0×10^{-10}	3.8×10^{-7}	-	<0.001
Acetonitrile	70,000	-	7.0×10^{-9}	4.8×10^{-11}	7.0×10^{-9}	3.8×10^{-11}	7.1×10^{-9}	7.0×10^{-9}	3.6×10^{-6}	-	<0.001
Acrolein	250	-	2.6×10^{-8}	3.6×10^{-10}	2.7×10^{-8}	2.9×10^{-10}	2.7×10^{-8}	2.7×10^{-8}	1.9×10^{-10}	-	<0.001
Antimony	500	2.0×10^{-3}	8.0×10^{-3}	0.02	0.02	0.01	9.0×10^{-3}	9.0×10^{-3}	3.0×10^{-3}	4.0×10^{-3}	0.005
Barium	500	9.5×10^{-4}	4.0×10^{-3}	9.0×10^{-3}	0.01	6.0×10^{-3}	4.0×10^{-3}	4.0×10^{-3}	1.0×10^{-3}	2.0×10^{-3}	0.002
Bromoform	5,000	-	7.0×10^{-10}	5.0×10^{-12}	7.0×10^{-10}	4.0×10^{-12}	7.1×10^{-10}	7.0×10^{-10}	3.8×10^{-7}	-	<0.001
Carbon disulfide	12,000	-	5.9×10^{-8}	8.0×10^{-10}	6.0×10^{-8}	6.4×10^{-10}	6.0×10^{-8}	6.0×10^{-8}	3.1×10^{-5}	-	<0.001
Chloride	1,500	0.13	0.52	1.2	1.5	0.8	0.58	0.56	0.18	0.27	0.1
Chlorobenzene	46,000	-	7.0×10^{-10}	5.0×10^{-12}	7.0×10^{-10}	4.0×10^{-12}	7.1×10^{-10}	7.0×10^{-10}	3.8×10^{-7}	-	<0.001

Table C.2-18. (continued).

	Occupational Exposure Limit (micrograms per cubic meter)[a]	No Action Alternative	Continued Current Operations Alternative	Separations Alternative: Full Separations Option	Separations Alternative: Planning Basis Option	Separations Alternative: Transuranic Separations Option	Non-Separations Alternative: Hot Isostatic Pressed Waste Option	Non-Separations Alternative: Direct Cement Waste Option	Non-Separations Alternative: Early Vitrification Option	Minimum INEEL Processing Alternative	Maximum concentration as a percent of standard
Maximum Onsite Concentrations (micrograms per cubic meter) (continued)											
Noncarcinogens											
Chromium (total)	500	3.1×10^{-4}	1.0×10^{-3}	3.0×10^{-3}	4.0×10^{-3}	2.0×10^{-3}	1.0×10^{-3}	1.0×10^{-3}	4.2×10^{-4}	6.5×10^{-4}	<0.001
Cobalt	20	2.0×10-3	9.0×10^{-3}	0.02	0.03	0.01	0.01	0.01	3.0×10^{-3}	5.0×10^{-3}	0.1
Copper	100	6.5×10^{-4}	3.0×10^{-3}	6.0×10^{-3}	8.0×10^{-3}	4.0×10^{-3}	3.0×10^{-3}	3.0×10^{-3}	1.0×10^{-3}	1.0×10^{-3}	0.008
Diethyl phthalate	5,000	-	1.9×10^{-10}	6.7×10^{-12}	2.0×10^{-10}	5.4×10^{-12}	2.0×10^{-10}	2.0×10^{-10}	1.0×10^{-7}	-	<0.001
Di-n-butyl phthalate	5,000	-	2.7×10^{-11}	9.5×10^{-13}	2.8×10^{-11}	7.7×10^{-13}	2.9×10^{-11}	2.8×10^{-11}	1.4×10^{-8}	-	<0.001
Di-n-octyl phthalate	5,000	-	2.7×10^{-13}	2.4×10^{-10}	1.2×10^{-8}	2.0×10^{-10}	1.2×10^{-8}	1.2×10^{-8}	6.3×10^{-6}	-	<0.001
2,4-Dinitrophenol	-	-	1.2×10^{-8}	1.9×10^{-11}	1.1×10^{-11}	1.5×10^{-11}	2.3×10^{-11}	5.7×10^{-12}	1.5×10^{-10}	-	-
Ethyl benzene	430,000	2.4×10^{-5}	9.9×10^{-5}	2.3×10^{-4}	2.9×10^{-4}	1.6×10^{-4}	1.1×10^{-4}	1.1×10^{-4}	3.3×10^{-5}	5.0×10^{-5}	<0.001
Fluoride	2,500	0.01	0.06	0.13	0.16	0.09	0.06	0.06	0.05	0.03	0.007
Lead	50	5.6×10^{-4}	2.0×10^{-3}	5.0×10^{-3}	7.0×10^{-3}	4.0×10^{-3}	3.0×10^{-3}	2.0×10^{-3}	7.5×10^{-4}	1.0×10^{-3}	0.01
Manganese	200	1.0×10^{-3}	5.0×10^{-3}	0.01	0.01	0.01	5.0×10^{-3}	5.0×10^{-3}	1.0×10^{-3}	2.0×10^{-3}	0.007
Mercury	25	4.2×10^{-5}	1.7×10^{-4}	4.2×10^{-4}	5.0×10^{-4}	2.9×10^{-4}	1.9×10^{-4}	1.8×10^{-4}	6.8×10^{-5}	8.7×10^{-5}	0.002
Methyl ethyl ketone	590,000	-	2.5×10^{-8}	1.7×10^{-10}	2.5×10^{-8}	1.4×10^{-10}	2.5×10^{-8}	2.5×10^{-8}	1.3×10^{-5}	-	<0.001
Molybdenum	5,000	2.9×10^{-4}	1.0×10^{-3}	$3/0\times10^{-3}$	3.0×10^{-3}	2.0×10^{-3}	1.0×10^{-3}	1.0×10^{-3}	3.9×10^{-4}	6.0×10^{-4}	<0.001
Naphthalene	50,000	4.2×10^{-4}	2.0×10^{-3}	4.0×10^{-3}	5.0×10^{-3}	3.0×10^{-3}	2.0×10^{-3}	2.0×10^{-3}	5.6×10^{-4}	8.7×10^{-4}	<0.001
Pentachlorophenol	500	-	1.5×10^{-9}	5.1×10^{-11}	1.5×10^{-9}	4.1×10^{-11}	1.5×10^{-9}	1.5×10^{-9}	7.5×10^{-7}	-	<0.001
Phenol	19,000	-	2.5×10^{-8}	8.9×10^{-10}	2.5×10^{-8}	7.2×10^{-10}	2.6×10^{-8}	2.5×10^{-8}	1.3×10^{-5}	-	<0.001
Phosphorus	100	4.0×10^{-3}	0.01	0.03	0.04	0.02	0.02	0.02	5.0×10^{-3}	7.0×10^{-3}	0.04
Propylene (propene)	-	-	7.5×10^{-7}	1.0×10^{-8}	7.6×10^{-7}	8.1×10^{-9}	7.7×10^{-7}	7.6×10^{-7}	5.5×10^{-9}	-	-
Pyridine	15,000	-	2.1×10^{-6}	7.3×10^{-8}	2.1×10^{-6}	5.9×10^{-8}	2.2×10^{-6}	2.1×10^{-6}	0.001	-	<0.001
Selenium	200	2.5×10^{-4}	1.0×10^{-3}	2.0×10^{-3}	3.0×10-3	2.0×10^{-3}	1.0×10^{-3}	1.0×10^{-3}	3.4×10^{-4}	5.2×10^{-4}	0.00
Silver	10	-	-	5.4×10^{-10}	2.9×10^{-10}	4.3×10^{-10}	6.5×10^{-10}	3.1×10^{-14}	2.8×10^{-10}	3.8×10^{-11}	<0.001
Thallium	100	-	2.4×10^{-10}	1.6×10^{-9}	1.1×10^{-9}	1.3×10^{-9}	2.3×10^{-9}	2.4×10^{-10}	1.2×10^{-9}	-	<0.001
Toluene	188,000	2.0×10^{-3}	9.0×10^{-3}	0.02	0.03	0.02	0.01	0.01	3.0×10^{-3}	5.0×10^{-3}	
1,2,4-Trichlorobenzene	-	-	4.4×10^{-11}	3.0×10^{-11}	6.0×10^{-11}	2.4×10^{-11}	8.1×10^{-11}	5.3×10^{-11}	2.3×10^{-8}	-	-
1,1,1-Trichloroethane (methyl chloroform)	1,900,000	8.7×10^{-5}	3.6×10^{-4}	8.3×10^{-4}	1.0×10^{-3}	5.7×10^{-4}	3.9×10^{-4}	3.8×10^{-4}	1.2×10^{-4}	1.8×10^{-4}	<0.001
Vanadium	50	0.01	0.05	0.11	0.14	0.08	0.05	0.05	0.02	0.02	0.3
Xylene	434,000	4.0×10^{-5}	1.6×10^{-4}	3.9×10^{-4}	4.8×10^{-4}	2.7×10^{-4}	1.8×10^{-4}	1.8×10^{-4}	5.4×10^{-5}	8.3×10^{-5}	<0.001
Zinc	5,000	0.01	0.04	0.10	0.13	0.07	0.05	0.05	0.01	0.02	0.003

a. 8-hour time-weighted average recommended by either the American Conference of Governmental Industrial Hygienists or the Occupational Safety and Health Administration (the more restrictive of the two is used).

b. Location of highest 8-hour level is within INTEC.

ALARA = as low as reasonably achievable.

Table C.2-19. Results of visibility screening analysis for waste processing alternatives.

Case	Color shift (delta E) parameter				Contrast parameter			
	Sky		Terrain		Sky		Terrain	
	View 1	View 2	View 1	View 2	View 1	View 2	View 1	View 2
Maximum acceptable screening value	2.0	2.0	2.0	2.0	0.05	0.05	0.05	0.05
Craters of the Moon Wilderness Area								
No Action Alternative	0.04	0.02	0.04	0.006	-	-	-	-
Continued Current Operations Alternative	0.16	0.12	0.09	0.03	-	-0.001	0.001	-
Separations Alternative								
Full Separations	0.33	0.23	0.31	0.06	0.001	-0.003	0.002	-
Planning Basis Option	0.47	0.33	0.37	0.09	0.001	-0.004	0.003	-
Transuranic Separations	0.21	0.15	0.16	0.04	-	-0.002	0.001	-
Non-Separations Alternative								
Hot Isostatic Pressed Waste Option	0.48	0.34	0.16	0.09	-0.001	-0.003	0.001	-
Direct Cement Waste Option	0.19	0.14	0.12	0.04	-	-0.001	0.001	-
Early Vitrification Option	0.06	0.05	0.06	0.01	-	-	-	-
Minimum INEEL Processing Alternative	0.03	0.02	0.04	0.006	-	-	-	-
Fort Hall Indian Reservation								
No Action Alternative	0.02	0.01	0.02	0.003	-	-	-	-
Continued Current Operations Alternative	0.07	0.05	0.04	0.02	-	-	-	-
Separations Alternative								
Full Separations	0.14	0.10	0.12	0.03	0.001	-0.001	0.001	-
Planning Basis Option	0.20	0.14	0.15	0.05	-	-0.002	0.001	-
Transuranic Separations	0.09	0.06	0.07	0.02	-	-0.001	0.001	-
Non-Separations Alternative								
Hot Isostatic Pressed Waste Option	0.21	0.15	0.07	0.05	-0.001	-0.001	0.001	-
Direct Cement Waste Option	0.08	0.06	0.05	0.02	-	-0.001	-	-
Early Vitrification Option	0.03	0.02	0.02	0.006	-	-	-	-
Minimum INEEL Processing Alternative	0.02	0.009	0.02	0.003	-	-	-	-

Table C.2-20. Airborne radionuclide emissions estimates for dispositioning proposed facilities associated with waste processing alternatives.

			Annual emission rate and total project emissions[a]							
			Total radioactivity		Strontium-90/Yttrium-90		Cesium-137		Plutonium-239	
Project number	Description	Duration (years)	(curies per year)	(curies)	(curies per year)	(curies)	(curies per year)	(curies)	(curies per year)	(curies)
			No Action							
P1D	No Action Alternative	-	-	-	-	-	-	-	-	-
			Continued Current Operations Alternative							
P1A	Calcine SBW including NWCF Upgrades (MACT)	3	1.2×10^{-7}	1.7×10^{-7}	1.0×10^{-7}	1.6×10^{-7}	1.2×10^{-8}	1.8×10^{-8}	3.0×10^{-12}	4.5×10^{-12}
P1B	NGLWM and TF Waste Heel Waste	1	5.8×10^{-8}	5.8×10^{-8}	5.2×10^{-8}	5.2×10^{-8}	6.0×10^{-9}	6.0×10^{-9}	1.5×10^{-12}	1.5×10^{-12}
Totals			1.2×10^{-7}	2.3×10^{-7}	1.0×10^{-7}	2.1×10^{-7}	1.2×10^{-8}	2.4×10^{-8}	3.0×10^{-12}	6.0×10^{-12}
			Full Separations Option[b]							
P59A	Calcine Retrieval and Transport	1	5.8×10^{-8}	5.8×10^{-8}	5.2×10^{-8}	5.2×10^{-8}	6.0×10^{-9}	6.0×10^{-9}	1.5×10^{-12}	1.5×10^{-12}
P9A	Full (early) Separations	3	5.8×10^{-8}	1.7×10^{-7}	5.2×10^{-8}	1.6×10^{-7}	6.0×10^{-9}	1.8×10^{-8}	1.5×10^{-12}	4.5×10^{-12}
P9B	Vitrification Plant	3	5.8×10^{-8}	1.7×10^{-7}	5.2×10^{-8}	1.6×10^{-7}	6.0×10^{-9}	1.8×10^{-8}	1.5×10^{-12}	4.5×10^{-12}
P9C	Class A Grout Plant	3	5.8×10^{-8}	1.7×10^{-7}	5.2×10^{-8}	1.6×10^{-7}	6.0×10^{-9}	1.8×10^{-8}	1.5×10^{-12}	4.5×10^{-12}
P24	Vitrified Product Interim Storage	3	-	-	-	-	-	-	-	-
P18	New Analytical Lab	2	5.8×10^{-8}	1.2×10^{-7}	5.2×10^{-8}	1.0×10^{-7}	6.0×10^{-9}	1.2×10^{-8}	1.5×10^{-12}	3.0×10^{-12}
P118	Separations Organic Incinerator Project	2	2.9×10^{-9}	5.8×10^{-9}	2.6×10^{-9}	5.2×10^{-9}	3.0×10^{-10}	6.0×10^{-10}	7.4×10^{-14}	1.5×10^{-13}
P133	Multifunction Pilot Plant	2	-	-	-	-	-	-	-	-
P35D	Class A Grout Packaging and Shipping to INEEL Landfill	2	5.8×10^{-8}	1.2×10^{-7}	5.2×10^{-8}	1.0×10^{-7}	6.0×10^{-9}	1.2×10^{-8}	1.5×10^{-12}	3.0×10^{-12}
P27	Class A Grout in New Landfill Facility	2	-	-	-	-	-	-	-	-
Totals			3.5×10^{-7}	8.2×10^{-7}	3.2×10^{-7}	7.4×10^{-7}	3.6×10^{-8}	8.4×10^{-8}	9.0×10^{-12}	2.1×10^{-11}
			Planning Basis Option[b]							
P1A	Calcine SBW including NWCF Upgrades (MACT)	3	1.2×10^{-7}	1.7×10^{-7}	1.0×10^{-7}	1.6×10^{-7}	1.2×10^{-8}	1.8×10^{-8}	3.0×10^{-12}	4.5×10^{-12}
P1B	NGLWM and TF Waste Heel Waste	1	5.8×10^{-8}	5.8×10^{-8}	5.2×10^{-8}	5.2×10^{-8}	6.0×10^{-9}	6.0×10^{-9}	1.5×10^{-12}	1.5×10^{-12}
P59A	Calcine Retrieval and Transport	1	5.8×10^{-8}	5.8×10^{-8}	5.2×10^{-8}	5.2×10^{-8}	6.0×10^{-9}	6.0×10^{-9}	1.5×10^{-12}	1.5×10^{-12}
P23A	Full Separations	3	5.8×10^{-8}	1.7×10^{-7}	5.2×10^{-8}	1.6×10^{-7}	6.0×10^{-9}	1.8×10^{-8}	1.5×10^{-12}	4.5×10^{-12}
P23B	Vitrification Plant	3	5.8×10^{-8}	1.7×10^{-7}	5.2×10^{-8}	1.6×10^{-7}	6.0×10^{-9}	1.8×10^{-8}	1.5×10^{-12}	4.5×10^{-12}
P23C	Class A Grout Plant	3	5.8×10^{-8}	1.7×10^{-7}	5.2×10^{-8}	1.6×10^{-7}	6.0×10^{-9}	1.8×10^{-8}	1.5×10^{-12}	4.5×10^{-12}
P24	Vitrified Product Interim Storage	-	-	-	-	-	-	-	-	-
P18	New Analytical Lab	2	5.8×10^{-8}	1.2×10^{-7}	5.2×10^{-8}	1.0×10^{-7}	6.0×10^{-9}	1.2×10^{-8}	1.5×10^{-12}	3.0×10^{-12}
P118	Separations Organic Incinerator Project	2	2.9×10^{-9}	5.8×10^{-9}	2.6×10^{-9}	5.2×10^{-9}	3.0×10^{-10}	6.0×10^{-10}	7.4×10^{-14}	1.5×10^{-13}
P133	Multifunction Pilot Plant	2	-	-	-	-	-	-	-	-
P35E	Class A Grout Packaging and Loading for Offsite Disposal	2	5.8×10^{-8}	1.2×10^{-7}	5.2×10^{-8}	1.0×10^{-7}	6.0×10^{-9}	1.2×10^{-8}	1.5×10^{-12}	3.0×10^{-12}
Totals			4.1×10^{-7}	1.1×10^{-7}	3.7×10^{-7}	9.2×10^{-7}	4.2×10^{-8}	1.0×10^{-7}	1.1×10^{-11}	2.6×10^{-11}

Table C.2-20. Airborne radionuclide emissions estimates for dispositioning proposed facilities associated with waste processing alternatives (continued).

			Annual emission rate and total project emissions[a]							
			Total radioactivity		Strontium-90/Yttrium-90		Cesium-137		Plutonium-239	
Project number	Description	Duration (years)	(curies per year)	(curies)	(curies per year)	(curies)	(curies per year)	(curies)	(curies per year)	(curies)
			Transuranic Separations Option[c]							
P59A	Calcine Retrieval and Transport	1	5.8×10^{-8}	5.8×10^{-8}	5.2×10^{-8}	5.2×10^{-8}	6.0×10^{-9}	6.0×10^{-9}	1.5×10^{-12}	1.5×10^{-12}
P49A	Transuranic-C Separations	3	5.8×10^{-8}	1.7×10^{-7}	5.2×10^{-8}	1.6×10^{-7}	6.0×10^{-9}	1.8×10^{-8}	1.5×10^{-12}	4.5×10^{-12}
P49C	Class C Grout Plant	2	5.8×10^{-8}	1.2×10^{-7}	5.2×10^{-8}	1.0×10^{-7}	6.0×10^{-9}	1.2×10^{-8}	1.5×10^{-12}	3.0×10^{-12}
P39A	Packaging and Loading Transuranic at INTEC for Shipment to WIPP	2	-	-	-	-	-	-	-	-
P18	New Analytical Lab	2	5.8×10^{-8}	1.2×10^{-7}	5.2×10^{-8}	1.0×10^{-7}	6.0×10^{-9}	1.2×10^{-8}	1.5×10^{-12}	3.0×10^{-12}
P118	Separations Organic Incinerator Project	2	2.9×10^{-9}	5.8×10^{-9}	2.6×10^{-9}	5.2×10^{-9}	3.0×10^{-10}	6.0×10^{-10}	7.4×10^{-14}	1.5×10^{-13}
P133	Multifunction Pilot Plant	2	-	-	-	-	-	-	-	-
P49D	Class C Grout Packaging & Shipping	2	5.8×10^{-8}	1.2×10^{-7}	5.2×10^{-8}	1.0×10^{-7}	6.0×10^{-9}	1.2×10^{-8}	1.5×10^{-12}	3.0×10^{-12}
P27	Class C Grout in New Landfill Facility	2	-	-	-	-	-	-	-	-
Totals			2.9×10^{-7}	5.9×10^{-7}	2.6×10^{-7}	5.3×10^{-7}	3.0×10^{-8}	6.0×10^{-8}	7.5×10^{-12}	1.5×10^{-11}
			Hot Isostatic Pressed Waste Option							
P1A	Calcine SBW including NWCF Upgrades (MACT)	3	1.2×10^{-7}	1.7×10^{-7}	1.0×10^{-7}	1.6×10^{-7}	1.2×10^{-8}	1.8×10^{-8}	3.0×10^{-12}	4.5×10^{-12}
P1B	NGLWM and TF Waste Heel Waste	1	5.8×10^{-8}	5.8×10^{-8}	5.2×10^{-8}	5.2×10^{-8}	6.0×10^{-9}	6.0×10^{-9}	1.5×10^{-12}	1.5×10^{-12}
P18	New Analytical Lab	2	5.8×10^{-8}	1.2×10^{-7}	5.2×10^{-8}	1.0×10^{-7}	6.0×10^{-9}	1.2×10^{-8}	1.5×10^{-12}	3.0×10^{-12}
P59A	Calcine Retrieval and Transport	1	5.8×10^{-8}	5.8×10^{-8}	5.2×10^{-8}	5.2×10^{-8}	6.0×10^{-9}	6.0×10^{-9}	1.5×10^{-12}	1.5×10^{-12}
P71	Mixing and HIPing	5	5.8×10^{-8}	2.9×10^{-7}	5.2×10^{-8}	2.6×10^{-7}	6.0×10^{-9}	3.0×10^{-8}	1.5×10^{-12}	7.4×10^{-12}
P72	HIPed HLW Interim Storage	3	-	-	-	-	-	-	-	-
P73A	Packaging and Loading HIPed Waste at INTEC for Shipment to NGR	3	-	-	-	-	-	-	-	-
P133	Multifunction Pilot Plant	2	-	-	-	-	-	-	-	-
Totals			2.3×10^{-7}	7.0×10^{-7}	2.1×10^{-7}	6.3×10^{-7}	2.4×10^{-8}	7.2×10^{-8}	6.0×10^{-12}	1.8×10^{-11}
			Direct Cement Waste Option							
P1A	Calcine SBW including NWCF Upgrades (MACT)	3	1.2×10^{-7}	1.7×10^{-7}	1.0×10^{-7}	1.6×10^{-7}	1.2×10^{-8}	1.8×10^{-8}	3.0×10^{-12}	4.5×10^{-12}
P1B	NGLWM and TF Waste Heel Waste	1	5.8×10^{-8}	5.8×10^{-8}	5.2×10^{-8}	5.2×10^{-8}	6.0×10^{-9}	6.0×10^{-9}	1.5×10^{-12}	1.5×10^{-12}
P18	New Analytical Lab	2	5.8×10^{-8}	1.2×10^{-7}	5.2×10^{-8}	1.0×10^{-7}	6.0×10^{-9}	1.2×10^{-8}	1.5×10^{-12}	3.0×10^{-12}
P59A	Calcine Retrieval and Transport	1	5.8×10^{-8}	5.8×10^{-8}	5.2×10^{-8}	5.2×10^{-8}	6.0×10^{-9}	6.0×10^{-9}	1.5×10^{-12}	1.5×10^{-12}
P80	Mixing and FUETEP Grout	3	5.8×10^{-8}	1.7×10^{-7}	5.2×10^{-8}	1.6×10^{-7}	6.0×10^{-9}	1.8×10^{-8}	1.5×10^{-12}	4.5×10^{-12}
P81	Unseparated Cementitious HLW Interim Storage	3	-	-	-	-	-	-	-	-
P83A	Packaging & Loading of Cement Waste at INTEC for Shipment to NGR	4	-	-	-	-	-	-	-	-
P133	Multifunction Pilot Plant	2	-	-	-	-	-	-	-	-
Totals			2.3×10^{-7}	5.8×10^{-7}	2.1×10^{-7}	5.2×10^{-7}	2.4×10^{-8}	6.0×10^{-8}	6.0×10^{-12}	1.5×10^{-11}

Table C.2-20. Airborne radionuclide emissions estimates for dispositioning proposed facilities associated with waste processing alternatives (continued).

			Annual emission rate and total project emissions[a]							
			Total radioactivity		Strontium-90/Yttrium-90		Cesium-137		Plutonium-239	
Project number	Description	Duration (years)	(curies per year)	(curies)	(curies per year)	(curies)	(curies per year)	(curies)	(curies per year)	(curies)
Early Vitrification Option										
P18	Calcine Retrieval and Transport	2	5.8×10^{-8}	1.2×10^{-7}	5.2×10^{-8}	1.0×10^{-7}	6.0×10^{-9}	1.2×10^{-8}	1.5×10^{-12}	3.0×10^{-12}
P59A	Calcine Retrieval and Transport	1	5.8×10^{-8}	5.8×10^{-8}	5.2×10^{-8}	5.2×10^{-8}	6.0×10^{-9}	6.0×10^{-9}	1.5×10^{-12}	1.5×10^{-12}
P61	Vitrified HLW Interim Storage	3	-	-	-	-	-	-	-	-
P62A	Packaging/Loading Vitrified HLW at INTEC for Shipment to NGR	3	-	-	-	-	-	-	-	-
P88	Early Vitrification with MACT	5	7.3×10^{-8}	3.6×10^{-7}	6.5×10^{-8}	3.3×10^{-7}	7.4×10^{-9}	3.7×10^{-8}	1.9×10^{-12}	9.3×10^{-12}
P90A	Packaging & Loading Vitrified SBW at INTEC for Shipment to WIPP	2	-	-	-	-	-	-	-	-
P133	Multifunction Pilot Plant	2	-	-	-	-	-	-	-	-
Totals			1.9×10^{-7}	5.4×10^{-7}	1.7×10^{-7}	4.8×10^{-7}	1.9×10^{-8}	5.5×10^{-8}	4.8×10^{-12}	1.4×10^{-11}
Minimum INEEL Processing Alternative[d]										
P18	New Analytical Lab	2	5.8×10^{-8}	1.2×10^{-7}	5.2×10^{-8}	1.0×10^{-7}	6.0×10^{-9}	1.2×10^{-8}	1.5×10^{-12}	3.0×10^{-12}
P24	Vitrified Product Interim Storage	3	-	-	-	-	-	-	-	-
P27	Class A Grout in New Landfill Facility	2	-	-	-	-	-	-	-	-
P111	SBW Treatment with CsIX	1	5.8×10^{-8}	5.8×10^{-8}	5.2×10^{-8}	5.2×10^{-8}	6.0×10^{-9}	6.0×10^{-9}	1.5×10^{-12}	1.5×10^{-12}
P112A	Packaging and Loading CH-Transuranic for Transport to WIPP	5	-	-	-	-	-	-	-	-
P133	Multifunction Pilot Plant	2	-	-	-	-	-	-	-	-
P59B	Calcine Retrieval and Transport Just in Time	1	5.8×10^{-8}	1.2×10^{-7}	5.2×10^{-8}	5.2×10^{-8}	6.0×10^{-9}	6.0×10^{-9}	1.5×10^{-12}	1.5×10^{-12}
P117B	Calcine Packaging & Loading Just in Time	3	1.7×10^{-7}	5.2×10^{-7}	1.6×10^{-7}	4.7×10^{-7}	1.8×10^{-8}	5.4×10^{-8}	4.5×10^{-12}	1.3×10^{-11}
Totals			3.5×10^{-7}	8.1×10^{-7}	3.1×10^{-7}	6.8×10^{-7}	3.6×10^{-8}	7.7×10^{-8}	8.9×10^{-12}	1.9×10^{-11}

a. Annual emissions represent the highest projected emission rate for any single year. Total emissions value is the product of annual emissions for each dispositioning project and the duration (in years) of that project. Annual totals include only those projects which are projected to occur over a similar time frame. Source: Project Data Sheets (Appendix C.6).

b. Assumes disposal of Class A grout either offsite or in new INEEL landfill facility; impacts of disposal in Tank Farm and bin sets are addressed in Figure 5.3-5.

c. Assumes disposal of Class C grout in new facility; impacts of disposal in Tank Farm and bin sets are addressed Figure 5.3-5.

d. Assumes "just-in-time" shipping scenario; emissions from option involving interim storage of calcine at Hanford would be somewhat less. Includes emissions at INEEL only.

Table C.2-21. Summary of radiation dose impacts associated with airborne radionuclide emissions from dispositioning facilities associated with waste processing alternatives.

Case (units)	Applicable Standard	Impact of alternative[a]: No Action Alternative	Continued Current Operations Alternative	Separations Alternative: Full Separations Option[b]	Separations Alternative: Planning Basis Option[b]	Separations Alternative: Transuranic Separations Option[c]	Non-Separations Alternative: Hot Isostatic Pressed Waste Option	Non-Separations Alternative: Direct Cement Waste Option	Non-Separations Alternative: Early Vitrification Option	Minimum INEEL Processing Alternative at INEEL[d]
Dose to maximally-exposed offsite individual (millirem per year)	10[e]	-	1.1×10^{-10}	3.3×10^{-10}	3.9×10^{-10}	4.7×10^{-10}	1.8×10^{-10}	1.3×10^{-10}	1.4×10^{-10}	5.6×10^{-10}
Dose to noninvolved worker (millirem per year)[f]	5,000[g]	-	2.0×10^{-11}	6.0×10^{-11}	7.0×10^{-11}	1.4×10^{-10}	3.7×10^{-11}	2.1×10^{-11}	2.8×10^{-11}	1.6×10^{-10}
Collective dose to population within 80 kilometers of INTEC (person-rem per year)[h]	N.A.	-	3.4×10^{-9}	1.0×10^{-8}	1.2×10^{-8}	1.1×10^{-8}	4.7×10^{-9}	3.8×10^{-9}	3.9×10^{-9}	1.3×10^{-8}

a. Doses are maximum effective dose equivalents over any single year during which dispositioning occurs. Annual totals include only those projects which are projected to occur over a similar time frame.
b. Impacts do not include disposal of Class A Grout in Tank Farm and bin sets, which are presented in Table 5.3-5.
c. Impacts do not include disposal of Class C Grout in Tank Farm and bin sets, which are presented in Table 5.3-5.
d. Assumes "just-in-time" shipping scenario; impacts of option involving interim storage of calcine at Hanford would be somewhat less. Does not include doses at Hanford.
e. EPA dose limit specified in 40 CFR 61.92; applies to effective dose equivalent from air releases only.
f. Location of highest onsite dose is Central Facilities Area.
g. Occupational dose limit per 10 CFR 835.202; applies to sum of doses from all exposure pathways.
h. A reference population of 200,000 people is used for future population dose estimates. At currently projected growth rates, this is the approximate population level that would exist around the Year 2030. During 1990, this population was 118,644.

Table C.2-22. Airborne radionuclide emissions estimates for dispositioning the Tank Farm and bin sets under alternative closure scenarios.

Project number	Description	Duration (years)	Annual emission rate and total project emissions [a]: Total radioactivity (curies per year)	Total radioactivity (curies)	Strontium-90/Yttrium-90 (curies per year)	Strontium-90/Yttrium-90 (curies)	Cesium-137 (curies per year)	Cesium-137 (curies)	Plutonium-239 (curies per year)	Plutonium-239 (curies)
Tank Farm										
P59G	Clean Closure	17	8.6×10^{-7}	1.5×10^{-5}	4.2×10^{-7}	7.1×10^{-6}	4.4×10^{-7}	7.4×10^{-6}	2.8×10^{-9}	4.8×10^{-8}
P3B	Performance-Based Closure with Clean Fill	17	1.1×10^{-7}	1.8×10^{-6}	5.2×10^{-8}	8.8×10^{-7}	5.5×10^{-8}	9.3×10^{-7}	3.5×10^{-10}	5.9×10^{-9}
P3C	Closure to Landfill Standards	17	7.8×10^{-7}	1.3×10^{-5}	3.8×10^{-7}	6.4×10^{-6}	4.0×10^{-7}	6.7×10^{-6}	2.5×10^{-9}	4.3×10^{-8}
P26/51	Performance-Based Closure with Class A or C Fill	27	1.1×10^{-7}	2.4×10^{-6}	5.3×10^{-8}	1.2×10^{-6}	5.6×10^{-8}	1.2×10^{-6}	3.6×10^{-10}	7.9×10^{-9}
Bin Sets										
P59F	Clean Closure	20	1.3×10^{-7}	2.6×10^{-6}	1.2×10^{-7}	2.3×10^{-6}	1.3×10^{-8}	2.7×10^{-7}	3.3×10^{-12}	6.7×10^{-11}
P59C	Performance-Based Closure with Clean Fill	20	1.7×10^{-7}	3.4×10^{-6}	1.5×10^{-5}	3.0×10^{-6}	1.7×10^{-8}	3.5×10^{-7}	4.3×10^{-12}	8.7×10^{-11}
P59D	Closure to Landfill Standards	20	1.2×10^{-6}	2.4×10^{-5}	1.1×10^{-6}	2.2×10^{-5}	1.2×10^{-7}	2.5×10^{-6}	3.1×10^{-11}	6.2×10^{-10}
P26/51	Performance-Based Closure with Class A or C Fill	18	1.7×10^{-7}	2.5×10^{-6}	1.5×10^{-7}	2.3×10^{-6}	1.7×10^{-8}	2.6×10^{-7}	4.3×10^{-12}	6.5×10^{-11}

a. Annual emissions represent the highest projected emission rate for any single year. Total emissions value is the product of annual emissions for each dispositioning project and the duration (in years) of that project. Annual totals include only those projects which are projected to occur over a similar time frame. Source: Project Data Sheets (Appendix C.6).

Table C.2-24. Airborne radionuclide emissions estimates for dispositioning other existing facilities associated with HLW management.

Facility group	Closure method[b]	Duration (years)	Annual emission rate and total project emissions[a] – Total Activity (curies per year)	Total Activity (curies)	Strontium-90/Yttrium-90 (curies per year)	Strontium-90/Yttrium-90 (curies)	Cesium-137 (curies per year)	Cesium-137 (curies)	Plutonium-239 (curies per year)	Plutonium-239 (curies)
Tank Farm Related Facilities										
Waste Storage Control House (CPP-619)	Landfill	6	1.5×10^{-8}	8.7×10^{-7}	7.0×10^{-8}	4.2×10^{-8}	7.4×10^{-9}	4.4×10^{-8}	4.7×10^{-11}	2.8×10^{-10}
Waste Storage Control House (CPP-628)	Landfill	6	1.5×10^{-8}	8.7×10^{-8}	7.0×10^{-9}	4.2×10^{-8}	7.4×10^{-9}	4.4×10^{-8}	4.7×10^{-11}	2.8×10^{-10}
Waste/Station Tank Transfer Bldg. (CPP-638)	Landfill	2	1.5×10^{-8}	2.9×10^{-8}	7.0×10^{-9}	1.4×10^{-8}	7.4×10^{-9}	1.5×10^{-8}	4.7×10^{-11}	9.5×10^{-11}
Instrument House (CPP-712)	Landfill	6	1.5×10^{-8}	8.7×10^{-8}	7.0×10^{-9}	4.2×10^{-8}	7.4×10^{-9}	4.4×10^{-8}	4.7×10^{-11}	2.8×10^{-10}
STR Waste Storage Tanks (CPP-717)	Landfill	6	$1.5\times10\text{-}^{8}$	8.7×10^{-8}	7.0×10^{-9}	4.2×10^{-8}	7.4×10^{-9}	4.4×10^{-8}	4.7×10^{-11}	2.8×10^{-10}
Total			5.8×10^{-8}	3.8×10^{-7}	2.8×10^{-8}	1.8×10^{-7}	3.0×10^{-8}	1.9×10^{-7}	1.9×10^{-10}	1.2×10^{-9}
Bin Set Related Facilities										
Instrument Bldg. for Bin Set 1 (CPP-639)	Landfill	6	1.5×10^{-8}	8.7×10^{-8}	1.3×10^{-8}	7.8×10^{-8}	1.5×10^{-9}	8.9×10^{-9}	3.7×10^{-13}	2.2×10^{-12}
Instr. Bldg. for 2nd Set of calcined solids (CPP-646)	Landfill	6	1.5×10^{-8}	8.7×10^{-8}	1.3×10^{-8}	7.8×10^{-8}	1.5×10^{-9}	8.9×10^{-9}	3.7×10^{-13}	2.2×10^{-12}
Instr. Bldg. for 3rd Set of calcined solids (CPP-647)	Landfill	6	1.5×10^{-8}	8.7×10^{-8}	1.3×10^{-8}	7.8×10^{-8}	1.5×10^{-9}	8.9×10^{-9}	3.7×10^{-13}	2.2×10^{-12}
Instr. Bldg. for 4th Set of calcined solids (CPP-658)	Landfill	6	1.5×10^{-8}	8.7×10^{-8}	1.3×10^{-8}	7.8×10^{-8}	1.5×10^{-9}	8.9×10^{-9}	3.7×10^{-13}	2.2×10^{-12}
Instr. Bldg. for 5th Set of calcined solids (CPP-671)	Landfill	6	1.5×10^{-8}	8.7×10^{-8}	1.3×10^{-8}	7.8×10^{-8}	1.5×10^{-9}	8.9×10^{-9}	3.7×10^{-13}	2.2×10^{-12}
Instr. Bldg. for 6th Set of calcined solids (CPP-673)	Landfill	6	1.5×10^{-8}	8.7×10^{-8}	1.3×10^{-8}	7.8×10^{-8}	1.5×10^{-9}	8.9×10^{-9}	3.7×10^{-13}	2.2×10^{-12}
Total			8.7×10^{-8}	5.2×10^{-7}	7.8×10^{-8}	4.7×10^{-7}	8.9×10^{-9}	5.4×10^{-8}	2.2×10^{-12}	1.3×10^{-4}
Process Equipment Waste Evaporator and Related Facilities										
Liquid Effluent Treat. & Disp. Bldg. (CPP-1618)	Clean	6	1.5×10^{-8}	8.7×10^{-8}	7.0×10^{-9}	4.2×10^{-8}	7.4×10^{-9}	4.4×10^{-8}	4.7×10^{-11}	2.8×10^{-10}
Waste Holdup Pumphouse (CPP-641)	Clean	2	1.5×10^{-8}	2.9×10^{-8}	7.0×10^{-9}	1.4×10^{-8}	7.4×10^{-9}	1.5×10^{-8}	4.7×10^{-11}	9.5×10^{-11}
PEW Evaporator Bldg. (CPP-604)	Landfill	6	1.5×10^{-8}	8.7×10^{-8}	7.0×10^{-9}	4.2×10^{-8}	7.4×10^{-9}	4.4×10^{-8}	4.7×10^{-11}	2.8×10^{-10}
Atmospheric Protection Bldg. (CPP-649)	Landfill	6	1.5×10^{-8}	8.7×10^{-8}	7.0×10^{-9}	4.2×10^{-8}	7.4×10^{-9}	4.4×10^{-8}	4.7×10^{-11}	2.8×10^{-10}
Pre-Filter Bldg. (CPP-756)	Landfill	6	1.5×10^{-8}	8.7×10^{-8}	7.0×10^{-9}	4.2×10^{-8}	7.4×10^{-9}	4.4×10^{-8}	4.7×10^{-11}	2.8×10^{-10}
Blower Bldg. (CPP-605)	Landfill	6	1.5×10^{-8}	8.7×10^{-8}	7.0×10^{-9}	4.2×10^{-8}	7.4×10^{-9}	4.4×10^{-8}	4.7×10^{-11}	2.8×10^{-10}
Main Exhaust Stack (CPP-708)	Landfill	6	1.5×10^{-8}	8.7×10^{-8}	7.0×10^{-9}	4.2×10^{-8}	7.4×10^{-9}	4.4×10^{-8}	4.7×10^{-11}	2.8×10^{-10}
Total			1.0×10^{-7}	5.5×10^{-7}	4.9×10^{-8}	2.7×10^{-7}	5.2×10^{-8}	2.8×10^{-7}	3.3×10^{-8}	1.8×10^{-9}
Fuel Processing Building and Related Facilities										
Fuel Processing Building (CPP-601)	Perf.-Based or Landfill	10	5.8×10^{-8}	5.8×10^{-7}	2.8×10^{-8}	2.8×10^{-7}	3.0×10^{-8}	3.0×10^{-7}	1.9×10^{-10}	1.9×10^{-9}
Remote Analytical Facility Building (CPP-627)	Perf.-Based or Landfill	10	5.8×10^{-8}	5.8×10^{-7}	2.8×10^{-8}	2.8×10^{-7}	3.0×10^{-8}	3.0×10^{-7}	1.9×10^{-10}	1.9×10^{-9}
Head End Process Plant (CPP-640)	Perf.-Based or Landfill	10	5.8×10^{-8}	5.8×10^{-7}	2.8×10^{-8}	2.8×10^{-7}	3.0×10^{-8}	3.0×10^{-7}	1.9×10^{-10}	1.9×10^{-9}
Total			1.7×10^{-7}	1.7×10^{-6}	8.5×10^{-8}	8.5×10^{-7}	8.9×10^{-9}	8.9×10^{-7}	5.7×10^{-10}	5.7×10^{-9}

Table C.2-24. (continued).

Facility group	Closure method[b]	Duration (years)	Total Activity (curies per year)	Total Activity (curies)	Strontium-90/Yttrium-90 (curies per year)	Strontium-90/Yttrium-90 (curies)	Cesium-137 (curies per year)	Cesium-137 (curies)	Plutonium-239 (curies per year)	Plutonium-239 (curies)
			Annual emission rate and total project emissions[a]							
Fluorinel and Storage Facility and Related Facilities										
FAST Facility and Stack	-[c]	6	5.8×10^{-8}	3.5×10^{-7}	2.8×10^{-8}	1.7×10^{-7}	1.4×10^{-8}	8.7×10^{-8}	4.7×10^{-11}	2.8×10^{-10}
New Waste Calcining Facility										
New Waste Calcining Facility	Perf.-Based or Landfill	3	5.8×10^{-8}	1.7×10^{-7}	5.2×10^{-8}	1.6×10^{-7}	6.0×10^{-9}	1.8×10^{-8}	1.5×10^{-12}	4.5×10^{-12}
Remote Analytical Laboratory										
Remote Analytical Laboratory (CPP-684)	Perf.-Based	6	2.9×10^{-8}	1.7×10^{-7}	1.4×10^{-8}	8.5×10^{-8}	1.5×10^{-8}	8.9×10^{-8}	9.5×10^{-11}	5.7×10^{-10}

a. Annual emissions represent the highest emission rate for any single year and are the sum of annual emission rates for each activity within a group that may occur during a common year; cumulative emissions are the annual rate multiplied by duration in years. Facility group totals are the sums of individual projects within that group. Annual emission rate totals are for projects that would occur over the same general time frame. All values are rounded to two significant figures. Source: Project Data Sheets (Appendix C.6).

b. See Table 3-4 for facility disposition alternatives that apply to each group. The Fuel Processing Building and Related Facilities and the New Waste Calcining Facility could be dispositioned by either performance-based closure or closure to landfill standards. Individual facilities within all other groups would be dispositioned according to a single closure method.

c. Project includes deactivation and demolition of the Fluorinel and Storage Facility building (CPP-666) and the associated stack (CPP-767). The Fluorinel and Storage Facility building would be closed according to performance-based closure criteria and the stack by clean closure. Emissions listed are totals from closure of both facilities.

Table C.2-25. Summary of radiation dose impacts associated with airborne radionuclide emissions from dispositioning other existing facilities associated with high-level waste management.

		Maximum annual radiation dose[a]							
Case	Applicable Standard	Tank Farm Related Facilities	Bin Set Related Facilities	Process Equip. Waste Evaporator and Related Facilities	Fuel Process. Building and Related Facilities	Fluorinel and Storage Facility and Related Facilities	Transport Lines Group	New Waste Calcining Facility	Remote Analytical Laboratory
Dose to maximally-exposed offsite individual (millirem per year)	10[b]	8.1×10^{-11}	6.7×10^{-10}	1.2×10^{-10}	2.4×10^{-10}	8.1×10^{-11}	-[c]	4.5×10^{-11}	4.1×10^{-11}
Dose to maximally-exposed noninvolved worker (millirem per year)[d]	5,000[e]	8.1×10^{-11}	1.6×10^{-10}	1.2×10^{-10}	2.4×10^{-10}	8.1×10^{-11}	-	1.0×10^{-11}	4.1×10^{-11}
Collective dose to population within 50 miles of INTEC (person-rem per year)[f]	NA	2.1×10^{-9}	3.7×10^{-9}	3.1×10^{-9}	6.2×10^{-9}	2.1×10^{-9}	-	2.5×10^{-9}	1.0×10^{-9}

a. Doses are maximum effective dose equivalents over any single year during which dispositioning occurs. Annual totals include only those projects which are projected to occur over a similar time frame.
b. EPA dose limit specified in 40 CFR 61.92; applies to effective dose equivalent from air releases only.
c. There would be no radionuclide emissions for this group under this closure option.
d. Location of highest onsite dose is Central Facilities Area.
e. Occupational dose limit per 10 CFR 835.202; applies to sum of doses from all exposure pathways.
f. A reference population of 200,000 people is used for future population dose estimates. At currently projected growth rates, this is the approximate population level that would exist around the year 2030. During 1990, this population was 118,644.

Table C.2-26. Summary of nonradiological air pollutant emissions estimates for dispositioning proposed facilities associated with waste processing alternatives.

			Annual and cumulative project emissions [a]							
			Criteria pollutants[b]		Toxic air pollutants		Carbon dioxide[c]		Fugitive dust	
Project number	Description	Duration (years)	(tons/ year)	(tons)	(pounds per year)	(pounds)	(tons/y ear)	(tons)	(tons/ year)	(tons)
No Action Alternative										
P1D	No Action Alternative	-	-	-	-	-	-	-	-	-
Continued Current Operations Alternative										
P1A	Calcine SBW including NWCF Upgrades (MACT)	3	100	150	120	170	2,300	3,300	10	15
P1B	NGLWM and TF Waste Heel Waste	1	38	38	43	43	840	840	14	14
P1F	Bin Set 1 Closure	2	7	14	8	16	150	307	11	22
Totals			150	200	170	230	3,300	4,400	35	51
Full Separations Option[d]										
P59A	Calcine Retrieval and Transport	1	57	57	65	65	1,300	1,300	7	7
P9A	Full (early) Separations	3	120	360	140	409	2,600	7,900	64	190
P9B	Vitrification Plant	3	64	190	73	220	1,400	4,200	15	45
P9C	Class A Grout Plant	3	64	160	73	180	1,400	3,500	15	38
P24	Vitrified Product Interim Storage	3	17	48	19	55	370	1,100	43	120
P18	New Analytical Lab	2	83	160	95	190	1,800	3,700	9	18
P118	Separations Organic Incinerator	2	6	12	7	14	130	260	2	4
P133	Waste Treatment Pilot Plant	2	31	63	36	71	690	1,400	8	17
P35D	Class A Grout Packaging & Shipping to INEEL Landfill	2	11	23	13	26	240	500	2	4
P27	Class A Grout in New Landfill Facility	2	32	64	36	72	700	1,400	310	620
Totals			490	1,100	550	1,300	11,000	25,000	480	1,100
Planning Basis Option[d]										
P1A	Calcine SBW including NWCF Upgrades (MACT)	3	103	150	120	170	2,300	3,300	10	15
P1B	NGLWM and TF Waste Heel Waste	1	38	38	43	43	840	840	14	14
P59A	Calcine Retrieval and Transport	1	57	57	65	65	1,300	1,300	7	7
P23A	Full Separations	3	120	360	140	409	2,600	7,900	64	190
P23B	Vitrification Plant	3	64	190	73	220	1,400	4,200	15	45
P23C	Class A Grout Plant	3	64	160	73	180	1,400	3,500	15	38
P24	Vitrified Product Interim Storage	3	17	48	19	55	370	1,100	43	120
P18	New Analytical Lab	2	83	160	95	190	1,800	3,700	9	18
P118	Separations Organic Incinerator	2	6	12	7	14	130	260	2	4
P133	Waste Treatment Pilot Plant	2	31	63	36	71	690	1,400	8	17
P35E	Class A Grout Packaging and Loading for Offsite Disposal	2	11	23	13	26	250	500	2	4
Totals			590	1,300	680	1,400	13,000	28,000	190	480

Table C.2-26. Summary of nonradiological air pollutant emissions estimates for dispositioning proposed facilities associated with waste processing alternatives (continued).

			Annual and cumulative project emissions [a]							
			Criteria pollutants[b]		Toxic air pollutants		Carbon dioxide[c]		Fugitive dust	
Project number	Description	Duration (years)	(tons/ year)	(tons)	(pounds per year)	(pounds)	(tons/ year)	(tons)	(tons/ year)	(tons)
	Transuranic Separations Option[e]									
P59A	Calcine Retrieval and Transport	1	57	57	65	65	1,300	1,300	7	7
P49A	Transuranic-C Separations	3	94	280	107	320	2,100	6,200	64	190
P49C	Class C Grout Plant	2	64	130	73	150	1,400	2,800	15	30
P39A	Packaging and Loading Transuranic at INTEC for Shipment to WIPP	2	29	43	33	49	630	950	-	-
P18	New Analytical Lab	2	83	170	95	190	1,800	3,700	9	18
P118	Separations Organic Incinerator	2	6	12	7	14	130	260	2	4
P133	Waste Treatment Pilot Plant	2	31	63	36	71	690	1,400	8	17
P49D	Class C Grout Packaging & Shipping	2	11	23	13	26	250	500	2	4
P27	Class C Grout in New Landfill Facility	2	32	64	36	72	700	1,400	310	620
Totals			407	840	460	960	9,000	18,000	420	890
	Hot Isostatic Pressed Waste Option									
P1A	Calcine SBW including NWCF Upgrades (MACT)	3	103	150	120	170	2,300	3,300	10	15
P1B	NGLWM and TF Waste Heel Waste	1	38	38	43	43	840	840	14	14
P18	New Analytical Lab	2	83	160	95	190	1,800	3,700	9	18
P59A	Calcine Retrieval and Transport	1	57	57	65	65	1,300	1,300	7	7
P71	Mixing and HIPing	5	49	250	56	280	1,100	5,400	89	450
P72	HIPed HLW Interim Storage	3	38	110	43	130	830	2,500	43	130
P73A	Packaging and Loading HIPed Waste at INTEC for Shipment to NGR	3	29	72	33	82	630	1,600	-	-
P133	Waste Treatment Pilot Plant	2	31	63	36	71	690	1,400	8	17
Totals			430	900	490	1,000	9,400	20,000	180	650
	Direct Cement Waste Option									
P1A	Calcine SBW including NWCF Upgrades (MACT)	3	103	150	120	170	2,300	3,300	10	15
P1B	NGLWM and TF Waste Heel Waste	1	38	38	43	43	840	840	14	14
P18	New Analytical Lab	2	83	170	95	190	1,800	3,700	9	18
P59A	Calcine Retrieval and Transport	1	57	57	65	65	1,300	1,300	7	7
P80	Direct Cement Process	3	72	220	82	250	1,600	4,800	51	150
P81	Unseparated Cementitious HLW Interim Storage	3	66	200	75	230	1,400	4,300	130	390
P83A	Packaging & Loading of Cement Waste at INTEC for Shipment to NGR	4	29	100	33	110	630	2,200	-	-
P133	Waste Treatment Pilot Plant	2	31	63	36	71	690	1,400	8	17
Totals			480	990	550	1,100	11,000	22,000	230	610

Table C.2-26. Summary of nonradiological air pollutant emissions estimates for dispositioning proposed facilities associated with waste processing alternatives (continued).

Project number	Description	Duration (years)	Annual and cumulative project emissions[a]: Criteria pollutants[b] (tons/ year)	Criteria pollutants[b] (tons)	Toxic air pollutants (pounds per year)	Toxic air pollutants (pounds)	Carbon dioxide[c] (tons/ year)	Carbon dioxide[c] (tons)	Fugitive dust (tons/ year)	Fugitive dust (tons)
Early Vitrification Option										
P18	Calcine Retrieval and Transport	2	83	170	95	190	1,800	3,700	9	18
P59A	Calcine Retrieval and Transport	1	57	57	65	65	1,300	1,300	7	7
P61	Vitrified HLW Interim Storage	3	53	160	61	180	1,200	3,500	72	220
P62A	Packaging/Loading Vitrified HLW at INTEC for Shipment to NGR	3	29	86	33	98	630	1,900	-	-
P88	Early Vitrification with MACT	5	106	530	120	606	2,300	12,000	40	200
P90A	Packaging & Loading Vitrified SBW at INTEC for Shipment to WIPP	2	29	43	33	49	630	950	-	-
P133	Waste Treatment Pilot Plant	2	31	63	36	71	690	1,400	8	17
Totals			390	1,100	440	1,300	8,500	24,000	140	460
Minimum INEEL Processing Alternative[f]										
P18	New Analytical Lab	2	83	170	95	190	1,800	3,700	9	18
P24	Vitrified Product Interim Storage	3	17	48	19	55	370	1,100	43	120
P27	Class A Grout in New Landfill Facility	2	32	64	36	72	700	1,400	310	620
P111	SBW Treatment with CsIX	1	38	38	43	43	840	840	14	14
P112A	Packaging and Loading CH-Transuranic for Transport to WIPP	5	29	130	33	150	630	2,800	-	-
P133	Waste Treatment Pilot Plant	2	31	63	36	71	690	1,400	8	17
P59B	Calcine Retrieval and Transport Just in Time	1	180	180	200	200	3,800	3,800	7	7
P117B	Calcine Packaging & Loading Just in Time	3	47	140	53	160	1,000	3,100	21	63
Totals			450	820	510	940	9,900	18,000	410	860

a. Maximum annual emissions represent the highest emission rate for any single year; total emissions value is the product of annual emissions for each dispositioning project and the duration (in years) of that project. Source: Project Data Sheets (Appendix C.6).

b. The specific pollutants and approximate relative percentages are as follows: carbon monoxide - 45 percent; sulfur dioxide - 7 percent; nitrogen dioxide - 38 percent; particulate matter - 2 percent; and volatile organic compounds - 8 percent.

c. Carbon dioxide is listed because this gas has been implicated in global warming.

d. Assumes disposal of Class A grout either offsite (Full Separations and Planning Basis Options) or in new INEEL landfill facility (Full Separations Option); impacts of disposal in Tank Farm and bin sets are addressed in Section C.2.7.2.

e. Assumes disposal of Class C grout in new facility; impacts of disposal in Tank Farm and bin sets are addressed in Section C.2.7.2.

f. Assumes "just-in-time" shipping scenario; nonradiological emissions impacts of interim storage of calcine at Hanford would be somewhat less.

Table C.2-27. Maximum criteria pollutant impacts from dispositioning of facilities associated with waste processing alternatives.

		Impact of alternative (micrograms per cubic meter)			Cumulative impact (micrograms per cubic meter)[a]			Percent of standard[b]		
Pollutant	Averaging time	INEEL boundary	Public roads	Craters of the Moon	INEEL boundary	Public roads	Craters of the Moon	INEEL boundary	Public roads	Craters of the Moon
No Action Alternative										
Carbon monoxide	1-hour	-	-	-	210	420	12	<1	1	<1
	8-hour	-	-	-	78	66	4.2	<1	<1	<1
Nitrogen dioxide	Annual	-	-	-	0.50	1.2	0.060	<1	1	<1
Sulfur dioxide	3-hour	-	-	-	24	38	3.8	2	3	<1
	24-hour	-	-	-	5.3	10	1.3	1	3	<1
	Annual	-	-	-	0.14	0.45	0.020	<1	<1	<1
Respirable particulates[c]	24-hour	-	-	-	12	24	1.0	8	16	<1
	Annual	-	-	-	0.49	1.8	0.040	<1	4	<1
Lead	Quarterly	-	-	-	2.3×10^{-4}	5.0×10^{-4}	5.5×10^{-5}	<1	<1	<1
Continued Current Operations Alternative										
Carbon monoxide	1-hour	140	380	32	340	800	44	<1	2	<1
	8-hour	54	140	5.5	130	210	10	1	2	<1
Nitrogen dioxide	Annual	0.13	0.51	0.010	0.59	1.7	0.070	<1	2	<1
Sulfur dioxide	3-hour	14	33	2.3	37	71	6.0	3	5	<1
	24-hour	2.9	7.7	0.29	8.3	18	1.5	2	5	<1
	Annual	0.020	0.090	2.0×10^{-3}	0.16	0.55	0.020	<1	<1	<1
Respirable particulates[c]	24-hour	1.1	2.8	0.11	13	27	1.1	9	18	<1
	Annual	9.0×10^{-3}	0.030	8.0×10^{-4}	0.50	1.8	0.040	<1	4	<1
Lead	Quarterly	1.9×10^{-6}	6.1×10^{-6}	1.8×10^{-7}	2.3×10^{-4}	5.0×10^{-4}	5.5×10^{-5}	<1	<1	<1
Full Separations Option										
Carbon monoxide	1-hour	440	1,300	104	650	1,700	120	2	4	<1
	8-hour	180	470	18	260	530	22	3	5	<1
Nitrogen dioxide	Annual	0.43	1.7	0.040	0.89	2.9	0.10	<1	3	<1
Sulfur dioxide	3-hour	46	110	7.4	69	150	11	5	11	<1
	24-hour	10	25	0.90	15	35	2.2	4	10	<1
	Annual	0.080	0.30	7.0×10^{-3}	0.22	0.75	0.020	<1	<1	<1
Respirable particulates[c]	24-hour	3.5	9.2	0.35	15	34	1.3	10	22	<1
	Annual	0.030	0.11	3.0×10^{-3}	0.52	1.9	0.050	1	4	<1
Lead	Quarterly	6.1×10^{-6}	2.0×10^{-5}	5.8×10^{-7}	2.4×10^{-4}	5.1×10^{-4}	5.6×10^{-5}	<1	<1	<1
Planning Basis Option										
Carbon monoxide	1-hour	540	1.5×10^{3}	130	750	2.0×10^{3}	140	2	5	<1
	8-hour	220	570	22	300	640	26	3	6	<1
Nitrogen dioxide	Annual	0.53	2.0	0.050	1.0	3.3	0.10	<1	3	<1
Sulfur dioxide	3-hour	56	130	9.1	80	170	13	6	13	<1
	24-hour	12	31	1.2	17	41	2.4	5	11	<1
	Annual	0.10	0.37	9.0×10^{-3}	0.24	0.82	0.020	<1	1	<1
Respirable particulates[c]	24-hour	4.3	11	0.43	16	36	1.4	11	24	<1
	Annual	0.040	0.13	3.0×10^{-3}	0.53	1.9	0.050	1	4	<1
Lead	Quarterly	7.5×10^{-6}	2.4×10^{-5}	7.1×10^{-7}	2.4×10^{-4}	5.2×10^{-4}	5.6×10^{-5}	<1	<1	<1

Table C.2-27. Maximum criteria pollutant impacts from dispositioning of facilities associated with waste processing alternatives (continued).

Pollutant	Averaging time	Impact of alternative (micrograms per cubic meter)			Cumulative impact (micrograms per cubic meter)[a]			Percent of standard[b]		
		INEEL boundary	Public roads	Craters of the Moon	INEEL boundary	Public roads	Craters of the Moon	INEEL boundary	Public roads	Craters of the Moon
Transuranic Separations Option										
Carbon monoxide	1-hour	370	1.1×10^{3}	87	580	1.5×10^{3}	99	1	4	<1
	8-hour	150	390	15	230	460	19	2	5	<1
Nitrogen dioxide	Annual	0.37	1.4	0.030	0.82	2.6	0.090	<1	3	<1
Sulfur dioxide	3-hour	38	91	6.2	62	130	10	5	10	<1
	24-hour	8.1	21	0.80	13	31	2.0	4	9	<1
	Annual	0.070	0.25	6.0×10^{-3}	0.21	0.71	0.020	<1	<1	<1
Respirable particulates[c]	24-hour	3.0	7.7	0.29	15	32	1.3	10	21	<1
	Annual	0.020	0.090	2.0×10^{-3}	0.51	1.8	0.050	1	4	<1
Lead	Quarterly	5.1×10^{-6}	1.7×10^{-5}	4.9×10^{-7}	2.4×10^{-4}	5.1×10^{-4}	5.5×10^{-5}	<1	<1	<1
Hot Isostatic Pressed Waste Option										
Carbon monoxide	1-hour	390	1.1×10^{3}	91	600	1.5×10^{3}	100	1	4	<1
	8-hour	160	410	16	240	480	20	2	5	<1
Nitrogen dioxide	Annual	0.38	1.5	0.030	0.84	2.7	0.090	<1	3	<1
Sulfur dioxide	3-hour	40	95	6.5	64	134	10	5	10	<1
	24-hour	8.5	22	0.84	14	32	2.1	4	9	<1
	Annual	0.070	0.26	6.0×10^{-3}	0.21	0.72	0.020	<1	<1	<1
Respirable particulates[c]	24-hour	3.1	8.1	0.31	15	32	1.3	10	22	<1
	Annual	0.030	0.10	2.0×10^{-3}	0.52	1.8	0.050	1	4	<1
Lead	Quarterly	5.4×10^{-6}	1.8×10^{-5}	5.1×10^{-7}	2.4×10^{-4}	5.1×10^{-4}	5.6×10^{-5}	<1	<1	<1
Direct Cement Waste Option										
Carbon monoxide	1-hour	440	1.2×10^{3}	102	640	1.6×10^{3}	114	2	4	<1
	8-hour	180	460	18	250	530	22	3	5	<1
Nitrogen dioxide	Annual	0.43	1.6	0.040	0.89	2.9	0.10	<1	3	<1
Sulfur dioxide	3-hour	45	110	7.3	69	145	11	5	11	<1
	24-hour	10	25	0.94	15	35	2.2	4	10	<1
	Annual	0.080	0.30	7.0×10^{-3}	0.22	0.75	0.020	<1	<1	<1
Respirable particulates[c]	24-hour	3.5	9.1	0.34	15	33	1.3	10	22	<1
	Annual	0.030	0.11	0.020	0.52	1.9	0.050	1	4	<1
Lead	Quarterly	6.0×10^{-6}	2.0×10^{-5}	5.7×10^{-7}	2.4×10^{-4}	5.1×10^{-4}	5.6×10^{-5}	<1	<1	<1
Early Vitrification Option										
Carbon monoxide	1-hour	350	1.0×10^{3}	83	559	1.4×10^{3}	95	1	4	<1
	8-hour	140	370	14	221	440	19	2	4	<1
Nitrogen dioxide	Annual	0.35	1.3	0.030	0.8	2.6	0.090	<1	3	<1
Sulfur dioxide	3-hour	37	86	5.9	60	130	10	5	10	<1
	24-hour	7.7	20	0.76	13	30	2.0	4	8	<1
	Annual	0.060	0.24	6.0×10^{-3}	0.2	0.69	0.020	<1	<1	<1
Respirable particulates[c]	24-hour	2.8	7.4	0.28	15	32	1.2	10	21	<1
	Annual	0.020	0.090	2.0×10^{-3}	0.51	1.8	0.050	1	4	<1
Lead	Quarterly	4.9×10^{-6}	1.6×10^{-5}	4.6×10^{-7}	2.3×10^{-4}	5.1×10^{-4}	5.5×10^{-5}	<1	<1	<1

Table C.2-27. Maximum criteria pollutant impacts from dispositioning of facilities associated with waste processing alternatives (continued).

Pollutant	Averaging time	Impact of alternative (micrograms per cubic meter)			Cumulative impact (micrograms per cubic meter)[a]			Percent of standard[b]		
		INEEL boundary	Public roads	Craters of the Moon	INEEL boundary	Public roads	Craters of the Moon	INEEL boundary	Public roads	Craters of the Moon
Minimum INEEL Processing Alternative[d]										
Carbon monoxide	1-hour	410	1.2×10^{3}	97	620	1.6×10^{3}	110	2	4	<1
	8-hour	170	430	17	240	500	21	2	5	<1
Nitrogen dioxide	Annual	0.40	1.6	0.040	0.86	2.8	0.090	<1	3	<1
Sulfur dioxide	3-hour	43	100	6.9	66	139	11	5	11	<1
	24-hour	9.0	23	0.88	14	33	2.1	4	9	<1
	Annual	0.070	0.28	7.0×10^{-3}	0.21	0.73	0.020	<1	<1	<1
Respirable particulates[c]	24-hour	3.3	8.6	0.32	15	33	1.3	10	22	<1
	Annual	0.030	0.10	2.0×10^{-3}	0.52	1.9	0.050	1	4	<1
Lead	Quarterly	5.7×10^{-6}	1.9×10^{-5}	5.4×10^{-7}	2.4×10^{-4}	5.1×10^{-4}	5.6×10^{-5}	<1	<1	<1

a. Cumulative impacts conservatively assume that the highest concentration for the alternative and the highest baseline concentration occur at the same location and (for concentrations other than annual averages) over the same time period.
b. Cumulative impacts are compared to the applicable standards provided in Table C.2-15. All standards except that for 3-hour sulfur dioxide are primary standards designed to protect public health. The 3-hour sulfur dioxide standard is a secondary standard designed to protect public welfare. (There is no primary standard for 3-hour sulfur dioxide.)
c. Values do not include contributions of fugitive dust.
d. Impacts for the Minimum INEEL Processing Alternative do not include impacts at Hanford.

Table C.2-28. Summary of maximum toxic air pollutant concentrations at onsite and offsite locations by waste processing alternative.

	Highest percentage of applicable standard[a,b]								
			Separations Alternative			Non-Separations Alternative			
Receptor	No Action Alternative	Continued Current Operations	Full Separations Option	Planning Basis Option	Transuranic Separations Option	Hot Isostatic Pressed Waste Option	Direct Cement Waste Option	Early Vitrification Option	Minimum INEEL Processing Alternative
Carcinogens									
INEEL boundary areas	-	0.65	2.1	2.6	1.8	1.9	2.1	1.7	2.0
Craters of the Moon	-	0.060	0.19	0.24	0.16	0.17	0.19	0.15	0.18
INEEL facility area location[d]	-	6.5	21	26	18	19	21	17	20
Noncarcinogens									
INEEL boundary areas	-	0.051	0.17	0.20	0.14	0.15	0.16	0.13	0.15
Craters of the Moon	-	5.0×10^{-3}	0.016	0.020	0.014	0.014	0.016	0.013	0.020
Public road locations	-	0.13	0.43	0.53	0.36	0.38	0.43	0.35	0.40
INEEL facility area location[d]	-	4.9	16	20	13	14	16	13	15

a. Applicable ambient air standards are specified in IDHW (1997) for carcinogenic air pollutants and noncarcinogenic toxic air pollutant increments. It should be noted that these standards apply only to new sources; for existing sources, they are used here as reference values for purposes of comparison.
b. Applicable standard for onsite levels is the 8-hour occupational exposure limit established by either the American Conference of Government Industrial Hygienists or the Occupational Safety and Health Administration; the lower of the two is used.
c. In all cases, the highest carcinogenic and noncarcinogenic impacts are due to nickel and vanadium, respectively.
d. Location of highest onsite impacts is within INTEC.

Table C.2-29. Summary of nonradiological air pollutant emissions estimates for Tank Farm and bin set closure scenarios.

Facilities	Duration (years)	Annual and cumulative project emissions[a] Criteria pollutants[b] (tons/year)	Criteria pollutants[b] (tons)	Toxic air pollutants (lb/year)	Toxic air pollutants (lb)	Carbon dioxide[c] (tons/year)	Carbon dioxide[c] (tons)	Fugitive dust (tons/year)	Fugitive dust (tons)
Tank Farm									
Clean Closure	17	43	730	48	820	1,500	2.6×10^4	130	2,200
Performance-Based Closure with Clean Fill	17	8.5	140	10	160	180	3.0×10^3	19	150
Closure to Landfill Standards	17	6.0	100	6.7	110	130	2.1×10^3	19	150
Performance-Based Closure with Class A or C Fill	27	5.3	110	6.0	160	110	2.2×10^3	37	670
Bin Sets									
Clean Closure	20	2.1	42	2.4	48	44	870	53	1.1×10^3
Performance-Based Closure with Clean Fill	20	1.8	36	2.0	40	37	740	33	660
Closure to Landfill Standards	20	1.8	36	2.0	40	38	760	33	660
Performance-Based Closure with Class A or C Fill	18	2.7	33	3.0	54	55	680	66	860

a. Annual emissions represent the highest emission rate for any single year and is the sum of annual emission rates for each activity within a group that may occur during a common year; cumulative emissions is the annual rate multiplied by duration in years. Facility group totals are the sums of individual projects within that group. Annual emission rate totals are for projects that would occur over the same general time frame. All values are rounded to two significant figures. Source: Project Data Sheets (Appendix C.6).

b. The specific pollutants and approximate relative percentages are as follows: carbon monoxide - 45 percent; sulfur dioxide - 7 percent; nitrogen dioxide - 38 percent; particulate matter - 2 percent; and volatile organic compounds - 8 percent.

c. Carbon dioxide is listed because this gas has been implicated in global warming.

Table C.2-30. Maximum criteria pollutant impacts from Tank Farm and bin set closure scenarios.

	Averaging time	Impact of alternative (micrograms per cubic meter)			Cumulative impact (micrograms per cubic meter)[a]			Percent of standard[b]		
		INEEL boundary	Public roads	Craters of the Moon	INEEL boundary	Public roads	Craters of the Moon	INEEL boundary	Public roads	Craters of the Moon
Tank Farm Closure Scenarios										
Clean Closure										
Carbon monoxide	1-hour	39	111	9.0	250	530	21	<1	1	<1
	8-hour	16	41	1.6	94	110	5.8	<1	1	<1
Nitrogen dioxide	Annual	0.04	0.15	4.0×10^{-3}	0.50	1.4	0.060	<1	1	<1
Sulfur dioxide	3-hour	4.1	10	0.66	28	48	4.5	2	4	<1
	24-hour	0.90	2.2	0.080	6.2	12	1.3	2	3	<1
	Annual	7.0×10^{-3}	0.03	6.3×10^{-4}	0.15	0.48	0.020	<1	<1	<1
Respirable particulates[c]	24-hour	0.31	0.82	0.031	12	25	1.0	8	17	<1
	Annual	2.5×10^{-3}	0.01	2.3×10^{-4}	0.49	1.8	0.040	<1	4	<1
Lead	Quarterly	5.4×10^{-7}	1.8×10^{-6}	5.1×10^{-8}	2.3×10^{-4}	5.0×10^{-4}	5.5×10^{-5}	<1	<1	<1
Performance-Based Closure										
Carbon monoxide	1-hour	7.7	22	1.8	210	441	14	<1	1	<1
	8-hour	3.1	8.0	0.32	81	74	4.5	<1	<1	<1
Nitrogen dioxide	Annual	0.010	0.030	1.0×10^{-3}	0.47	1.2	0.06	<1	1	<1
Sulfur dioxide	3-hour	0.80	1.9	0.13	24	40	3.9	2	3	<1
	24-hour	0.17	0.40	0.020	5.5	10	1.3	2	3	<1
	Annual	1.4×10^{-3}	0.010	1.2×10^{-4}	0.14	0.46	0.020	<1	<1	<1
Respirable particulates[c]	24-hour	0.062	0.16	0.010	12	25	0.97	8	16	<1
	Annual	5.0×10^{-4}	1.9×10^{-3}	4.6×10^{-5}	0.49	1.8	0.043	<1	4	<1
Lead	Quarterly	1.1×10^{-7}	3.5×10^{-7}	1.0×10^{-8}	2.3×10^{-4}	5.0×10^{-4}	5.5×10^{-5}	<1	<1	<1
Closure to Landfill Standards										
Carbon monoxide	1-hour	5.5	16	1.3	210	430	13	<1	1	<1
	8-hour	2.2	5.8	0.22	80	71	4.4	<1	<1	<1
Nitrogen dioxide	Annual	5.4×10^{-3}	0.021	4.9×10^{-4}	0.46	1.2	0.056	<1	1	<1
Sulfur dioxide	3-hour	0.57	1.3	0.090	24	40	3.9	2	3	<1
	24-hour	0.12	0.31	0.010	5.4	10	1.3	1	3	<1
	Annual	1.0×10^{-3}	0.00	8.8×10^{-5}	0.14	0.46	0.016	<1	<1	<1
Respirable particulates[c]	24-hour	0.044	0.11	4.3×10^{-3}	12	24	1.0	8	16	<1
	Annual	3.5×10^{-4}	1.4×10^{-3}	3.2×10^{-5}	0.49	1.8	0.043	<1	4	<1
Lead	Quarterly	7.5×10^{-8}	2.5×10^{-7}	7.2×10^{-9}	2.3×10^{-4}	5.0×10^{-4}	5.5×10^{-5}	<1	<1	<1
Performance-Based Closure with Class A or C Grout Disposal										
Carbon monoxide	1-hour	4.8	14	1.1	211	432	13	<1	1	<1
	8-hour	1.9	5.1	0.20	80	71	4.4	<1	<1	<1
Nitrogen dioxide	Annual	5.0×10^{-3}	0.018	4.3×10^{-4}	0.46	1.2	0.060	<1	1	<1
Sulfur dioxide	3-hour	0.50	1.2	0.080	24	40	3.9	2	3	<1
	24-hour	0.11	0.27	0.010	5.4	10	1.3	1	3	<1
	Annual	8.5×10^{-4}	3.0×10^{-3}	7.8×10^{-5}	0.14	0.50	0.020	<1	<1	<1
Respirable particulates[c]	24-hour	0.040	0.10	4.0×10^{-3}	12	24	1.0	8	16	<1
	Annual	3.1×10^{-4}	1.0×10^{-3}	2.8×10^{-5}	0.49	1.8	0.040	<1	4	<1
Lead	Quarterly	6.6×10^{-8}	2.2×10^{-7}	6.3×10^{-9}	2.3×10^{-4}	5.0×10^{-4}	5.5×10^{-5}	<1	<1	<1

Table C.2-30. Maximum criteria pollutant impacts from Tank Farm and bin set closure scenarios (continued).

	Averaging time	Impact of alternative (micrograms per cubic meter): INEEL boundary	Impact of alternative: Public roads	Impact of alternative: Craters of the Moon	Cumulative impact (micrograms per cubic meter)[a]: INEEL boundary	Cumulative impact: Public roads	Cumulative impact: Craters of the Moon	Percent of standard[b]: INEEL boundary	Percent of standard: Public roads	Percent of standard: Craters of the Moon
Bin Set Closure Scenarios										
Clean Closure										
Carbon monoxide	1-hour	1.9	5.4	0.45	210	420	12	<1	1	<1
	8-hour	0.77	2.0	0.080	79	68	4.3	<1	<1	<1
Nitrogen dioxide	Annual	2.0×10^{-3}	7.0×10^{-3}	1.7×10^{-4}	0.46	1.2	0.060	<1	1	<1
Sulfur dioxide	3-hour	0.20	0.47	0.030	24	39	3.8	2	3	<1
	24-hour	0.040	0.11	4.0×10^{-3}	5.4	10	1.3	1	3	<1
	Annual	3.4×10^{-4}	1.0×10^{-3}	3.1×10^{-5}	0.14	0.46	0.020	<1	<1	<1
Respirable particulates[c]	24-hour	0.015	0.040	1.5×10^{-3}	12	24	1.0	8	16	<1
	Annual	1.2×10^{-4}	4.8×10^{-4}	1.1×10^{-5}	0.49	1.8	0.040	<1	4	<1
Lead	Quarterly	2.6×10^{-8}	8.6×10^{-8}	2.5×10^{-9}	2.3×10^{-4}	5.0×10^{-4}	5.5×10^{-5}	<1	<1	<1
Performance Based Closure										
Carbon monoxide	1-hour	1.6	4.7	0.38	210	420	12	<1	1	<1
	8-hour	0.66	1.7	0.070	79	67	4.3	<1	<1	<1
Nitrogen dioxide	Annual	1.6×10^{-3}	6.0×10^{-3}	1.5×10^{-4}	0.46	1.2	0.060	<1	1	<1
Sulfur dioxide	3-hour	0.17	0.40	0.028	24	39	3.8	2	3	<1
	24-hour	0.036	0.093	3.5×10^{-3}	5.4	10	1.3	1	3	<1
	Annual	2.9×10^{-4}	1.0×10^{-3}	2.6×10^{-5}	0.14	0.50	0.020	<1	<1	<1
Respirable particulates[c]	24-hour	0.013	0.034	1.3×10^{-3}	12	24	1.0	8	16	<1
	Annual	1.1×10^{-4}	4.1×10^{-4}	9.7×10^{-6}	0.49	1.8	0.040	<1	4	<1
Lead	Quarterly	2.3×10^{-8}	7.4×10^{-8}	2.2×10^{-9}	2.3×10^{-4}	5.0×10^{-4}	5.5×10^{-5}	<1	<1	<1
Closure to Landfill Standards										
Carbon monoxide	1-hour	1.6	4.7	0.38	210	420	12	<1	1	<1
	8-hour	0.66	1.7	0.067	79	67	4.3	<1	<1	<1
Nitrogen dioxide	Annual	1.6×10^{-3}	0.006	1.5×10^{-4}	0.46	1.2	0.060	<1	1	<1
Sulfur dioxide	3-hour	0.17	0.40	0.028	24	39	3.8	2	3	<1
	24-hour	0.036	0.093	3.5×10^{-3}	5.4	10	1.3	1	3	<1
	Annual	2.9×10^{-4}	1.0×10^{-3}	2.6×10^{-5}	0.14	0.46	0.020	<1	<1	<1
Respirable particulates[c]	24-hour	0.013	0.034	1.3×10^{-3}	12	24	1.0	8	16	<1
	Annual	1.1×10^{-4}	4.1×10^{-4}	9.7×10^{-6}	0.49	1.8	0.043	<1	4	<1
Lead	Quarterly	2.3×10^{-8}	7.4×10^{-8}	2.2×10^{-9}	2.3×10^{-4}	5.0×10^{-4}	5.5×10^{-5}	<1	<1	<1
Performance-Based Closure with Class A or C Grout Disposal										
Carbon monoxide	1-hour	2.5	7.0	0.60	210	430	13	<1	1	<1
	8-hour	1.0	2.6	0.10	79	68	4.3	<1	<1	<1
Nitrogen dioxide	Annual	2.0×10^{-3}	9.0×10^{-3}	2.2×10^{-4}	0.50	1.2	0.06	<1	1	<1
Sulfur dioxide	3-hour	0.25	0.60	0.040	24	39	3.8	2	3	<1
	24-hour	0.050	0.14	0.010	5.4	10	1.3	1	3	<1
	Annual	4.4×10^{-4}	2.0×10^{-3}	4.0×10^{-5}	0.14	0.46	0.020	<1	<1	<1
Respirable particulates[c]	24-hour	0.020	0.050	2.0×10^{-3}	12	24	1.0	8	16	<1
	Annual	1.6×10^{-4}	6.1×10^{-4}	1.5×10^{-5}	0.49	1.8	0.040	<1	4	<1
Lead	Quarterly	3.4×10^{-8}	1.1×10^{-7}	3.2×10^{-9}	2.3×10^{-4}	5.0×10^{-4}	5.5×10^{-5}	<1	<1	<1

Table C.2-30. Maximum criteria pollutant impacts from Tank Farm and bin set closure scenarios (continued).

a. Cumulative impacts conservatively assume that the highest concentration for the alternative and the highest baseline concentration occur at the same location and (for concentrations other than annual averages) over the same time period.

b. Cumulative impacts are compared to the applicable standards provided in Table C.2-15. All standards except that for 3-hour sulfur dioxide are primary standards designed to protect public health. The 3-hour sulfur dioxide standard is a secondary standard designed to protect public welfare. (There is no primary standard for 3-hour sulfur dioxide.)

c. Values do not include contributions of fugitive dust.

Table C.2-31. Summary of maximum toxic air pollutant concentrations at onsite and offsite locations from Tank Farm and bin set closure scenarios.

	Highest percentage of applicable standard[a,b]							
	Tank Farm				Bin sets			
Case	Clean closure	Performance-based closure	Closure to landfill standards	Performance-based closure with Class A or C grout disposal	Clean closure	Performance-based closure	Closure to landfill standards	Performance-based closure with Class A or C grout disposal
Carcinogens[c]								
INEEL boundary areas	0.19	0.037	0.026	0.023	9.2×10^{-3}	7.9×10^{-3}	7.9×10^{-3}	0.012
Craters of the Moon	0.017	3.4×10^{-3}	2.4×10^{-3}	2.1×10^{-3}	$<1.0\times10^{-3}$	$<1.0\times10^{-3}$	$<1.0\times10^{-3}$	1.1×10^{-3}
INEEL facility area location[d]	1.9	0.37	0.26	0.23	0.092	0.079	0.079	0.12
Noncarcinogens[c]								
INEEL boundary areas	0.015	2.9×10^{-3}	2.1×10^{-3}	1.8×10^{-3}	$<1.0\times10^{-3}$	$<1.0\times10^{-3}$	$<1.0\times10^{-3}$	$<1.0\times10^{-3}$
Craters of the Moon	1.4×10^{-3}	$<1.0\times10^{-3}$	$<1.0\times10^{-3}$	$<1.0\times10^{-3}$	$<1.0\times10^{-3}$	$<1.0\times10^{-3}$	$<1.0\times10^{-3}$	$<1.0\times10^{-3}$
Public road locations	0.038	7.6×10^{-3}	5.4×10^{-3}	4.7×10^{-3}	1.9×10^{-3}	1.6×10^{-3}	1.6×10^{-3}	2.4×10^{-3}
INEEL facility area location[d]	1.4	0.28	0.20	0.17	0.069	0.059	0.059	0.089

a. Applicable ambient air standards are specified in IDHW (1997) for carcinogenic air pollutants and noncarcinogenic toxic air pollutant increments. It should be noted that these standards apply only to new sources; they are used here as reference values for purposes of comparison.
b. Applicable standard for onsite levels is the 8-hour occupational exposure limit established by either the American Conference of Government Industrial Hygienists or the Occupational Safety and Health Administration; the lower of the two is used.
c. In all cases, the highest carcinogenic and noncarcinogenic impacts are due to nickel and vanadium, respectively.
d. Location of highest onsite impacts is within INTEC.

Table C.2-32. Summary of nonradiological air pollutant emissions estimates for dispositioning other existing INTEC facilities associated with HLW management.

Facility group	Closure method[b]	Duration (years)[c]	Annual and cumulative project emissions[a]: Criteria pollutants[d] Tons/yr	Criteria pollutants[d] Tons	Toxic air pollutants Lb/yr	Toxic air pollutants Lb	Carbon dioxide[e] Tons/yr	Carbon dioxide[e] Tons	Fugitive dust Tons/yr	Fugitive dust Tons
Tank Farm Related Facilities										
Waste Storage Control House (CPP-619)	Landfill	6	13	78	14	28	260	1,600	-	-
Waste Storage Control House (CPP-628)	Landfill	6	13	78	14	28	260	1,600	0.72	4.3
Waste /Station Tank Transfer Bldg. (CPP-638)	Landfill	2	13	26	15	30	260	520	-	-
Instrument House (CPP-712)	Landfill	6	13	78	14	28	260	1,600	-	-
STR Waste Storage Tanks (CPP-717)	Landfill	6	13	78	14	28	260	1,600	-	-
Total			65	440	72	490	1,300	8,800	0.72	4.3
Bin Set Related Facilities										
Instrument Bldg. for Bin Set 1 (CPP-639)	Landfill	6	75	450	84	500	1,600	9,300	-	-
Instr. Bldg. for 2nd Set of calcined solids (CPP-646)	Landfill	6	75	450	84	500	1,600	9,300	-	-
Instr. Bldg. for 3rd Set of calcined solids (CPP-647)	Landfill	6	75	450	84	500	1,600	9,300	-	-
Instr. Bldg. for 4th Set of calcined solids (CPP-658)	Landfill	6	75	450	84	500	1,600	9,300	-	-
Instr. Bldg. for 5th Set of calcined solids (CPP-671)	Landfill	6	75	450	84	500	1,600	9,300	-	-
Instr. Bldg. for 6th Set of calcined solids (CPP-673)	Landfill	6	75	450	84	500	1,600	9,300	-	-
Total			450	2,700	500	3,000	9,300	56,000	-	-
Process Equipment Waste Evaporator and Related Facilities										
Liquid Effluent Treat. & Disp. Bldg. (CPP-1618)	Clean	6	75	450	84	500	1,500	9,000	4.3	26
Waste Holdup Pumphouse (CPP-641)	Clean	2	13	26	15	29	260	520	-	-
PEW Evaporator Bldg. (CPP-604)	Landfill	6	33	200	37	220	660	4,000	16	96
Atmospheric Protection Bldg. (CPP-649)	Landfill	6	75	450	84	500	1,500	9,000	3.3	20
Pre-Filter Bldg. (CPP-756)	Landfill	6	75	450	84	500	1,500	9,000	4.3	26
Blower Bldg. (CPP-605)	Landfill	6	75	450	84	500	1,500	9,000	3.3	20
Main Exhaust Stack (CPP-708)	Landfill	6	75	450	84	500	1,500	9,000	35	210
PEW Equip. Waste and Cell Floor Drain Lines	Landfill	1	9	9	10	10	180	180	-	-
PEW Condensate Lines	Landfill	1	9	9	10	10	180	180	-	-
Total			430	2,500	470	2,800	8,400	49,000	66	390
Fuel Processing Building and Related Facilities[b]										
Fuel Processing Building (CPP-601)	Perf.-Based or Landfill	10	50	500	56	560	1,000	10,000	49	490
Remote Analytical Facility Building (CPP-627)	Perf.-Based or Landfill	10	50	500	56	560	1,000	10,000	10	100
Head End Process Plant (CPP-640)	Perf.-Based or Landfill	10	50	500	56	560	1,000	10,000	12	120
Total			150	1,500	170	1,700	3,000	30,000	71	710

Table C.2-32. (continued).

			Annual and cumulative project emissions[a]							
			Criteria pollutants[d]		Toxic air pollutants		Carbon dioxide[e]		Fugitive dust	
Facility group	Closure method[b]	Duration (years)[c]	(tons/ year)	(tons)	(pounds per year)	(pounds)	(tons/ year)	(tons)	(tons/year)	(tons)
Fluorinel and Storage Facility and Related Facilities										
FAST Facility and Stack	- [f]	6	50	300	56	340	1,000	6,000	20	690
Transport Lines Group										
Process Off-Gas Lines	Perf.-Based	1	9.0	9.0	10	10	190	190	2.9	2.9
Process (Dissolver) Transport Lines	Perf.-Based	1	9.0	9.0	10	10	190	190	1.4	1.4
High-Level Liquid Waste (Raffinate) Lines	Landfill	1	9.0	9.0	10	10	190	190	1.4	1.4
Calcine Solids Transport Lines	Landfill	1	9.0	9.0	10	10	190	190	1.4	1.4
Total			36	36	40	40	750	750	7.2	7.2
New Waste Calcining Facility[g]										
New Waste Calcining Facility	Perf.-Based or Landfill	3	50	150	56	170	1,000	3,100	6.3	190
Remote Analytical Laboratory										
Remote Analytical Laboratory (CPP-684)	Perf.-Based	6	33	200	37	220	680	4,100	8.6	52

a. Annual emissions represent the highest emission rate for any single year and is the sum of annual emission rates for each activity within a group that may occur during a common year; cumulative emissions are the annual rate multiplied by duration in years. Facility group totals are the sums of individual projects within that group. Annual emission rate totals are for projects that would occur over the same general time frame. All values are rounded to two significant figures. Source: Project Data Sheets (Appendix C.6).

a. See Table 3-22 for facility disposition alternatives that apply to each group. The Fuel Processing Building and Related Facilities and the New Waste Calcining Facility could be dispositioned by either performance-based closure or closure to landfill standards. Individual facilities within all other groups would be dispositioned according to a single closure method.

b. Duration refers to total number of calendar years during which dispositioning of facilities within the listed groups would occur.

c. The specific pollutants and approximate relative percentages are as follows: carbon monoxide – 45 percent; sulfur dioxide - 7 percent; nitrogen dioxide - 38 percent; particulate matter - 2 percent; and volatile organic compounds - 8 percent.

d. Carbon dioxide is listed because this gas has been implicated in global warming.

e. Project includes deactivation and demolition of the Fluorinel Dissolution Process and Fuel Storage (FAST) building (CPP-666) and the associated stack (CPP-767). The FAST building would be closed according to performance-based closure criteria and the stack by clean closure. Emissions listed are totals from closure of both facilities.

f. The decontamination and decommissioning of this facility is also included is some of the high-level waste processing alternatives present in Table 5.3.4-1.

Table C.2-33. Maximum criteria pollutant impacts from dispositioning of other existing INTEC facilities associated with HLW management.

Pollutant	Averaging time	Impact of alternative (micrograms per cubic meter): Site boundary	Impact of alternative: Public roads	Impact of alternative: Craters of the Moon	Cumulative impact (micrograms per cubic meter)[a]: Site boundary	Cumulative impact: Public roads	Cumulative impact: Craters of the Moon	Percent of standard[b]: Site boundary	Percent of standard: Public roads	Percent of standard: Craters of the Moon
Tank Farm Related Facilities										
Carbon monoxide	1-hour	59	170	14	270	590	26	<1	1	<1
	8-hour	24	62	2.4	100	130	6.6	1	1	<1
Nitrogen dioxide	Annual	0.058	0.22	5.3×10^{-3}	0.52	1.4	0.060	<1	1	<1
Sulfur dioxide	3-hour	6.1	14	1.0	30	53	4.8	2	4	<1
	24-hour	1.3	3.4	0.13	6.6	13	1.4	2	4	<1
	Annual	0.010	0.040	1.0×10^{-3}	0.15	0.49	0.017	<1	1	<1
Respirable particulates[c]	24-hour	0.50	1.2	0.050	12	26	1.0	8	17	<1
	Annual	0.038	0.015	3.5×10^{-4}	0.49	1.8	0.040	<1	4	<1
Lead	Quarterly	8.2×10^{-7}	2.7×10^{-6}	7.8×10^{-8}	2.3×10^{-4}	5.0×10^{-4}	5.5×10^{-5}	<1	<1	<1
Bin Set Related Facilities										
Carbon monoxide	1-hour	410	1.2×10^{3}	96	620	1.6×10^{3}	108	2	4	<1
	8-hour	170	430	17	240	498	21	2	5	<1
Nitrogen dioxide	Annual	0.40	1.5	0.037	0.86	2.8	0.09	<1	3	<1
Sulfur dioxide	3-hour	42	100	6.9	66	140	11	5	11	<1
	24-hour	8.9	23	0.88	14	33	2.1	4	9	<1
	Annual	0.073	0.28	6.6×10^{-3}	0.21	0.73	0.02	<1	1	<1
Respirable particulates[c]	24-hour	3.3	8.5	0.32	15	33	1.3	10	22	<1
	Annual	0.027	0.10	2.4×10^{-3}	0.52	1.9	0.050	1	4	<1
Lead	Quarterly	5.6×10^{-6}	1.8×10^{-5}	5.4×10^{-7}	2.4×10^{-4}	5.1×10^{-4}	5.6×10^{-5}	<1	<1	<1
Process Equipment Waste Evaporator and Related Facilities										
Carbon monoxide	1-hour	380	1.1×10^{3}	90	590	1.5×10^{3}	100	1	4	<1
	8-hour	150	400	16	230	470	20	2	5	<1
Nitrogen dioxide	Annual	0.38	1.4	0.030	0.84	2.7	0.090	<1	3	<1
Sulfur dioxide	3-hour	40	93	6.4	63	130	10	5	10	<1
	24-hour	8.3	22	0.82	14	32	2.1	4	9	<1
	Annual	0.070	0.26	6.0×10^{-3}	0.21	0.71	0.020	<1	<1	<1
Respirable particulates[c]	24-hour	3.1	8.0	0.30	15	32	1.3	10	22	<1
	Annual	0.020	0.10	2.0×10^{-3}	0.51	1.8	0.050	1	4	<1
Lead	Quarterly	5.3×10^{-6}	1.7×10^{-5}	5.0×10^{-7}	2.4×10^{-4}	5.1×10^{-4}	5.6×10^{-5}	<1	<1	<1
Fuel Processing Building and Related Facilities										
Carbon monoxide	1-hour	140	390	32	340	810	44	<1	2	<1
	8-hour	55	140	5.6	130	210	10	1	2	<1
Nitrogen dioxide	Annual	0.13	0.52	0.01	0.59	1.7	0.070	<1	2	<1
Sulfur dioxide	3-hour	14	33	2.3	38	72	6.1	3	6	<1
	24-hour	3.0	7.8	0.29	8.3	18	1.5	2	5	<1
	Annual	0.020	0.090	2.0×10^{-3}	0.17	0.55	0.020	<1	<1	<1
Respirable particulates[c]	24-hour	1.1	2.8	0.11	13	27	1.1	9	18	<1
	Annual	9.0×10^{-3}	0.030	8.1×10^{-4}	0.50	1.8	0.040	<1	4	<1
Lead	Quarterly	1.9×10^{-6}	6.1×10^{-6}	1.8×10^{-7}	2.3×10^{-4}	5.0×10^{-4}	5.5×10^{-5}	<1	<1	<1
FAST and Related Facilities										
Carbon monoxide	1-hour	46	130	11	250	550	23	<1	1	<1
	8-hour	18	48	1.9	97	110	6.1	<1	1	<1

Table C.2-33. (continued).

Pollutant	Averaging time	Impact of alternative (micrograms per cubic meter) Site boundary	Public roads	Craters of the Moon	Cumulative impact (micrograms per cubic meter)[a] Site boundary	Public roads	Craters of the Moon	Percent of standard[b] Site boundary	Public roads	Craters of the Moon
FAST and Related Facilities (continued)										
Nitrogen dioxide	Annual	0.040	0.17	4.0×10^{-3}	0.5	1.4	0.060	<1	1	<1
Sulfur dioxide	3-hour	4.7	11	0.76	28	50	4.6	2	4	<1
	24-hour	1.0	2.6	0.10	6.3	12	1.3	2	3	<1
	Annual	8.0×10^{-3}	0.030	7.3×10^{-4}	0.15	0.49	0.02	<1	<1	<1
Respirable particulates[c]	24-hour	0.36	0.95	0.04	12	25	1.0	8	17	<1
	Annual	3.0×10^{-3}	0.010	2.7×10^{-4}	0.49	1.8	0.040	<1	4	<1
Lead	Quarterly	6.3×10^{-7}	2.0×10^{-6}	6.0×10^{-8}	2.3×10^{-4}	5.0×10^{-4}	5.5×10^{-5}	<1	<1	<1
Transport Line Group										
Carbon monoxide	1-hour	33	93	7.7	240	510	20	<1	1	<1
	8-hour	13	35	1.3	91	100	5.5	<1	1	<1
Nitrogen dioxide	Annual	0.030	0.12	3.0×10^{-3}	0.49	1.3	0.060	<1	1	<1
Sulfur dioxide	3-hour	3.4	8.0	0.55	27	47	4.4	2	4	<1
	24-hour	0.72	1.9	0.07	6.0	12	1.3	2	3	<1
	Annual	6.0×10^{-3}	0.020	5.3×10^{-4}	0.15	0.48	0.02	<1	<1	<1
Respirable particulates[c]	24-hour	0.26	0.68	0.030	12	25	1.0	8	17	<1
	Annual	2.0×10^{-3}	8.0×10^{-3}	1.9×10^{-4}	0.49	1.8	0.040	<1	4	<1
Lead	Quarterly	4.5×10^{-7}	1.5×10^{-6}	4.3×10^{-8}	2.3×10^{-4}	5.0×10^{-4}	5.5×10^{-5}	<1	<1	<1
New Waste Calcining Facility										
Carbon monoxide	1-hour	46	130	11	250	550	23	<1	1	<1
	8-hour	18	48	1.9	97	114	6.1	<1	1	<1
Nitrogen dioxide	Annual	0.045	0.17	4.0×10^{-3}	0.50	1.4	0.060	<1	1	<1
Sulfur dioxide	3-hour	4.7	11	0.76	28	50	4.6	2	4	<1
	24-hour	1.0	2.6	0.10	6.3	12	1.3	2	3	<1
	Annual	8.0×10^{-3}	0.030	7.3×10^{-4}	0.15	0.49	0.017	<1	<1	<1
Respirable particulates[c]	24-hour	0.36	0.95	0.036	12	25	1.0	8	17	<1
	Annual	3.0×10^{-3}	0.011	2.7×10^{-4}	0.49	1.8	0.043	<1	4	<1
Lead	Quarterly	6.3×10^{-7}	2.0×10^{-6}	6.0×10^{-8}	2.3×10^{-4}	5.0×10^{-4}	5.5×10^{-5}	<1	<1	<1
Remote Analytical Laboratory										
Carbon monoxide	1-hour	30	85	7.1	240	500	19	<1	1	<1
	8-hour	12	32	1.2	90	97	5.4	<1	<1	<1
Nitrogen dioxide	Annual	0.030	0.11	3.0×10^{-3}	0.49	1.3	0.060	<1	1	<1
Sulfur dioxide	3-hour	3.1	7.3	0.50	27	46	4.3	2	4	<1
	24-hour	0.7	1.7	0.060	6.0	12	1.3	2	3	<1
	Annual	5.0×10^{-3}	0.02	4.8×10^{-4}	0.15	0.47	0.020	<1	<1	<1
Respirable particulates[c]	24-hour	0.24	0.60	0.020	12	25	1.0	8	17	<1
	Annual	2.0×10^{-3}	7.0×10^{-3}	1.8×10^{-4}	0.49	1.8	0.040	<1	4	<1
Lead	Quarterly	4.1×10^{-7}	1.4×10^{-6}	3.9×10^{-8}	2.3×10^{-4}	5.0×10^{-4}	5.5×10^{-5}	<1	<1	<1

a. Cumulative impacts conservatively assume that the highest concentration for the alternative and the highest baseline concentration occur at the same location and (for concentrations other than annual averages) over the same time period.
b. Cumulative impacts are compared to the applicable standards provided in Table C.2-15. All standards except that for 3-hour sulfur dioxide are primary standards designed to protect public health. The 3-hour sulfur dioxide standard is a secondary standard designed to protect public welfare. (There is no primary standard for 3-hour sulfur dioxide.)
c. Values do not include contributions of fugitive dust.

Table C.2-34. Summary of maximum toxic air pollutant concentrations at onsite and offsite locations from dispositioning of other existing INTEC facilities associated with HLW management.

	Highest percentage of applicable standard[a,b]							
Receptor	Tank Farm Related Facilities	Bin Set Related Facilities	PEW Evaporator and Related Facilities	Fuel Processing Building and Related Facilities	FAST and Related Facilities	Transport Lines Group	New Waste Calcining Facility	Remote Analytical Laboratory
Carcinogens[c]								
INEEL boundary areas	0.29	2.0	0.29	0.66	0.22	0.16	0.22	0.14
Craters of the Moon	0.026	0.18	0.026	0.060	0.020	0.014	0.020	0.013
INEEL facility area location[d]	2.8	20	2.8	6.6	2.2	1.6	2.2	1.4
Noncarcinogens[c]								
INEEL boundary areas	0.22	0.15	0.14	0.051	0.017	0.012	0.017	0.010
Craters of the Moon	2.2×10^{-3}	0.015	0.014	5.0×10^{-3}	2.0×10^{-3}	1.0×10^{-3}	0.002	1.0×10^{-3}
Public road locations	0.058	0.40	0.37	0.13	0.045	0.032	0.045	0.029
INEEL facility area location[d]	2.8	15	14	4.9	1.6	1.2	1.6	1.1

a. Applicable ambient air standards are specified in IDHW (1997) for carcinogenic air pollutants and noncarcinogenic toxic air pollutant increments. It should be noted that these standards apply only to new sources; they are used here as reference values for purposes of comparison.
b. Applicable standard for onsite levels is the 8-hour occupational exposure limit established by either the American Conference of Government Industrial Hygienists or the Occupational Safety and Health Administration; the lower of the two is used.
c. In all cases, the highest carcinogenic and noncarcinogenic impacts are due to nickel and vanadium, respectively.
d. Location of highest onsite impacts is within INTEC.

APPENDIX C.3

HEALTH AND SAFETY

TABLE OF CONTENTS

List of Tables

C.3 Health and Safety

C.3.1 INTRODUCTION

Health and safety impacts to workers and the public can arise from various work-related activities associated with waste processing and facility disposition. Health impacts that were evaluated in this EIS include those resulting from radiological and non-radiological activities and have been presented for the following three types of impacts:

- Radiological health impacts were evaluated for all radiological workers involved with waste processing and facility disposition based on the likelihood of developing a latent cancer fatality (LCF) from worker exposure to radiological air and surface contaminants. Radiological health impacts from facility emissions were also evaluated for the general public, maximally-exposed individual, and noninvolved worker.

- Non-radiological health impacts were presented in terms of the hazard quotient for each type of carcinogenic and noncarcinogenic toxic air pollutant for all workers involved with waste processing and facility disposition activities and the public using estimated site boundary pollutant concentration levels.

- Occupational health and safety impacts were evaluated for all workers involved with waste processing and facility disposition activities based on historical injury and illness data at INEEL.

These health impacts and the methodologies and results used to obtain them are presented in Sections 5.2.10 and 5.3.8 of this EIS.

C.3.2 RADIOLOGICAL HEALTH IMPACTS

For calculating worker radiological health impacts, Project Data Summaries and supporting Engineering Design Files (see Appendix C.6) were used as sources of information on the number of radiological workers and estimated average radiation dose per worker, and duration of each project within a specific option or alternative. Data were then used to determine the annual average collective dose (person-rem), the total project phase collective worker dose (person-rem), and the estimated increase in the number of LCFs from the total collective worker dose. The LCF value is calculated by multiplying the total collective worker dose by the appropriate dose-to-risk conversion factor based on the *1993 Limitations of Exposure to Ionizing Radiation* (NCRP 1993). These risk factors are 0.0005 and 0.0004 LCFs per person-rem of radiation exposure to the general public and worker population, respectively. The factor for the population is slightly higher due to the presence of infants and children, which are more sensitive to radiation than the adult worker population. Data on worker radiological health impacts are presented separately for construction, operations, and dispositioning activities.

Radiological health impacts from facility emissions are presented for the maximally-exposed offsite individual, the maximally-exposed onsite worker, and the general public. Estimates of radiological dose are presented in Sections 5.2.6 and 5.3.4. These doses are then integrated for the duration of the project phase for each category above. LCF estimates are calculated for the population based on the total collective dose.

C.3.2.1 Waste Processing

Table C.3-1 provides radiological dose and LCFs during construction activities by project. Data are presented in terms of annual and integrated impacts to involved workers.

Table C.3-2 provides radiological dose and LCFs during operations activities by project. Data are presented in terms of annual and integrated impacts to involved workers.

Radiological impacts from facility airborne emissions to the maximally-exposed onsite and offsite individuals and general population within 50 miles of INEEL is based on worker and radiological dose data presented in Appendix C.2, Table C.2-9. Collective population data from Table C.2-9 was multiplied by the dose-to-risk conversion factor of 0.0005 for the general public to determine LCFs in Section 5.2.10.

C.3.2.2 Facility Disposition

Section C.3.4.2 discusses radiological impacts for the involved workers by project for the existing facilities during facility disposition activities.

C.3.3 NONRADIOLOGICAL HEALTH IMPACTS

For nonradiological health impacts from atmospheric releases, DOE used toxic air pollutant emissions data for each project under an alternative to estimate air concentrations at the INEEL site boundary. For the evaluation of occupational health effects, the modeled chemical concentration is compared with the applicable occupational standard that provides levels at which no adverse effects are expected, yielding a hazard quotient. The hazard quotient is a ratio between the calculated concentration in air and the

applicable standard. For noncarcinogenic toxic air pollutants, if the hazard quotient is less than 1, then no adverse health effects would be expected. If the hazard quotient is greater than 1, additional investigation would be warranted. For carcinogenic toxic air pollutants, risks are estimated as the incremental probability of an individual developing cancer over a lifetime as a result of exposure to the potential carcinogen.

Section 5.2.10 presents the waste processing options with the maximum carcinogenic and non-carcinogenic pollutant maximum concentrations based on data from Appendix C.2, Table C.2-12. Table C.2-12 provides maximum pollutant concentrations by each of the projects within the waste processing options.

C.3.4 OCCUPATIONAL HEALTH AND SAFETY IMPACTS

Estimates of occupational illness and injury rates for workers involved with the waste processing alternatives are provided in terms of lost workdays and total recordable cases that would occur during a peak employment year and for the entire period of construction and operations for each of the alternatives. The lost workday values represent the number of workdays beyond the day of injury or onset of illness the employee was away from work or limited to restricted work activity because of an occupational injury or illness. The total recordable cases include work-related death, illness, or injury that resulted in loss of consciousness, restriction of work or motion, transfer to another job, or required medical treatment beyond first aid.

Historical total recordable cases and lost workday rates were obtained from the Computerized Accident/Incident Reporting System (CAIRS) database (Millet 1998) for Idaho construction and operations activities over a 5-year and 15-year period, respectively. These rates are computed using the following formula to determine the number of lost workdays and total recordable cases:

LWD = LWD rate × (Employee hours worked/200,000 hours)

TRC = TRC rate × (Employee hours worked/200,000 hours)

where:

LWD = lost workday, TRC = total recordable case

The 200,000 in the formula represents the equivalent of 100 employees working 40 hours per week for 50 weeks per year and provides the standard base for incidence rates.

Section 5.2.10 provides estimates of annual and cumulative lost workdays and total recordable cases by alternative during construction and operations for the waste processing alternatives.

The following information is in support of the worker safety information provided in Section 5.2.10 and 5.3.8 for waste processing and facility disposition respectively:

C.3.4.1 Waste Processing

Tables C.3-3 and C.3-4 provide the number of peak-year and total workers and the lost workdays and total recordable cases by project during construction.

Table C.3-3. Worker safety during construction - peak year employment levels.

Project	Number of workers[a]	Lost workdays/year[b]	Total recordable cases/year[c]
No Action Alternative	21	6.7	0.80
Continued Current Operations Alternative	89	28	3.4
Separations Alternative			
Full Separations Option	850	270	32
Planning Basis Option	870	280	33
Transuranic Separations Option	680	210	26
Non-Separations Alternative			
Hot Isostatic Pressed Waste Option	360	110	14
Direct Cement Waste Option	400	130	15
Early Vitrification Option	330	100	13
Minimum INEEL Processing Alternative	200	63	7.5

a. For peak year employment levels, see Appendix C.1.
b. Lost workday rate used to calculate lost workdays is 31.6 based on a 5-year historical average at INEEL for construction workers from 1992-1997.
c. Total recordable cases rate used to calculate total recordable cases is 3.8 based on a 5-year historical average at INEEL for construction workers from 1992-1997.

Tables C.3-5 and C.3-6 provide the number of peak-year and total workers and the lost workdays and total recordable cases by project during operations.

C.3.4.2 Facility Disposition

Table C.3-7 provides peak-year employment and worker safety data by alternative. Project specific employment numbers are provided in Appendix C.1.

Table C.3-8 contains estimated radiological impacts and occupational worker data for existing facilities by project.

Table C.3-5. Worker safety during operations - peak year employment levels.

Project	Number of workers[a]	Lost workdays/year[b]	Total recordable cases/year[c]
No Action Alternative	80	18	2.6
Continued Current Operations Alternative	280	63	8.9
Separations Alternative			
Full Separations Option	440	100	14
Planning Basis Option	410	92	13
Transuranic Separations Option	320	72	10
Non-Separations Alternative			
Hot Isostatic Pressed Waste Option	460	100	15
Direct Cement Waste Option	530	120	17
Early Vitrification Option	330	74	11
Minimum INEEL Processing Alternative	330	74	11

a. For peak year employment levels, see Appendix C.1.
b. Lost workday rate used to calculate lost workdays is 31.6 based on a 5-year historical average at INEEL for construction workers from 1992-1997.
c. Total recordable cases rate used to calculate total recordable cases is 3.8 based on a 5-year historical average at INEEL for construction workers from 1992-1997.

Table C.3-7. Estimated worker injury impacts during dispositioning activities of new facilities at INEEL by alternative.

Project	Dispositioning peak year employment levels		
	Number of workers[a]	Lost workdays/year[b]	Total recordable cases/year[c]
Continued Current Operations Alternative	140	43	5.2
Separations Alternative			
Full Separations Option	790	250	30
Planning Basis Option	780	250	30
Transuranic Separations Option	730	230	28
Non-Separations Alternative			
Hot Isostatic Pressed Waste Option	450	140	17
Direct Cement Waste Option	420	130	16
Early Vitrification Option	320	100	12
Minimum INEEL Processing Alternative	320	100	12

a. For peak year employment levels, see Appendix C.1.
b. Lost workday rate used to calculate lost workdays is 31.6 based on a 5-year historical average at INEEL for construction workers from 1992-1997.
c. Total recordable cases rate used to calculate total recordable cases is 3.8 based on a 5-year historical average at INEEL for construction workers from 1992-1997.

References

NCRP (National Council on Radiation Protection and Measurements), 1993, *Limitations of Exposure to Ionizing Radiation*, Report Number 116, Washington, D.C.

Millet, B., 1998, *CAIRS Database Statistical Summary Profile*, facsimile transmittal to J. Beck, Lockheed Martin Idaho Technologies Company, October 13.

Table C.3-1. Estimated radiological impacts during construction activities to involved workers by project.

Project	Description	Workers per year	Total workers	Average annual radiation dose (millirem per year)	Processing time (years)	Annual collective dose (person-rem per year)	Total collective dose (person-rem)	Estimated increase in latent cancer fatalities
No Action Alternative								
P1D	No Action Alternative	0	0	0	0	0	0	0
P1E	Bin Set 1 Calcine Transfer	21	110	690	5	15	73	0.03
P4	Long-Term Storage of Calcine in Bin Sets	0	0	0	0	0	0	0
P18MC	Remote Analytical Laboratory Operations	0	0	0	0	0	0	0
Totals		21	110	NA[a]	NA	15	73	0.03
Continued Current Operations Alternative								
P1A	Calcine SBW including New Waste Calcining Facility Upgrades	0	0	0	0	0	0	0
P1B	Newly-Generated Liquid Waste and Tank Farm Heel Management	0	0	0	0	0	0	0
P1E	Bin Set 1 Calcine Transfer	21	110	690	5	15	73	0.03
P4	Long-Term Storage of Calcine in Bin Sets	0	0	0	0	0	0	0
P18MC	Remote Analytical Laboratory Operations	0	0	0	0	0	0	0
P112E	Shipping Transuranic Waste from INTEC to the Waste Isolation Pilot Plant	0	0	0	0	0	0	0
Totals		21	110	NA	NA	15	73	0.03
Full Separations Option								
P59A	Calcine Retrieval and Transport	90	450	250	5	23	110	0.05
P9A	Full Separations	0	0	0	0	0	0	0
P9B	Vitrification Plant	0	0	0	0	0	0	0
P9C	Class A Grout Plant	0	0	0	0	0	0	0
P24	Vitrified Product Interim Storage	0	0	0	0	0	0	0
P25A	Packaging and Loading Vitrified HLW at INTEC for Shipment to a Geologic Repository	0	0	0	0	0	0	0
P25B	Shipping HLW from INTEC to a Geologic Repository	0	0	0	0	0	0	0
P18	New Analytical Laboratory	0	0	0	0	0	0	0
P118	Separations Organic Incinerator	0	0	0	0	0	0	0
P133	Waste Treatment Pilot Plant	0	0	0	0	0	0	0

Table C.3-1. Estimated radiological impacts during construction activities to involved workers by project (continued).

Project	Description	Workers per year	Total workers	Average annual radiation dose (millirem per year)	Processing time (years)	Annual collective dose (person-rem per year)	Total collective dose (person-rem)	Estimated increase in latent cancer fatalities
P35D	Class A Grout Packaging and Shipping to a Low-Activity Waste Disposal Facility	0	0	0	0	0	0	0
P27	Class A Grout Disposal in a Low-Activity Waste Disposal Facility	6	42	190	7	1.1	8.0	0
Totals		96	490	NA	NA	24	120	0.05
Planning Basis Option								
P1A	Calcine SBW including New Waste Calcining Facility Upgrades	0	0	0	0	0	0	0
P1B	Newly-Generated Liquid Waste and Tank Farm Heel Management	0	0	0	0	0	0	0
P59A	Calcine Retrieval and Transport	90	450	250	5	23	110	0.05
P23A	Full Separations	0	0	0	0	0	0	0
P23B	Vitrification Plant	0	0	0	0	0	0	0
P23C	Class A Grout Plant	0	0	0	0	0	0	0
P24	Interim Storage of Vitrified Waste	0	0	0	0	0	0	0
P25A	Packaging and Loading Vitrified HLW at INTEC for Shipment to a Geologic Repository	0	0	0	0	0	0	0
P25B	Shipping HLW from INTEC to a Geologic Repository	0	0	0	0	0	0	0
P18	New Analytical Laboratory	0	0	0	0	0	0	0
P118	Separations Organic Incinerator	0	0	0	0	0	0	0
P133	Waste Treatment Pilot Plant	0	0	0	0	0	0	0
P35D	Class A Grout Packaging and Shipping to a Low-Activity Waste Disposal Facility	0	0	0	0	0	0	0
P27	Class A Grout Disposal in a Low-Activity Waste Disposal Facility	6	42	190	7	1.1	8.0	0
Totals		96	490	NA	NA	24	120	0.05
Transuranic Separations Option								
P59A	Calcine Retrieval and Transport	90	450	250	5	23	110	0.05
P49A	Transuranic/Class C Separations	0	0	0	0	0	0	0
P49C	Class C Grout Plant	0	0	0	0	0	0	0
P39B	Shipping Transuranic Waste at INTEC for Shipment to the Waste Isolation Pilot Plant	0	0	0	0	0	0	0

Table C.3-1. Estimated radiological impacts during construction activities to involved workers by project (continued).

Project	Description	Workers per year	Total workers	Average annual radiation dose (millirem per year)	Processing time (years)	Annual collective dose (person-rem per year)	Total collective dose (person-rem)	Estimated increase in latent cancer fatalities
P39A	Shipping Transuranic Waste from INTEC to the Waste Isolation Pilot Plant	0	0	0	0	0	0	0
P18	New Analytical Laboratory	0	0	0	0	0	0	0
P118	Separations Organic Incinerator	0	0	0	0	0	0	0
P133	Waste Treatment Pilot Plant	0	0	0	0	0	0	0
P49D	Class C Grout Packaging and Shipping to a Low-Activity Waste Disposal Facility	0	0	0	0	0	0	0
P27	Class C Grout Disposal in a Low-Activity Waste Disposal Facility	6	42	190	7	1.1	8.0	0
Totals		96	490	NA	NA	24	120	0.05
Hot Isostatic Pressed Waste Option								
P1A	Calcine SBW including New Waste Calcining Facility Upgrades	0	0	0	0	0	0	0
P1B	Newly-Generated Liquid Waste and Tank Farm Heel Waste Management	0	0	0	0	0	0	0
P18	New Analytical Laboratory	0	0	0	0	0	0	0
P59A	Calcine Retrieval and Transport	90	450	250	5	22	110	0.05
P71	Mixing and Hot Isostatic Pressing	0	0	0	0	0	0	0
P72	Interim Storage of Hot Isostatic Pressed Waste	0	0	0	0	0	0	0
P73A	Packaging and Loading Hot Isostatic Pressed Waste at INTEC for Shipment to a Geologic Repository	0	0	0	0	0	0	0
P73B	Shipping Hot Isostatic Pressed Waste from INTEC to a Geologic Repository	0	0	0	0	0	0	0
P112E	Shipping TRU from INTEC to Waste Isolation Pilot Plant	0	0	0	0	0	0	0
P133	Waste Treatment Pilot Plant	0	0	0	0	0	0	0
Totals		90	450	NA	NA	22	110	0.05
Direct Cement Waste Option								
P1A	Calcine SBW including New Waste Calcining Facility Upgrades	0	0	0	0	0	0	0
P1B	Newly-Generated Liquid Waste and Tank Farm Heel Management	0	0	0	0	0	0	0
P18	New Analytical Laboratory	0	0	0	0	0	0	0

Table C.3-1. Estimated radiological impacts during construction activities to involved workers by project (continued).

Project	Description	Workers per year	Total workers	Average annual radiation dose (millirem per year)	Processing time (years)	Annual collective dose (person-rem per year)	Total collective dose (person-rem)	Estimated increase in latent cancer fatalities
P59A	Calcine Retrieval and Transport	90	450	250	5	22	110	0.05
P80	Direct Cement Process	0	0	0	0	0	0	0
P81	Unseparated Cementitious HLW Interim Storage	0	0	0	0	0	0	0
P83A	Packaging and Loading Cementitious Waste at INTEC for Shipment to a Geologic Repository	0	0	0	0	0	0	0
P83B	Shipping Cementitious Waste from INTEC to a Geologic Repository	0	0	0	0	0	0	0
P112E	Shipping Transuranic Waste from INTEC to Waste Isolation Pilot Plant	0	0	0	0	0	0	0
P133	Waste Treatment Pilot Plant	0	0	0	0	0	0	0
Totals		90	450	NA	NA	22	110	0.05
				Early Vitrification Option				
P1C	Process Equipment Waste Evaporator and Liquid Effluent Treatment and Disposal Facility	0	0	0	0	0	0	0
P18	New Analytical Laboratory	0	0	0	0	0	0	0
P59A	Calcine Retrieval and Transport	90	450	250	5	22	110	0.05
P61	Vitrified HLW Interim Storage	0	0	0	0	0	0	0
P62A	Packaging and Loading Vitrified HLW at INTEC for Shipment to a Geologic Repository	0	0	0	0	0	0	0
P63A	Shipping of Vitrified HLW from INTEC to a Geologic Repository	0	0	0	0	0	0	0
P88	Early Vitrification with Maximum Achievable Control Technology	0	0	0	0	0	0	0
P90A	Packaging and Loading Vitrified SBW at INTEC for Shipment to the Waste Isolation Pilot Plant	0	0	0	0	0	0	0
P90B	Shipping of Vitrified SBW from INTEC to the Waste Isolation Pilot Plant	0	0	0	0	0	0	0
P133	Waste Treatment Pilot Plant	0	0	0	0	0	0	0
Totals		90	450	NA	NA	22	110	0.05

Table C.3-1. Estimated radiological impacts during construction activities to involved workers by project (continued).

Project	Description	Workers per year	Total workers	Average annual radiation dose (millirem per year)	Processing time (years)	Annual collective dose (person-rem per year)	Total collective dose (person-rem)	Estimated increase in latent cancer fatalities
Minimum INEEL Processing Alternative								
P1C	Process Equipment Waste Evaporator and Liquid Effluent Treatment and Disposal Facility	0	0	0	0	0	0	0
P18	New Analytical Laboratory	0	0	0	0	0	0	0
P24	Interim Storage of Vitrified Waste	0	0	0	0	0	0	0
P25A	Packaging and Loading Vitrified HLW at INTEC for Shipment to a Geologic Repository	0	0	0	0	0	0	0
P25B	Shipping HLW from INTEC to a Geologic Repository	0	0	0	0	0	0	0
P27	Class A Grout Disposal in a Low-Activity Waste Disposal Facility	6	42	190	7	1.1	8.0	0
P64D	Transport of the Vitrified Waste to INEEL	0	0	0	0	0	0	0
P111	SBW and Newly-Generated Liquid Waste Treatment with Cesium Ion Exchange to Contact-Handled Transuranic Grout and Low-Level Waste Grout	0	0	0	0	0	0	0
P112B	Transport Contac-Handled Transuranic Waste to the Waste Isolation Pilot Plant	0	0	0	0	0	0	0
P133	Waste Treatment Pilot Plant	0	0	0	0	0	0	0
P59A	Calcine Retrieval and Transport	90	450	250	5	22	110	0.05
P117A	Calcine Packaging and Loading to Hanford	0	0	0	0	0	0	0
P121A	Calcine Transport to Hanford	0	0	0	0	0	0	0
Totals		96	490	NA	NA	22	120	0.05

a. NA = not applicable.

Table C.3-2. Estimated radiological impacts during operations to involved workers by project.

Project		Number workers/year	Number workers	Average annual worker rad dose (millirem per year)	Processing times (years)	Annual collective dose (person-rem per year)	Total collective dose (person-rem)	Estimated increases in latent cancer fatalities
No Action Alternative								
P1D	No Action Alternative	42	710	190	17	8.0	140	0.05
		15	260	190	17	2.9	48	0.02
P1E	Bin Set 1 Calcine Transfer	17	290	190	17	3.2	55	0.02
P4	Long-Term Storage of Calcine in Bin Sets	0	0	190	81	0	0	0
P18MC	Remote Analytical Laboratory Operations	45	1.3×10^3	190	29	8.6	250	0.10
Totals		120	2.6×10^3	NA[a]	NA	23	490	0.19
Continued Current Operations Alternative								
P1A	Calcine SBW including New Waste Calcining Facility Upgrades	96	580	190	6	18	110	0.04
P1B	Newly-Generated Liquid Waste and Tank Farm Heel Waste Management	60	1.3×10^3	190	21	11	240	0.10
P1B (II)[b]	Newly-Generated Liquid Waste and Tank Farm Heel Waste Management	40	840	190	21	7.6	160	0.06
P1E	Bin Set 1 Calcine Transfer	17	17	190	1	3.2	3.2	0
P4	Long-Term Storage of Calcine in Bin Sets	0	0	190	81	0	0	0
P18MC	Remote Analytical Laboratory Operations	45	1.3×10^3	190	29	8.6	250	0.10
Totals		260	4.0×10^3	NA	NA	49	760	0.30
Full Separations Option								
P9A	Full Separations	30	630	190	21	5.7	120	0.05
P9B	Vitrification Plant	40	720	190	18	7.6	140	0.05
P9C	Class A Grout Plant	16	340	190	21	3.0	64	0.03
P18	New Analytical Laboratory	95	3.2×10^3	190	34	18	610	0.25
P24	Vitrified Product Interim Storage	5	240	190	47	0.95	45	0.02
P25A	Packaging and Loading Vitrified HLW at INTEC for Shipment to a Geologic Repository	6	120	190	20	1.1	23	0.01
P25B	Shipping HLW from INTEC to a Geologic Repository	0	0	0	0	0	0	0
P59A	Calcine Retrieval and Transport	10	210	190	21	1.9	40	0.02
P118	Separations Organic Incinerator	2	42	190	21	0.38	8.0	0

Table C.3-2. Estimated radiological impacts during operations to involved workers by project (continued).

Project		Number workers/year	Number workers	Average annual worker rad dose (millirem per year)	Processing times (years)	Annual collective dose (person-rem per year)	Total collective dose (person-rem)	Estimated increases in latent cancer fatalities
P27	Class A Grout Disposal in a Low-Activity Waste Disposal Facility	2.5	53	190	21	0.48	10	0
P35D	Class A Grout Packaging and Shipping to a Low-Activity Waste Disposal Facility	8	170	190	21	1.5	32	0.01
Totals		210	5.7×10^3	NA	NA	41	1.1×10^3	0.44
Planning Basis Option								
P1A	Calcine SBW including New Waste Calcining Facility Upgrades	96	580	190	6	18	110	0.04
P1B	Newly Generated Liquid Waste and Tank Farm Heel Waste Management	60	1.3×10^3	190	21	11	240	0.10
P1B(11)[b]	Newly Generated Liquid Waste and Tank Farm Heel Waste Management	40	840	190	21	7.6	160	0.06
P59A	Calcine Retrieval and Transport	10	210	190	21	1.9	40	0.02
P23A	Full Separations	30	480	190	16	5.7	91	0.04
P23B	Vitrification Plant	40	600	190	15	7.6	110	0.05
P23C	Class A Grout Plant	16	260	190	16	3.0	49	0.02
P24	Interim Storage of Vitrified Waste	5	240	190	47	0.95	45	0.02
P25A	Packaging and Loading Vitrified HLW at INTEC for Shipment to a Geologic Repository	6	120	190	20	1.1	23	0.01
P25B	Shipping HLW from INTEC to a Geological Repository	0	0	0	0	0	0	0
P18	New Analytical Laboratory	95	3.2×10^3	190	34	18	610	0.25
P118	Separations Organic Incinerator	2	32	190	16	0.38	6.1	0
P35D	Class A Grout Packaging and Shipping to a Low-Activity Waste Disposal Facility	8	180	190	23	1.5	35	0.01
P27	Class A Grout Disposal in a Low-Activity Waste Disposal Facility	2.5	53	190	21	0.48	10	0
Totals		410	8.1×10^3	NA	NA	80	1.5×10^3	0.61
Transuranic Separations Option								
P18	New Analytical Laboratory	95	3.2×10^3	190	34	18	610	0.25
P39A	Shipping Transuranic Waste from INTEC to the Waste Isolation Pilot Plant	2.5	48	190	19	0.48	9.0	0

Table C.3-2. Estimated radiological impacts during operations to involved workers by project (continued).

Project		Number workers/year	Number workers	Average annual worker rad dose (millirem per year)	Processing times (years)	Annual collective dose (person-rem per year)	Total collective dose (person-rem)	Estimated increases in latent cancer fatalities
P39B	Shipping Transuranic Waste at INTEC for Shipment to the Waste Isolation Pilot Plant	0	0	0	0	0	0	0
P49A	Transuranic/Class C Separations	50	1.1×10^3	190	21	9.5	200	0.08
P49C	Class C Grout Plant	16	340	190	21	3.0	64	0.03
P59A	Calcine Retrieval and Transport	10	210	190	21	1.9	40	0.02
P118	Separations Organic Incinerator	2	42	190	21	0.38	8.0	0
P27	Class A Grout Disposal in a Low-Activity Waste Disposal Facility	2.5	53	190	21	0.48	10.0	0
P49D	Class C Grout Packaging and Shipping to a Low-Activity Waste Disposal Facility	8.5	180	190	21	1.6	34	0.01
Totals		190	5.1×10^3	NA	NA	35	980	0.39
Hot Isostatic Pressed Waste Option								
P1A	Calcine SBW including New Waste Calcining Facility Upgrades	96	580	190	6	18	110	0.04
P1B	Newly-Generated Liquid Waste and Tank Farm Heel Waste Management	60	1.3×10^3	190	21	11	240	0.10
P1B (II)	Newly-Generated Liquid Waste and Tank Farm Heel Waste Management	40	840	190	21	7.6	160	0.06
P18	New Analytical Laboratory	95	3.2×10^3	190	34	18	610	0.25
P59A	Calcine Retrieval and Transport	10	210	190	21	1.9	40	0.02
P71	Mixing and Hot Isostatic Pressing	22	460	190	21	4.2	88	0.04
P72	Interim Storage of Hot Isostatic Pressed Waste	2.5	140	190	54	0.48	26	0.01
P73A	Packaging and Loading Hot Isostatic Pressed Waste at INTEC for Shipment to a Geologic Repository	2.5	50	190	20	0.48	9.5	0
P73B	Shipping Hot Isostatic Pressed Waste from INTEC to a Geologic Repository	0	0	0	0	0	0	0
P112E	Shipping Transuranic Waste from INTEC to the Waste Isolation Pilot Plant	0	0	0	0	0	0	0
Totals		330	6.8×10^3	NA	NA	62	1.3×10^3	0.51
Direct Cement Waste Option								
P1A	Calcine SBW including New Waste Calcining Facility Upgrades	96	580	190	6	18	110	0.04
P1B	Newly-Generated Liquid Waste and Tank Farm Heel Waste Management	60	1.3×10^3	190	21	11	240	0.10

Table C.3-2. Estimated radiological impacts during operations to involved workers by project (continued).

Project		Number workers/year	Number workers	Average annual worker rad dose (millirem per year)	Processing times (years)	Annual collective dose (person-rem per year)	Total collective dose (person-rem)	Estimated increases in latent cancer fatalities
P1B (II)	Newly-Generated Liquid Waste and Tank Farm Heel Waste Management	40	840	190	21	7.6	160	0.06
P18	New Analytical Laboratory	95	3.2×10^3	190	34	18	610	0.25
P59A	Calcine Retrieval and Transport	10	210	190	21	1.9	40	0.02
P80	Direct Cement Process	93	2.0×10^3	190	21	18	370	0.15
P81	Unseparated Cementitious HLW Interim Storage	4.5	240	190	54	0.86	46	0.02
P83A	Packaging and Loading Cementitious Waste at INTEC for Shipment to a Geologic Repository	2.5	50	190	20	0.48	9.5	0
P83B	Shipping Cementitious Waste from INTEC to a Geologic Repository	0	0	0	0	0	0	0
P112E	Shipping Transuranic Waste from INTEC to the Waste Isolation Pilot Plant	0	0	0	0	0	0	0
Totals		400	8.4×10^3	NA	NA	76	1.6×10^3	0.64
Early Vitrification Option								
P1C	Process Equipment Waste Evaporator and Liquid Effluent Treatment and Disposal	28	1.0×10^3	190	36	5.3	190	0.08
P18	New Analytical Laboratory	95	3.3×10^3	190	34	18	610	0.25
P59A	Calcine Retrieval and Transport	10	210	190	21	1.9	40	0.02
P61	Vitrified HLW Interim Storage	4.5	240	190	54	0.86	46	0.02
P62A	Packaging and Loading Vitrified HLW at INTEC for Shipment to a Geologic Repository	2.5	50	190	20	0.48	9.5	0
P63A	Shipping of Vitrified HLW from INTEC to a Geologic Repository	0	0	0	0	0	0	0
P88	Early Vitrification with Maximum Achievable Control Technology	39	820	190	21	7.4	160	0.06
P90A	Packaging and Loading Vitrified SBW at INTEC for Shipment to the Waste Isolation Pilot Plant	2.5	45	190	18	0.48	8.6	0
P90B	Shipping of Vitrified SBW from INTEC to the Waste Isolation Pilot Plant	0	0	0	0	0	0	0
Totals		180	5.6×10^3	NA	NA	34	870	0.35

Table C.3-2. Estimated radiological impacts during operations to involved workers by project (continued).

Project		Number workers/year	Number workers	Average annual worker rad dose (millirem per year)	Processing times (years)	Annual collective dose (person-rem per year)	Total collective dose (person-rem)	Estimated increases in latent cancer fatalities
Minimum INEEL Processing Alternative								
P1C	Process Equipment Waste Evaporator and Liquid Effluent Treatment and Disposal	28	730	190	26	5.3	140	0.06
P18	New Analytical Laboratory	95	3.2×10^{3}	190	34	18	610	0.25
P24	Interim Storage of Vitrified Waste	5	240	190	47	0.95	45	0.02
P25A	Packaging and Loading Vitrified HLW at INTEC for Shipment to a Geologic Repository	6	120	190	20	1.1	23	0.01
P25B	Shipping HLW from INTEC to a Geologic Repository	0	0	0	0	0	0	0
P27	Class A Grout Disposal in a Low-Activity Waste Disposal Facility	2.5	53	190	21	0.48	10	0
P64D	Transport of the Vitrified Waste to INEEL	0	0	0	0	0	0	0
P111A	SBW and Newly-Generated Liquid Waste Treatment with Cesium Ion Exchange to Contact-Handled Transuranic Grout and Low-Level Waste Grout	33	170	190	5	6.3	31	0.01
P111B	SBW and Newly-Generated Liquid Waste Treatment with Cesium Ion Exchange to Contact-Handled Transuranic Grout and Low-Level Waste Grout	15	230	190	15	2.9	43	0.02
P112A	Packaging and Loading Contact-Handled Transuranic (from SBW and Newly-Generated Liquid Waste Cesium Ion Exchange Grout Treatment) for Shipment to WIPP	2.5	38	190	15	0.48	7.1	0
P112B	Transport Contact-Handled Transuranic Waste to the Waste Isolation Pilot Plant	0	0	0	0	0	0	0

Table C.3-2. Estimated radiological impacts during operations to involved workers by project (continued).

Project		Number workers/year	Number workers	Average annual worker rad dose (millirem per year)	Processing times (years)	Annual collective dose (person-rem per year)	Total collective dose (person-rem)	Estimated increases in latent cancer fatalities
P59A	Calcine Retrieval and Transport	10	140	190	14	1.9	27	0.01
P117A	Calcine Packaging and Loading to Hanford	44	620	190	14	8.4	120	0.05
P121A	Calcine Transport to Hanford	NA						0
Totals		240	5.5×10^{3}	NA	NA	46	1.1×10^{3}	0.42

a. NA = not applicable.
b. Project data from project data sheets are divided into two phases.

Table C.3.4. Estimated worker injury impacts during construction activities of new facilities at INEEL by alternative.

Project	Description	Average number workers/year	LWD[a] per year	TRC[b] per year	Processing time (years)	Total workers	Total LWD	Total TRC
No Action Alternative								
P1D	No Action Alternative	0	0	0	0	0	0	0
P1E	Bin Set 1 Calcine Transfer	21	6.6	0.80	5	100	33	4.0
Totals		21	6.6	0.80	NA	100	33	4.0
Continued Current Operations Alternative								
P1A	Calcine SBW including New Waste Calcining Facility Upgrades	48	15	1.8	4	190	61	7.3
P1B	Newly-Generated Liquid Waste and Tank Farm Heel Waste Management	20	6.3	0.76	4	80	25	3.0
P1E	Bin Set 1 Calcine Transfer	18	5.7	0.68	5	90	29	3.4
Totals		86	27	3.3	NA	360	120	14
Full Separations Option								
P9A	Full Separations	300	95	11	5	1.5×10^3	480	57
P9B	Vitrification Plant	280	88	11	5	1.4×10^3	440	53
P9C	Class A Grout Plant	160	49	5.9	5	780	250	29
P18	New Analytical Laboratory	59	19	2.2	2	120	37	4.5
P24	Interim Storage of Vitrified Waste	110	35	4.2	3.7	410	130	16
P59A	Calcine Retrieval and Transport	190	60	7.2	5	950	300	36
P118	Separations Organic Incinerator	10	3.2	0.38	3.3	33	10	1.3
P133	Waste Treatment Pilot Plant	63	20	2.4	4	250	80	9.6
Totals		1.2×10^3	370	44	NA	5.4×10^3	1.7×10^3	200
Planning Basis Option								
P1A	Calcine SBW including New Waste Calcining Facility Upgrades	48	15	1.8	4	190	61	7.3
P1B	Newly-Generated Liquid Waste and Tank Farm Heel Waste Management	20	6.3	0.76	6	120	38	4.6
P59A	Calcine Retrieval and Transport	190	60	7.2	5	950	300	36
P23A	Full Separations	300	95	11	5	1.5×10^3	480	57
P23B	Vitrification Plant	280	88	11	5	1.4×10^3	440	53
P23C	Class A Grout Plant	160	49	5.9	5	780	250	29
P24	Interim Storage of Vitrified Waste	110	35	4.2	3.7	410	130	16
P18	New Analytical Laboratory	59	19	2.2	2	120	38	4.5
P118	Separations Organic Incinerator	10	3.2	0.38	3.3	33	10	1.3
P35D	Class A Grout Packaging and Shipping to a Low-Activity Waste Disposal Facility	22	6.9	0.82	4.2	91	29	3.5
P27	Class A Grout Disposal in a Low-Activity Waste Disposal Facility	78	24	3.0	7	550	170	21
P133	Waste Treatment Pilot Plant	63	20	2.4	4	250	80	9.6
Totals		1.3×10^3	420	51	NA	6.4×10^3	2.0×10^3	240

Table C.3-4. Estimated worker injury impacts during construction activities of new facilities at INEEL by alternative (continued).

Project	Description	Average number workers/year	LWD[a] per year	TRC[b] per year	Processing time (years)	Total workers	Total LWD	Total TRC
Transuranic Separations Option								
P18	New Analytical Laboratory	59	19	2.2	2	120	38	4.5
P27	Class A Grout Disposal in a Low-Activity Waste Disposal Facility	78	25	3.0	7	550	170	21
P49A	Transuranic Waste /Class C Separations	300	94	11	5	1.5×10^3	470	57
P49C	Class C Grout Plant	200	63	7.6	5	1.0×10^3	320	38
P49D	Class C Grout Packaging and Shipping to a Low-Activity Waste Disposal Facility	22	6.9	0.82	4.2	91	29	3.5
P59A	Calcine Retrieval and Transport	190	60	7.2	5	950	300	36
P118	Separations Organic Incinerator	10	3.2	0.38	3.3	33	10	1.3
P133	Waste Treatment Pilot Plant	63	20	2.4	4	250	80	9.6
Totals		920	290	35	NA	4.5×10^3	1.4×10^3	170
Hot Isostatic Pressed Waste Option								
P1A	Calcine SBW including New Waste Calcining Facility Upgrades	48	15	1.8	4	190	61	7.3
P1B	Newly-Generated Liquid Waste and Tank Farm Heel Waste Management	20	6.3	0.76	4	80	25	3.0
P18	New Analytical Laboratory	59	19	2.2	2	120	38	4.5
P59A	Calcine Retrieval and Transport	190	60	7.2	5	950	300	36
P71	Mixing and Hot Isostatic Pressing	100	32	3.8	4	400	130	15
P72	Interim Storage of Hot Isostatic Pressed Waste	92	29	3.5	3	280	88	10
P133	Waste Treatment Pilot Plant	63	20	2.4	4	250	80	9.6
Totals		570	180	22	NA	2.3×10^3	720	86
Direct Cement Waste Option								
P1A	Calcine SBW including New Waste Calcining Facility Upgrades	48	15	1.8	4	190	61	7.3
P1B	Newly-Generated Liquid Waste and Tank Farm Heel Waste Management	20	6.3	0.76	4	80	25	3.0
P18	New Analytical Laboratory	59	19	2.2	2	120	38	4.5
P59A	Calcine Retrieval and Transport	190	60	7.2	5	950	300	36
P80	Direct Cement Process	130	42	5.1	4	540	170	20
P133	Waste Treatment Pilot Plant	63	20	2.4	4	250	80	9.6
Total		510	160	20	NA	2.1×10^3	680	81

Table C.3-4. Estimated worker injury impacts during construction activities of new facilities at INEEL by alternative (continued).

Project	Description	Average number workers/year	LWD[a] per year	TRC[b] per year	Processing time (years)	Total workers	Total LWD	Total TRC
				Early Vitrification Option				
P18	New Analytical Laboratory	59	19	2.2	2	120	38	4.5
P59A	Calcine Retrieval and Transport	190	60	7.2	5	950	300	36
P61	Vitrified HLW Interim Storage	110	36	4.3	4	460	150	17
P88	Early Vitrification Facility with Maximum Achievable Control Technology	110	35	4.2	5	550	170	21
P133	Waste Treatment Pilot Plant	63	20	2.4	4	250	80	9.6
Totals		540	170	20	NA	2.3×10^3	740	88
				Minimum INEEL Processing Alternative				
P18	New Analytical Laboratory	59	19	2.2	2	120	37	4.5
P24	Interim Storage of Vitrified Waste	110	35	4.2	3.7	410	130	16
P27	Class A Grout Disposal in a Low-Activity Waste Disposal Facility	78	25	3.0	7	550	170	21
P59A	Calcine Retrieval and Transport	190	60	7.2	5	950	300	36
P111	SBW and Newly-Generated Liquid Waste Treatment with Cesium Ion Exchange to Contact-Handled Transuranic Grout and Low-Level Waste Grout	20	6.3	0.76	3	60	19	2.3
P117A	Calcine Packaging and Loading to Hanford	78	25	3.0	4	310	99	12
P133	Waste Treatment Pilot Plant	63	20	2.4	4	250	80	9.6
Totals		600	190	23	NA	2.6×10^3	840	100

a. LWD = lost workday. The number of workdays, beyond the day of injury or onset of illness the employee was away from work or limited to restricted work activity because of an occupational injury or illness. The LWD rate used to calculate number of lost workdays is 31.6 based on a 5-year historical average for construction workers at INEEL from 1992-1997.

b. TRC = total recordable case. A recordable case includes work-related death, illness, or injury which resulted in loss of consciousness, restriction of work or motion, transfer to another job, or required medical treatment beyond first aid. The TRC rate used to calculate number of total recordable cases is 3.8 based on a 5-year historical average for construction workers at INEEL from 1992-1997.

Table C.3-6. Estimated worker injury impacts during operations activities of new facilities at INEEL by alternative.

Project	Description	Average number workers/year	LWD[a] per year	TRC[b] per year	Processing time (years)	Total workers	Total LWD	Total TRC
No Action Alternative								
P1D	No Action Alternative	62	14	2.0	17	1.0×10^3	240	34
P1E	Bin Set 1 Calcine Transfer	18	4.1	0.58	17	300	69	9.8
Totals		80	18	2.6	NA	1.4×10^3	310	44
Continued Current Operations Alternative								
P1A	Calcine SBW including New Waste Calcining Facility Upgrades	150	33	4.7	6	900	200	28
P1B	Newly-Generated Liquid Waste and Tank Farm Heel Waste Management	76	17	2.4	5	380	86	12
P1B(11)[c]	Newly-Generated Liquid Waste and Tank Farm Heel Waste Management	56	13	1.8	14	780	180	25
P1E	Bin Set 1 Calcine Transfer	18	4.0	0.58	1	18	4.1	0.58
P4	Long-Term Storage of Calcine in Bin Sets	3	0.68	0.10	81	240	55	7.8
P18MC	Remote Analytical Laboratory Operations	52	12	1.7	29	1.5×10^3	340	48
Totals		350	80	11	NA	3.8×10^3	860	120
Full Separations Option								
P9A	Full Separations	120	27	3.8	21	2.5×10^3	570	80
P9B	Vitrification Plant	90	20	2.9	18	1.6×10^3	370	52
P9C	Class A Grout Plant	38	8.6	1.2	21	800	180	26
P18	New Analytical Laboratory	100	24	3.4	34	3.6×10^3	800	110
P24	Interim Storage of Vitrified Waste	6.5	1.5	0.21	47	300	69	9.8
P25A	Packaging and Loading Vitrified HLW at INTEC for Shipment to a Geologic Repository	7	1.6	0.22	20	140	32	4.5
P59A	Calcine Retrieval and Transport	11	2.5	0.36	21	240	54	7.6
P118	Separations Organic Incinerator	8.5	1.9	0.27	21	180	40	5.7
P27	Class A Grout Disposal in a Low-Activity Waste Disposal Facility	17	3.8	0.54	21	360	80	11
P35D	Class A Grout Packaging and Shipping to a Low-Activity Waste Disposal Facility	9.5	2.2	0.30	21	200	45	6.4
P133	Waste Treatment Pilot Plant	39	8.8	1.3	27	1.1×10^3	240	34
Totals		450	100	15	NA	1.1×10^4	2.5×10^3	350

Table C.3-6. Estimated worker injury impacts during operations activities of new facilities at INEEL by alternative (continued).

Project	Description	Average number workers/year	LWD[a] per year	TRC[b] per year	Processing time (years)	Total workers	Total LWD	Total TRC
Planning Basis Option								
P1A	Calcine SBW including New Waste Calcining Facility Upgrades	150	33	4.7	6	890	200	28
P1B	Newly-Generated Liquid Waste and Tank Farm Heel Waste Management	130	30	4.2	21	2.8×10^3	630	89
P59A	Calcine Retrieval and Transport	11	2.5	0.36	21	240	53	7.6
P23A	Full Separations	120	27	3.8	16	1.9×10^3	430	61
P23B	Vitrification Plant	90	20	2.9	15	1.4×10^3	300	43
P23C	Class A Grout Plant	38	8.6	1.2	16	600	140	19
P24	Interim Storage of Vitrified Waste	6.5	1.5	0.21	47	300	6.9	9.8
P25A	Packaging and Loading Vitrified HLW at INTEC for Shipment to a Geologic Repository	7	1.6	0.22	20	140	32	4.5
P25B	Shipping HLW from INTEC to a Geologic Repository	0	0	0	0	0	0	0
P18	New Analytical Laboratory	100	24	3.4	34	3.6×10^3	800	110
P118	Separations Organic Incinerator	8.5	1.9	0.27	21	180	40	5.7
P35D	Class A Grout Packaging and Shipping to a Low-Activity Waste Disposal Facility	9.5	2.2	0.30	21	200	45	6.4
P27	Class A Grout Disposal in a Low-Activity Waste Disposal Facility	17	3.8	0.54	21	360	81	11
P133	Waste Treatment Pilot Plant	39	8.8	1.3	27	1.1×10^3	240	34
Totals		730	170	23	NA	1.4×10^4	3.1×10^3	430
Transuranic Separations Option								
P18	New Analytical Laboratory	100	24	3.4	34	3.6×10^3	800	110
P27	Class A Grout Disposal in a Low-Activity Waste Disposal Facility	17	3.8	0.54	21	360	81	11
P39A	Packaging and Loading Transuranic Waste at INTEC for Shipment to the Waste Isolation Pilot Plant	6.5	1.5	0.21	19	120	28	4.0
P49A	Transuranic Waste/Class A Separations	84	19	2.7	21	1.8×10^3	400	56
P49C	Class C Grout Plant	40	9.0	1.3	21	840	190	27
P49D	Class C Grout Packaging and Shipping to a Low-Activity Waste Disposal Facility	8.5	1.9	0.27	21	180	40	5.7
P59A	Calcine Retrieval and Transport	11	2.5	0.36	21	240	53	7.6

Table C.3-6. Estimated worker injury impacts during operations activities of new facilities at INEEL by alternative (continued).

Project	Description	Average number workers/year	LWD[a] per year	TRC[b] per year	Processing time (years)	Total workers	Total LWD	Total TRC
P118	Separations Organic Incinerator	8.5	1.9	0.27	21	180	40	5.7
P133	Waste Treatment Pilot Plant	39	8.8	1.3	27	1.1×10^3	240	34
Totals		320	72	10	NA	8.3×10^3	1.9×10^3	270
Hot Isostatic Pressed Waste Option								
P1A	Calcine SBW including New Waste Calcining Facility Upgrades	150	33	4.7	6	890	200	28
P1B	Newly-Generated Liquid Waste and Tank Farm Heel Waste Management	76	17	2.4	5	380	86	12
P1B(11)[c]	Newly-Generated Liquid Waste and Tank Farm Heel Waste Management	56	13	1.8	14	780	180	25
P18	New Analytical Laboratory	100	24	3.4	34	3.6×10^3	800	110
P59A	Calcine Retrieval and Transport	11	2.5	0.36	21	240	53	7.6
P71	Mixing and Isostatic Pressing	78	18	2.5	21	1.6×10^3	370	52
P72	Interim Storage Isostatic Pressed Waste	6.5	1.5	0.21	54	350	79	11
P73A	Packaging and Loading Hot Isostatic Pressed Waste at INTEC for Shipment to a Geologic Repository	6.5	1.5	0.21	20	130	29	4.2
P133	Waste Treatment Pilot Plant	39	8.8	1.3	27	1.1×10^3	240	34
Totals		530	120	17	NA	9.0×10^3	2.0×10^3	290
Direct Cement Waste Option								
P1A	Calcine SBW including New Waste Calcining Facility Upgrades	150	33	4.7	6	890	200	28
P1B	Newly-Generated Liquid Waste and Tank Farm Heel Waste Management	76	17	2.4	5	380	86	12
P1B(11)[c]	Newly-Generated Liquid Waste and Tank Farm Heel Waste Management	56	13	1.8	14	780	180	25
P18	New Analytical Laboratory	100	24	3.4	34	3.6×10^3	800	110
P59A	Calcine Retrieval and Transport	11	2.5	0.36	21	240	53	7.6
P80	Direct Cement Process	140	32	4.5	21	2.9×10^3	660	94
P81	Unseparated Cementitious HLW Interim Storage	6.5	1.5	0.21	54	350	79	11
P83A	Packaging & Loading Cementitious Waste at INTEC for Shipment to a Geologic Repository	11	2.5	0.35	20	220	50	7.0
P133	Waste Treatment Pilot Plant	39	8.8	1.3	27	1.1×10^3	240	34
Totals		590	130	19.0	NA	1.0×10^4	2.3×10^3	330

Table C.3-6. Estimated worker injury impacts during operations activities of new facilities at INEEL by alternative (continued).

Project	Description	Average number workers/year	LWD[a] per year	TRC[b] per year	Processing time (years)	Total workers	Total LWD	Total TRC
Early Vitrification Option								
P1C	Process Equipment Waste Evaporator and Liquid Effluent Treatment and Disposal Facility	28	6.3	0.90	36	1.0×10^3	230	32
P18	New Analytical Laboratory	100	24	3.4	34	3.6×10^3	800	110
P59A	Calcine Retrieval and Transport	11.3	2.5	0.36	21	240	53	7.6
P61	Vitrified HLW Interim Storage	6.5	1.5	0.21	54	350	79	11
P62A	Packaging and Loading of Vitrified HLW at INTEC for Shipment to a Geologic Repository	6.5	1.5	0.21	20	130	29	4.2
P88	Early Vitrification with Maximum Achievable Control Technology	130	29	4.1	21	2.7×10^3	600	87
P90A	Packaging and Loading Vitrified SBW at INTEC for Shipment to the Waste Isolation Pilot Plant	6.5	1.5	0.21	18	120	26	3.7
P133	Waste Treatment Pilot Plant	39	8.8	1.3	27	1.1×10^3	240	34
Totals		330	75	11	NA	8.2×10^3	1.8×10^3	260
Minimum INEEL Processing Alternative								
P1C	Process Equipment Waste Evaporator and Liquid Effluent Treatment and Disposal Facility	28	6.3	0.90	26	730	160	23
P18	New Analytical Laboratory	100	2.4	3.4	34	3.6×10^3	800	110
P24	Interim Storage of Vitrified Waste	6.5	1.5	0.21	47	300	69	9.8
P25A	Packaging and Loading Vitrified HLW at INTEC for Shipment to a Geologic Repository	6	1.4	0.19	20	120	27	3.8
P59A	Calcine Retrieval and Transport	11	2.5	0.36	14	160	36	5.0
P111A	SBW and Newly-Generated Liquid Waste Treatment with Cesium Ion Exchange to Contact-Handled Transuranic Grout and Low-Level Waste Grout	33	7.5	1.1	5	170	37	5.3
P111B	SBW and Newly-Generated Liquid Waste Treatment with Cesium Ion Exchange to Contact-Handled Transuranic Grout and Low-Level Waste Grout	21	4.8	0.67	15	300	71	10

Table C.3-6. Estimated worker injury impacts during operations activities of new facilities at INEEL by alternative (continued).

Project	Description	Average number workers/year	LWD[a] per year	TRC[b] per year	Processing time (years)	Total workers	Total LWD	Total TRC
P112A	Packaging and Loading Contact-Handled Transuranic Waste for Shipment to WIPP	18	4.1	0.58	15	270	61	8.6
P117A	Packaging and Loading Calcine to Hanford	48	11	1.5	14	670	150	22
P133	Waste Treatment Pilot Plant	39	8.8	1.3	27	1.1×10^3	240	34
Totals		320	71	10	NA	7.4×10^3	1.7×10^3	240

a. LWD = Lost Workdays. The number of workdays, beyond the day of injury or onset of illness the employee was away from work or limited to restricted work activity because of an occupational injury or illness. LWD rate used to calculate lost workdays is 22.6 based on 15-year historical average at INEEL from 1982- 1997.

b. TRC = Total Recordable Case. A recordable case includes work-related death, illness, or injury which resulted in loss of consciousness, restriction of work or motion, transfer to another job, or required medical treatment beyond first aid. The TRC rate used to calculate total recordable cases is 3.2 based on 15-year historical average at INEEL from 1982-1997.

c. Project data from project data sheets are divided into two phases.

Table C.3-8. Estimated radiological impacts and occupational worker data for existing facilities by project.

Project	Radiological impacts data: Radiological workers per year	Annual dose per worker (millirem)	Annual collective dose (person-rem)	Number of years	Total collective dose (person-rem)	Worker safety data: Nonradiological workers per year	Total employment (worker years)
Tank Farm							
Clean Closure	280	1.0×10^3	280	27	7.6×10^3	280	7.6×10^3
Performance-Based Closure	11	1.1×10^3	12	22	270	16	360
Closure to Landfill Standards	12	1.2×10^3	14	16	220	12	190
Performance-Based Closure with Class A Fill	22	2.1×10^3	16	40	300	27	420
Performance-Based Closure with Class C Fill	23	5.9×10^3[a]	28	40	490	28	420
Total	350	NA	370	NA	9.1×10^3	390	9.1×10^3
Tank Farm related facilities							
CPP-619	0.01	250	2.5×10^{-3}	6	0.02	0.02	0.13
CPP-628	0.26	250	0.07	6	0.39	0.38	2.3
CPP-638	0.09	250	0.02	2	0.05	0.15	0.3
CPP-712	0.02	250	5.0×10^{-3}	6	0.03	0.03	0.18
CPP-717	0.82	250	0.21	6	1.2	1.20	7.2
CPP-737	0.11	250	0.03	6	0.17	0.18	1.1
CPP-738	0.05	250	0.01	6	0.08	0.09	0.52
CPP-739	0.04	250	0.01	6	0.06	0.06	0.35
CPP-743	0.09	250	0.02	6	0.14	0.14	0.82
CPP-641	0.34	250	0.09	2	0.17	0.56	1.1
Total	1.8	NA	0.5	NA	2.3	2.8	14
Bin sets							
Clean Closure	58	600	35	27	940	58	1.6×10^3
Performance-Based Closure	49	870	43	20	850	55	1.1×10^3
Closure to Landfill Standards	27	700	20	21	400	27	570
Performance-Based Closure with Class A Fill	92	2.1×10^3	60	34	960	98	1.3×10^3
Performance-Based Closure with Class C Fill	98	2.9×10^3	75	34	1.2×10^3	104	1.3×10^3
Total	420	NA	280	NA	4.7×10^3	430	6.2×10^3

Table C.3-8. Estimated radiological impacts and occupational worker data for existing facilities by project (continued).

Project	Radiological impacts data: Radiological workers per year	Radiological impacts data: Annual dose per worker (millirem)	Radiological impacts data: Annual collective dose (person-rem)	Radiological impacts data: Number of years	Radiological impacts data: Total collective dose (person-rem)	Worker safety data: Nonradiological workers per year	Worker safety data: Total employment (worker years)
Bin sets related facilities							
CPP-639	0.04	250	0.01	6	0.06	0.07	0.4
CPP-646	0.01	250	2.5×10^{-3}	6	0.02	0.01	0.08
CPP-647	0.01	250	2.5×10^{-3}	6	0.02	0.01	0.08
CPP-658	0.01	250	2.5×10^{-3}	6	0.02	0.02	0.09
CPP-671	0.08	250	0.02	6	0.12	0.13	0.76
CPP-673	0.02	250	5.0×10^{-3}	6	0.03	0.04	0.22
Total	0.17	NA	0.04	NA	0.26	0.27	1.6
Process Equipment Waste Evaporator and related facilities							
CPP-604	38	500	19	6	110	38	230
CPP-605	0.7	250	0.18	6	1.0	1.2	7.0
CPP-649	1	250	0.25	6	1.5	1.6	9.8
CPP-708	6.0	250	1.5	6	9.0	8.6	52
CPP-756	0.75	250	0.19	6	1.1	1.2	7.3
CPP-1618	0.9	250	0.23	6	1.4	1.4	8.6
Total	48	NA	21	NA	128	52	312
Fuel Processing Building and related facilities – Closure to Landfill Standards							
CPP-601	10	250	2.5	10	25	16	160
CPP-627	5.1	250	1.3	10	13	8	80
CPP-640	4.8	250	1.2	10	12	8	80
Total	20	NA	5	NA	50	30	320
Fuel Processing Building and related facilities – Performance-Based Closure							
CPP-601	13	250	3.3	10	30	20	200
CPP-627	6	250	1.5	10	15	10	100
CPP-640	6	250	1.5	10	15	10	100
Total	25	NA	6.3	NA	60	40	400
FAST and related facilities							
CPP-666	34	250	8.4	6	50	50	320
CPP-767	0	0	0	0	0	0	0
Total	34	NA	8.4	NA	50	50	320

Table C.3-8. Estimated radiological impacts and occupational worker data for existing facilities by project (continued).

	Radiological impacts data					Worker safety data	
Project	Radiological workers per year	Annual dose per worker (millirem)	Annual collective dose (person-rem)	Number of years	Total collective dose (person-rem)	Nonradiological workers per year	Total employment (worker years)
Other HLW facilities							
CPP-659							
Performance-Based Closure	35	250	8.8	5	44	47	240
Closure to Landfill Standards	32	250	8	5	40	44	220
CPP-684	4.2	250	1.0	5	5.3	6.9	35
Total	70	NA	18	NA	90	98	490

a. Annual dose from grout fill operations (4,500 mrem per year) accounts for majority of the dose. Administrative controls would prevent workers from actually receiving this level of radiation dose.

APPENDIX C.4

FACILITY ACCIDENTS

TABLE OF CONTENTS

List of Tables

TABLE OF CONTENTS (Continued)

List of Tables (Continued)

List of Figures

C.4 Facility Accidents

C.4.1 FACILITY OPERATIONAL ACCIDENTS FOR WASTE PROCESSING ALTERNATIVES

C.4.1.1 Introduction

C.4.1.1.1 Purpose

The purpose of Section C.4.1 is to present supporting analysis information for Section 5.2.14, Facility Accidents, including the three potential bounding accidents (abnormal events, design basis events, and beyond design basis events) for each of the 9 waste processing alternatives/options. Seventy-two bounding accidents are discussed in Section C.4.1.3 and C.4.1.4. The major process elements and their relation to the waste processing alternatives are shown in Table C.4-1.

C.4.1.1.2 Accident Analysis Definitions

The National Environmental Policy Act defines accidents as undesired events, or combinations of events, that can occur during or as a result of implementing an alternative and that have the potential to result in human health impacts and environmental impacts. Human health impacts could result from exposure to direct health impacts, such as exposure to fires or explosions, ionizing radiation, radiological or chemically hazardous releases, or combinations of these hazards. Environmental impacts include such effects as land use restrictions, ecological damage, and damage to or loss of natural resources. Facility accidents may provide a key discriminator among waste processing alternatives, particularly if the potential for accident impacts varies substantively for the different facilities and operations associated with the alternatives.

Environmental impacts are associated with existing environmental contamination or with materials that could constitute a hazard to humans or the ecology if released during an accident. The purpose of implementing any of the waste processing alternatives is to reduce existing impacts posed by calcine and SBW in their present forms. In addition, the waste processing alternatives are associated with HLW facilities that may require eventual dispositioning. Reduction of environmental risk is accomplished by elimination or control of hazards associated with materials at a facility by removing them, rendering them immobile, or rendering them otherwise inaccessible to human or environmental contact. This constitutes

Table C.4-1. Process elements and waste processing alternatives.[a]

AA[b]	Processing elements / Waste processing alternatives	No Action Alternative	Continued Current Operations Alternative	Full Separations Option	Planning Basis Option	Transuranic Separations Option	Hot Isostatic Pressed Waste Option	Direct Cement Waste Option	Early Vitrification Option	Minimum INEEL Processing Alternative
1	New Waste Calcining Facility Continued Operation		X		X		X	X		
2	New Waste Calcining Facility High Temp & Maximum Achievable Control Technology Modifications		X		X		X	X		
3	Calcine Retrieval and Onsite Transport	X	X	X	X	X	X	X	X	X
4	Full Separations			X	X					
5	Transuranic Separations (TRUEX)					X				
6	Cesium Separations (Cesium Ion Exchange)		X							X
7	Class C Grout					X				X
8	Borosilicate Vitrification (Cesium, Transuranic, Strontium)			X	X					
9	Borosilicate Vitrification (Calcine & SBW)								X	
10	HLW/SBW Immobilization for Transport (Calcine & Cs IX)									X
11	HLW/SBW Immobilization for Transport (HIP)						X			
12	HLW/SBW Immobilization for Transport (Direct Cement)							X		
13	HLW/SBW Immobilization for Transport (Calcine & SBW)	-- Not used --								
14	Liquid Waste Stream Evaporation		X	X	X	X	X	X		
15	Additional Off-Gas Treatment			X	X	X	X	X	X	X
16	Class C Grout Disposal					X				
17	HLW Interim Storage for Transport									X
18	HLW/HAW Stabilization and Preparation for Transport									X
19	HLW/HAW Stabilization and Preparation for Transport	-- Not used --								
20	Long-Term Onsite Storage of Calcine in bin sets	X	X							
21	Transuranic Stabilization and Preparation for Transport to Waste Isolation Pilot Plant		X		X	X	X	X		X
22	Long-Term Onsite Storage of SBW	X								
23	SBW Stabilization and Preparation for Transport to Waste Isolation Pilot Plant								X	
24	SBW Retrieval and Onsite Transport		X	X	X	X	X	X	X	X

a. Two accident analyses (13 and 19) are no longer used. Neither of these accident analyses will be discussed further in this appendix.
b. Accident Analyses as defined in the Technical Resource Document (DOE 1999).
Cs IX = cesium ion exchange; HAW = high-activity waste; HIP = Hot Isostatic Press.

a reduction in the potential for long-term exposures to the public or the environment, which is called environmental risk reduction. Existing hazards that would represent a risk to humans and the ecological environment, if they are not mitigated, may be thought of as the "risk of doing nothing." The effectiveness of environmental risk reduction is a discriminator among the potential waste processing alternatives.

During implementation, each of the waste processing alternatives temporarily adds risk to humans and the environment during the life of the project. Implementation risk results from the activities associated with implementing a waste processing alternative. This implementation risk, which can be thought of as the "risk of doing something," is illustrated qualitatively in Figure C.4-1 as the potentially negative impact of a waste processing alternative. Implementation risk to humans is the sum of risk from facility accidents (i.e., accidents involving release of or exposure to radioactive or chemical materials, transportation accidents, industrial accidents, and accrued occupational exposures during operations). Facility accidents involve risk to the public and are a potential discriminator for waste processing alternatives.

Observational data is not available to predict future performance of planned HLW facilities. Safety assurance documents such as facility safety analysis reports and safety analysis reports for packaging provide a perspective on safety issues and their resolution in DOE facilities and operations. However, these documents are used mainly to identify design features and operational controls that control risk to the public. A perspective on the implementation risk for waste processing alternatives is obtained through an analysis of radiological and toxicological accidents supported by the *Idaho High-Level Waste and Facilities Disposition EIS Facility Accidents Technical Resource Document* (DOE 1999), which is referred to as the TRD in this Appendix.

Facility accidents would not be expected to be the dominant source of implementation risk to workers for waste processing alternatives. The relative contribution to worker risk of facility accidents, industrial accidents, and occupational exposures is shown conceptually in Figure C.4-2. Figure C.4-2 shows that implementation risk is more likely to be dominated by industrial accidents and unavoidable occupational exposures. Facility accident risks to workers would be dependent on the effectiveness of environmental safety and health management at future facilities associated with HLW treatment. An effective environmental, safety, and health program that manages risk to workers and the public is assumed in this accident analysis.

Consequences of industrial 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 this EIS included concerns about potential accidents, the historical record shows the industrial accident rate for DOE facilities at the INEEL is somewhat lower (Millet 1998) compared to the rate in the DOE complex overall. The historic accident rate also compares favorably to national average rates compiled for various industrial groups by the National Safety Council (NSC 1993) and Idaho averages compiled from state statistics (DOE 1993a). One measure of the expected effectiveness of site management in controlling facility accident risks at future facilities is the effectiveness of current management in controlling risk to workers. The Computerized Accident Incident Reporting System database that chronicles injuries, accidents, and fatalities to workers at INEEL can be used as a measure of management effectiveness in controlling the risk of fatal industrial accidents to involved and noninvolved workers. This assumption is based on the fact that control over all accidents in the workplace is a requirement for controlling fatal accidents. Historically at INEEL, fatal accidents represent approximately 0.1 percent of all accidents. Accident data is typically collected in terms of different types of activities. From the SNF & INEL EIS (DOE 1995), the rate of injury/illness for construction activities in the DOE complex was 6.2/100 worker-years, and the rate of injury/illness for construction activities in private industry was 13/100 worker-years from 1988-1992. From 1993-1997, the rate of injury/illness for construction activities at INEEL was 5.4 per 100 worker-years (Fong 1999). This data supports the conclusion that the injury/illness rate at INEEL is slightly lower than DOE as a whole and significantly lower than private industry. The fatality rate from 1993-1997 was 0.05 per 100 worker-years which is higher than the previously reported fatality rate for the period 1988-1992 and is due to the occurrence of a fatality at the INEEL in 1996. An additional INEEL fatality occurred in 1998. Incorporating this 1998 fatality into the industrial accident rate using a Bayesian update results in a fatality rate of 0.14 per 100 worker-years, which is clearly greater than the fatality rate for the DOE complex as a whole. However, a comprehensive correction action effort is currently being implemented to control and reduce the industrial accident rate at the INEEL. Over the time period of this EIS it can be assumed that the fatality rate at the INEEL will be similar to or better than that of the DOE complex as a whole.

Waste processing alternatives and options being considered in this EIS require an analysis of facility accidents as one of the impacts associated with implementation. The scope of the accident analysis is to evaluate, for each waste processing alternative, the potential for facility accidents that would not necessarily occur but which are reasonably foreseeable and could result in significant impacts (DOE 1993b). The accident analysis must be sufficiently comprehensive to inform the public and other stakeholders of possible impacts and tradeoffs among major waste processing alternatives. Although most safety assurance evaluations of facility accidents indicate that industrial accidents are the largest single contributor to the overall health and safety risk to workers associated with the implementation of an alternative, industrial accident risks are evaluated separately in this EIS (Section 5.2.10) and are not part of the scope of the accident analysis.

The EIS accident analysis requires a technical information base that includes descriptions of potentially bounding accidents (scenarios), as well as the likelihood, source term, and predicted consequences of each accident. Given the large number of alternatives being considered for HLW management and the extensive number of activities associated with implementing each alternative, development of a comprehensive technical basis for identifying and evaluating bounding accidents poses a significant challenge to the National Environmental Policy Act process. The TRD has been assembled to provide a comprehensive and easily referenced source of information for facility accident analysis in the Idaho HLW & FD EIS and is the basis of this appendix.

Since future facilities must be designed and operated to mitigate the risk of accidents, the accident analysis in the TRD is intended to form a functional safety envelope for the safety assurance program for the waste processing alternative chosen for implementation. Subsequent programs such as the development of technical safety requirements, environmental safety and health programs, and safety analysis reports provide the protective features that ensure that safety is not compromised. The EIS facility accident analysis scope encompasses the limits of safety concerns for the future facilities needed to implement waste processing alternatives. At the time these facilities are designed, built, and operated, the safety documentation needed to maintain safety assurance at these facilities would use information in the TRD to bound concerns as well as to focus assessments and commitments. Safety analysis reports and safety analysis reports for packaging do not define new areas of concern but represent scenarios that are contained within the set of accidents outlined in this EIS. The EIS facility analysis scope as compared to future safety documentation is shown in Figure C.4-3.

The scope of this appendix and the TRD involves identification of a set of bounding accidents for HLW management and determination of source terms for each selected bounding event. Specific accident analysis information includes the following:

- Identification of the potential for significant accidents in activities, operations, and facilities (process elements) associated with each alternative
- Definition of a set of discrete evaluations that comprehensively assess accidents for each process element and are used to establish a set of bounding accidents for each alternative

- Performance of comprehensive, technically rigorous, and consistent analysis of abnormal, design basis, and beyond design basis accidents for each process element

- Identification of bounding abnormal, design basis, and beyond design basis accidents for each process element

- Development of source terms and the basis for estimating source terms for the bounding accidents

The TRD provides input information to a consequence assessment that, in turn, provides estimated doses and health consequences to individuals and exposed populations. These results are presented in this appendix and Section 5.2.14. This relationship is shown in Figure C.4-4. The scopes of this appendix and the TRD do not include:

- Evaluation of facility accidents occurring at sites other than INEEL

- Evaluation of accidents associated with transportation of radioactive or hazardous material, other than transportation within a site as part of facility operations

- Evaluation of environmental impacts (Human health impacts are the primary focus rather than flora of fauna impacts. If significant environmental impacts had been identified, they would have been evaluated)

- Evaluation of facility closure accidents, which are included in Section C.4.2 of this appendix and Section 5.3.11 of the Idaho HLW & FD EIS

The process of identifying potentially bounding accidents and source terms (the output of the *Technical Resource Document*) is initiated with screening evaluations to determine activities to implement waste processing alternatives that could result in bounding accidents. In addition, the process includes identification of accident scenarios, development of frequencies for accident scenarios, development of source terms for accident scenarios, and selection of potentially bounding accident scenarios for consequence evaluation. The relationship of TRD elements and references to the produced results is shown in Figure C.4-5.

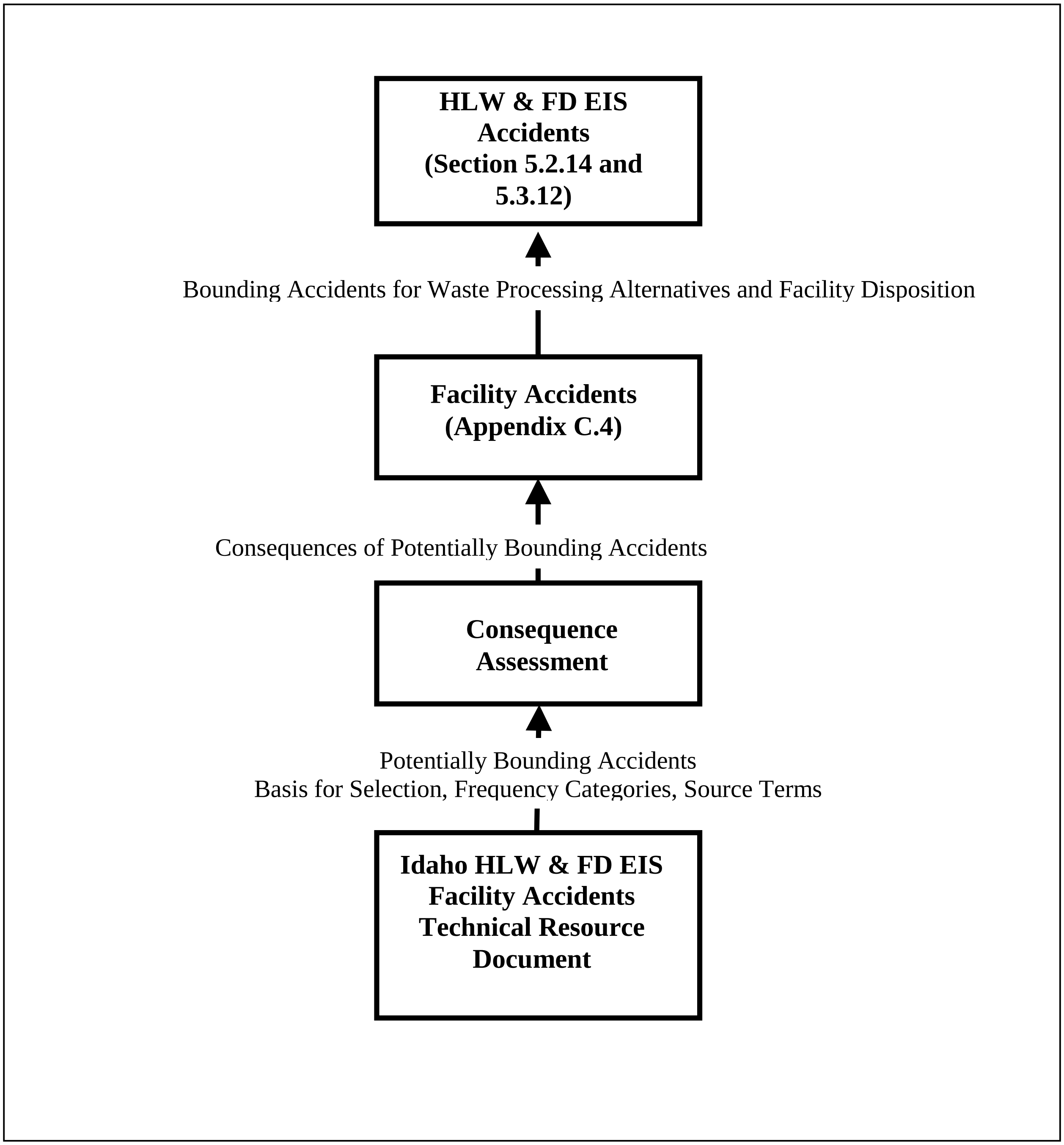

Figure C.4-4. Facility Accidents Technical Resource Document as reference document.

C.4.1.1.3 Overview of Facility Accidents Analysis

Section C.4.1.2 describes the methodology or technical approach used to identify and evaluate bounding accidents for each waste processing alternative and identifies the alternatives and their risk-contributing attributes that are considered in the accident analysis. Also, Section C.4.1.2 identifies six generic types of accidents, the two types of source terms, (i.e., radiological and hazardous material releases), the sources of the material/mass balance data for generating the source terms, and a discussion of natural phenomena/external events that could initiate accidents. This latter discussion provides the basis for predicting the frequency of natural phenomena, which are key initiators of potentially bounding accidents for waste processing alternatives. External events, or operational failures occurring outside a facility, may impact the safety and operability of the facility. This section discusses the basis for screening potential external event causes at INTEC and a systematic approach to establishing completeness for the review process. Section C.4.1.2.5 provides an evaluation of involved worker risk that can result from industrial accidents, exposure to radioactive materials during normal operations, and facility accidents. Risk from occupational exposures and industrial accidents is appraised in Appendix C.3. The accident analysis evaluations do not directly provide the portion of risk posed by bounding facility accident scenarios for an alternative. However, a heuristic argument is developed.

Section C.4.1.3 describes the results of a multi-level screening process that has been used to identify and evaluate bounding radioactive-release accidents for the process elements of the waste processing alternatives. Results of the top-level screening evaluation (C.4.1.3.1) are used to prioritize the processes or major facilities that are associated with implementing the alternatives. The prioritization process is used to define a minimum set of accident evaluations that provide a sufficiently comprehensive basis for identifying bounding accidents. Results of the second-level screening process, the accident evaluations, are summarized in descriptions of the bounding accidents for each of the accident evaluations in Sections C.4.1.3.2 through C.4.1.3.4. Results are presented so that the waste processing alternatives to which they apply are clearly identified. Consistent with DOE recommendations for National Environmental Policy Act accident analysis, bounding accidents are identified for three frequency ranges: abnormal events occurring at least once in a thousand years of facility operation (frequency $\geq 1.0\times10^{-3}$ per year); design basis events occurring between once in a thousand and once in a million years of operation (1.0×10^{-3} > frequency $\geq 1.0\times10^{-6}$ per year); and beyond design basis events occurring less frequently than once in a million years of facility operation but equal to or greater than once in ten million years (1.0×10^{-6} > frequency $\geq 1.0\times10^{-7}$ per year). Each accident evaluation summary provides the basis for frequency range categorization and the makeup of source term releases that would occur.

Section C.4.1.4 describes accident analysis that could result in release of hazardous chemicals. Chemical release accidents may have a direct impact on the public or may initiate a cascade of onsite events that eventually result in a release of radioactive materials. Results of the process element screening process are given, and the results of the accident evaluations for potentially significant releases of chemical substances are expressed for each frequency range in postulated source terms in Sections C.4.1.4.2 through C.4.1.4.4.

Section C.4.1.5 describes the consequences of the various accident analyses. Consequences represent radiological impacts to INEEL workers and the general public (C.4.1.5.1). Accidents that contribute chemicals to the atmosphere during the event are discussed in Section C.4.1.5.2. Accidents that produce mainly groundwater releases are discussed in Section C.4.1.5.3.

Section C.4.1.6 provides the results of the point estimates of involved worker risk and the mean values of the simulations and provides the relative contributions from industrial accidents, facility accidents, and occupational exposure.

Section C.4.1.7 provides a basis for identifying a bounding accident in each of the three frequency categories for each waste processing alternative. In particular, the section provides a crosswalk between significant accidents described in Section C.4.1.3 and the waste processing alternatives, as well as a rationale for identifying the bounding accidents for each frequency category. Also, Section C.4.1.7 includes a discussion of groundwater releases, localized hazards, common cause initiators and a sensitivity analysis of the consequences. Section C.4.1.7.6 provides an integrated perspective on risk to co-located workers and the public as a result of bounding facility accidents for all waste processing alternatives. The contributed risk of bounding accidents is compared with guidelines for design and operation of DOE facilities.

Section C.4.2 summarizes the facility disposition analysis that was conducted to evaluate the disposition of the major HLW facilities and to assess the relative impacts of each planned facility disposition with respect to potential facility accidents.

Section C.4.2.1 provides a discussion of the purpose of the facility disposition section and the approach and scope of the analyses for both noninvolved workers and the offsite public and the involved worker.

Section C.4.2.2 describes the three facility disposition alternatives considered by DOE in this EIS. These alternatives include clean closure, performance-based closure, and closure to landfill standards.

Sections C.4.2.3 and C.4.2.4 outline the analysis methodology used for noninvolved workers and the offsite population and the involved worker, respectively.

C.4.1.2 Methodology

C.4.1.2.1 Basis For Selection of Potentially Bounding Accidents

The technical approach and methods used in this analysis are intended to be fully compliant with DOE technical guidelines for accident analysis (DOE 1993b). These same guidelines allow the exclusion of information that is previously addressed in other EIS documents. For activities occurring at Hanford under the Minimum INEEL Processing Alternative, facility accidents due to the processing of INEEL waste are effectively analyzed in the Jacobs Engineering evaluation (Jacobs 1998) that is based on information from the Tank Waste Remediation System (TWRS) EIS (DOE 1998a). Accidents that could occur during the processing of INEEL waste are bounded by accidents that are defined for the TWRS waste treatment alternatives. Another similar example of partitioning in this EIS is the exclusion of the accidents at WIPP from predicted impacts. Such exclusions are not only permissible in DOE NEPA guidelines, they constitute a reasonable method of assuring that there is not a “double counting” of impacts associated with DOE activities. Technical guidelines require the identification of accidents for each alternative that are reasonably foreseeable and bounding. A bounding accident is defined as the reasonably foreseeable event that has the highest potential for environmental impacts, particularly human health and safety impacts, among all reasonably foreseeable accidents.

Most of the facilities and operations comprising the major waste processing alternatives do not as yet have specified design criteria. For the TRD, the term “reasonably foreseeable” is defined as the combined probability and consequences of accident events to include those scenarios with the potential for contributing a human health risk of once in 10 million years or greater. An accident that occurs with a frequency of once in 10 million years and would likely result in one or more fatalities is reasonably foreseeable. Bounding accidents are identified in three frequency ranges of occurrence:

- **Abnormal Events –** occur at a frequency equal to or greater than once in a thousand years.
- **Design Basis Events –** occur at a frequency equal to or greater than once in a million years but less than once in a thousand years.
- **Beyond Design Basis Events –** occur at a frequency equal to or greater than once in 10 million years but less than once in a million years.

Accident analysis of HLW treatment facilities that are currently operating has been performed using data from facility safety assurance documentation, facility operating experience, and probabilistic data from similar facilities and operations. Accident analysis of facilities that have not as yet been designed relies mainly on information from technical feasibility studies that establish basic design parameters and process implementation costs. Information used in the accident analysis includes preliminary facility inventories, material at risk for major process streams within a facility, process design data, and some overall design features. Considering the early state of knowledge on most facility designs, methods used to assess the potential for facility accidents are based mainly on DOE guidance, experience with similar systems, and an understanding of the INTEC site layout. Documents such as safety analysis reports, safety reviews, and unresolved safety question determinations that routinely evaluate the potential for harm to human health have not been available for this EIS accident analysis.

The Idaho HLW & FD EIS accident analysis (developed in the TRD) for HLW treatment facilities incorporates three levels of screening analyses:

1. A screening evaluation of major facilities and operations (process elements) needed to implement waste processing alternatives has been performed to assess the potential for significant facility accidents. The accident potential of various process elements has been evaluated and prioritized. Process element attributes that infer the existence of significant process hazards include inventories of hazardous or radioactive materials, dispersible physical forms, and the potential for energetic releases during operation. Therefore, the existence of significant hazards in facility operation is a prerequisite for potentially bounding accidents. Table C.4-2 describes the basis for selecting process elements for further review. Process elements with a moderate potential for accidents are selected for detailed accident analysis.

2. Detailed accident analysis begins with the description of activities, inventories, and conditions pertinent to the accident analysis. A standardized set of "accident initiating events" is compared against the described set of activities, inventories, and operating conditions to identify and describe "accident scenarios." Accident initiating events are those with varying frequency and severity that challenge and sometimes degrade the safety functions of the facility. The six categories of initiators used in the accident analysis include:

   – Failures resulting in fires during facility operations

   – Failures resulting in explosions during facility operations

Table C.4-2. Accident analysis evaluation prioritization basis.

Prioritization basis for process elements	Activity not likely to yield bounding accident scenarios[a,b,c]	Activity may yield bounding accident scenarios[a,b,c]	Activity likely to yield bounding accident scenarios[a,b,c]
Previous EIS or SARs[d] provide sufficient data to evaluate accident potential[e,g]	IIIA	IIA	IA
Previous EIS or SARs provide portion of data to evaluate accident potential[f,g]	IIIB	IIB	IB
Previous EIS or SARs do not provide data to evaluate accident potential[f,h]	IIIC	IIC	IC

a. EIS guidelines on accident analysis define sets of occurrences that "bound" the potential for accidents during facility operation to impact the environment are identified for each treatment alternative. A scenario is bounding if it is a credible event that results in the most impact.

b. EIS guidelines require that bounding accidents be identified for process elements that implement an alternative in three frequency ranges:
- Abnormal events occurring at a frequency $\geq 1.0\times10^{-3}$ per year,
- Design Basis events occurring at a frequency of $< 1.0\times10^{-3}$ per year and $\geq 1.0\times10^{-6}$ per year, and
- Beyond Design Basis events occurring $< 1.0\times10^{-6}$ per year but $\geq 1.0\times10^{-7}$ per year.

c. Priority rankings for process element accident potential are as follows:
   I. Inventory at risk and frequency of accidental release are likely to produce bounding accident for treatment alternative,
   II. Inventory at risk and frequency of accidental release could credibly produce a bounding accident scenario.
   III. Process element does not contain sufficient inventory or driving release energy to result in bounding scenario.

d. SAR = Safety Analysis Report.

e. Previously completed evaluations on this or an equivalent facility provide a sufficient data to identify accident scenarios, identify inventories of materials at risk, accident scenario frequencies of occurrence, and accident scenario release fractions.

f. Priority rankings for available data sources are as follows:
   A. Sufficient data already exists to support accident evaluation for waste processing alternatives.
   B. Data may be extrapolated from previous evaluations, supplemented by systems reviews.
   C. Current information sources are inadequate. Data must be supplied through systems reviews.

g. Previously completed evaluations on this or similar facilities could provide part of the information needed to identify accident scenarios, frequencies of occurrence, and source terms. Existing documentation would have to be supplemented with independent systematic reviews to provide a consistent and viable accident analysis basis.

h. Due to uncertainties regarding the technology or its application to a process element, existing documents do not provide information needed to identify accident scenarios, frequencies of occurrence, and source terms. Systematic reviews are required to evaluate accident potential.

(Shaded box) Requires accident analysis evaluation that includes systematic scenario identification, estimation of accident frequencies, identification of bounding accidents, and estimation of source terms.

(Unshaded box) Does not require accident evaluation based on currently available information.

- Failures resulting in inventory spills
- Operational failures resulting in occurrence of criticality
- Occurrence of natural phenomena (such as seismic events or floods) that induce damage to a facility and require safe shutdown
- Occurrence of external events (usually human-initiated events not occurring in a facility)

An accident scenario consists of a set of causal events starting with an initiating event that can lead to release of radioactive or hazardous materials with the potential to cause injury or death.

3. Finally, accident scenarios are "binned" into the three major frequency categories, and the accident scenario in each frequency range with the highest potential risk of health and safety impacts to offsite persons or co-located onsite workers (the dominant accident scenario) is selected for evaluation of source terms and human health consequences. Sources of initiator frequencies include DOE guidelines and reports [(i.e., DOE-STD-1021 (DOE 1996a) and DOE-STD-1024 (DOE 1996b) for natural phenomena)], NRC guidelines and reports, and commercial sources of accident and reliability data. Source terms for each of the dominant accident scenarios are estimated. Source terms of dominant accident scenarios associated with each alternative in each frequency range are compared, and the scenario with the largest risk implications is chosen for reporting in Section 5.2.14, Facility Accidents.

C.4.1.2.2 Bounding Accident Scenarios

Systems Review Team

A team of systems review analysts was selected to evaluate potential accidents that could arise from operation of the identified facilities and activities. The team was comprised of individuals from DOE-ID and other organizations. The team included personnel knowledgeable in HLW management, facility operation, radiological hazards, chemical hazards, hazards identification, source term development, and consequence evaluation. The analysis team was subdivided into two groups. One group developed the accident evaluation methodology and conducted the accident evaluations. The other group provided project oversight and review of documents prepared by the methodology group.

Systems Review Methodology

The ultimate objective in the systems review process was the determination of bounding accident scenarios for each activity. However, DOE also tried to capture and retain the work that went into the intermediate steps in the process. To ensure traceability of how the bounding accidents were selected and how the source terms were estimated, detailed documentation for each of the 24 process elements was incorporated in Appendix A of the TRD. Table C.4-3 provides the form used to document the accident identification process for each of the 24 process elements. The actual forms for each process element are provided in the TRD. Section C.4.1.2.3 describes how the source terms were selected.

Bounding Accident Scenario Identification (Per Table C.4-3)

Process/Alternative Data. The information in this block is related to operations data (e.g., Primary Activities and Operating Information) for the process elements and radioactive or hazardous material inventory information (e.g., Material Inventories) for the alternatives. Since this form serves as a summary sheet, the information in this block is not intended to be an exhaustive listing of every detail of the process/alternative, but should provide sufficient data to validate and understand the results of the bounding accident analysis.

Hazards Identification. This section is structured as a table showing the accident type with respect to accident frequency range. The six accident types included in this section were outlined above and are fire, explosion, spill, criticality, natural phenomena, and external events. The three frequency ranges, abnormal, design basis, and beyond design basis, are based on the definitions in Section C.4.1.2.1. This hazards identification table identifies all the reasonably foreseeable accidents for each accident type and frequency range and shows the "bounding accident" in italics. These accidents are based on different release mechanisms. This approach lends itself to the source term development process since the source terms are a function of the release mechanism. It is noted that natural phenomena and external events are provided as separate accident types, even though they are merely additional causes for the other four accident types (e.g., an earthquake causes a spill). This is done for completeness to ensure that these types of events, which are often overlooked, are evaluated. In addition, there may be cases where an accident could logically fit into two accident types. For instance, an explosion could topple a drum and result in a spill. The exact placement of the scenario is not important, just that it is captured in the table. Sabotage and terrorist activities maybe classified as either internal or external initiators but will not be addressed separately. It was believed that sabotage or terrorist activities are just a mechanism to cause one of the accident types already presented. Sabotage and terrorism are not random or accidental events but the consequences from these acts are likely bounded by events already defined as accidents.

Table C.4-3. Accident Analysis Summary Form

<table>
<tr><td colspan="4">SUMMARY SHEET
PROCESS ELEMENT
(Table 1.3, Accident Analysis #)</td></tr>
<tr><td>Alternative/
Option(s)</td><td colspan="3"></td></tr>
<tr><td colspan="4"></td></tr>
<tr><td colspan="4">PROCESS/ALTERNATIVE DATA</td></tr>
<tr><td>Primary Activities</td><td colspan="3"></td></tr>
<tr><td>Material Inventories</td><td colspan="3"></td></tr>
<tr><td>Operating Information</td><td colspan="3"></td></tr>
<tr><td colspan="4">HAZARDS IDENTIFICATION</td></tr>
<tr><td></td><td colspan="3">Frequency Bins</td></tr>
<tr><td>Accident Type</td><td>**Abnormal**</td><td>**Design Basis Event**</td><td>**Beyond Design Basis**</td></tr>
<tr><td>Fire</td><td></td><td></td><td></td></tr>
<tr><td>Explosion</td><td></td><td></td><td></td></tr>
<tr><td>Spill</td><td></td><td></td><td></td></tr>
<tr><td>Criticality</td><td></td><td></td><td></td></tr>
<tr><td>Natural Phenomena:
flood, lightning, seismic, high wind</td><td></td><td></td><td></td></tr>
<tr><td>External Events</td><td></td><td></td><td></td></tr>
<tr><td colspan="4">ACCIDENT SCENARIO DESCRIPTIONS</td></tr>
<tr><td>Identifier</td><td colspan="3">Description</td></tr>
<tr><td>Abnormal Event
Justification for selection of bounding Abnormal Event.</td><td colspan="3"></td></tr>
<tr><td>Design Basis Event
Justification for selection of bounding Design Basis Event</td><td colspan="3"></td></tr>
<tr><td>Beyond Design Basis Event
Justification for selection of bounding Beyond Design Basis Event</td><td colspan="3"></td></tr>
<tr><td colspan="4">REFERENCES</td></tr>
</table>

Nominally, each of the cells in the Hazard Identification Table is populated with a brief description of a reasonable worst-case scenario for each frequency bin and accident type. An exception would be processes/alternatives, which involve both chemicals and radioactive materials. In these cases, a chemical accident scenario and a radiological accident scenario are identified. It is recognized that there are some accident types/frequency combinations that will be left blank since there isn't a logical accident scenario that would fit in the cell.

Accident Scenario Descriptions. This section shows more detailed descriptions of all the potential accidents identified in the Hazardous Identification Table just discussed. These scenario descriptions include additional information such as data on the material at risk, material form, and pertinent information to determine the source term. Also, this section shows the bounding accident in italics and a justification for the choice of the bounding accident.

Evaluating the Potential Impact of Additional Information on Bounding Accidents

Over time, additional information may become available that raises concerns over the choice of bounding facility accidents or the potential consequences of such accidents. Such additional information might include:

- Vulnerabilities not previously recognized in the systematic accident analysis contained within the TRD (e.g., the impact of newly received engineering data modifying the expected response of a system to one or more external natural phenomena)

- Proposed projects not included in the affected environment baseline that could impact the perception of stakeholders and reviewers regarding the adequacy and comprehensiveness of the Idaho HLW & FD EIS (e.g., the potential impact of locating the Venture Star ground support operation at INEEL)

Additional information must be evaluated efficiently and the results reflected in the Idaho HLW & FD EIS Project File. A rapid approach can be used to evaluate additional information using a risk-based perturbation process. In this perturbation process, risks associated with current bounding accidents are estimated and used as a risk baseline. Changes in the baseline risk data as a result of new unanalyzed information are reflected as modifications to the baseline risk projections. Appendix C of the TRD provides a detailed explanation of the use of this risk-based perturbation process.

Of the accident scenarios identified in Appendix A of the TRD, 72 accidents were selected as being potentially bounding based on the probabilistic and source term information developed. Of the

72 accidents reported in the TRD, 27 accidents (one abnormal event, one design basis event, and one beyond design basis event accident for each of the nine waste processing alternatives) were identified as being bounding based on evaluation of consequences. Health consequences were evaluated as a result of exposure to released radioactive materials and/or released chemically toxic substances. Consequences of radioactive material exposures were calculated for a hypothetical maximally exposed individual (in rem) at the closest publicly accessible point to the release, a hypothetical non-involved worker (in rem) who is onsite and located 640 meters from the accident, and the offsite population within a 50-mile range (in person-rem) of radiation dose to the general public for doses less than 20 rem. For larger doses, when the rate of exposure would be greater than 10 rad (radiation absorbed dose) per hour, the increased likelihood of latent cancer fatality is doubled, assuming the body's diminished capability to repair radiation damage. For offsite consequences, the number of expected fatalities of the exposed population was estimated using the currently accepted mortality factor of 5.0×10^{-4} latent cancer fatalities per person-rem. Frequencies for each accident (per year of operation) were estimated using:

- Design data and other information on waste processing alternatives and natural phenomena
- Knowledge of systems vulnerabilities for critical HLW treatment systems based on extrapolation of data from similar previously evaluated systems
- Site-specific evaluations performed during the Idaho HLW & FD EIS preparation

C.4.1.2.3 Source Term Review Basis

Source Term Review Methodology

Source terms were developed for each of the bounding accidents identified for the 24 process elements or activities that were evaluated for each of the three frequency bins. Although the accidents involved different initiators and material forms, there were two distinct source term types that were considered: radiological releases and chemical releases. The following paragraphs describe these two distinct source terms types.

Radiological Releases

For non-criticality radiological releases, the source term is defined as the amount of respirable material that is released to the atmosphere from a specific location. The radiological source term for non-criticality events is dependent upon several factors including the material at risk, material form, initiator, operating conditions, and material composition. This relationship is summarized in the equation given below, which is modified from the *Safety Analysis and Risk Assessment Handbook* (Peterson 1997) and in DOE-STD-3010) (DOE 1994). The technical approach described in DOE-STD-3010 is used to estimate source terms for radioactive releases. This approach applies a linear set of release factors to the material at risk constituents to produce an estimated release inventory. The release inventory is combined with the conditions under which the release occurs and other environmental factors to produce the total material released (Q) for consequence estimation. Factors applied in the DOE-STD-3010 source term method are shown below (DOE 1994).

$$Q = MAR \times DR \times LPF \times ARF \times RF \times COMP$$

Where:

Q	=	Total Material Released (Ci)
MAR	=	Material At Risk (Ci, volume, or mass based on inventories or process flow rates)
DR	=	Damage Ratio (fraction of the material at risk that is exposed to the event)
LPF	=	Leakpath Factor (fraction of the material that enters the outdoor environment)
ARF	=	Airborne Release Fraction (fraction of material released suspended in air)
RF	=	Respirable Fraction (fraction of material released that can be inhaled)
COMP	=	Material Composition by Radionuclide (Ci, Ci/volume, or Ci/mass)

For criticality events, the source term also includes exposure to prompt critical radiation, which is a function of the number of fissions involved. The number of fissions is dependent upon the nuclear material orientation and type. Criticality is assessed internally in each accident analysis. Only one bounding criticality accident scenario was identified. DBE 21, Transuranic Waste Stabilization and Preparation for Transport to the Waste Isolation Pilot Plant, identified an inadvertent criticality during transuranic waste shipping container loading operations as a result of vulnerability to loss of control over storage geometry. This scenario is identified in Table 3.4-11 under the Minimum INEEL Processing Alternative. Most waste processing alternatives would not contribute enough fissile materials in an aqueous environment to allow criticalities to develop.

Chemical Releases

Chemicals that pose the greatest hazard to workers and the public are gases at ambient temperature and pressure. An example is ammonia, which is stored under pressure as a liquid but quickly becomes a vapor as it is released. Chemicals such as nitric acid are liquids at ambient conditions and pose a toxic hazard to involved workers. However, the potential for these types of chemicals to become airborne and travel to co-located or offsite facilities is low. Therefore, the focus of the chemical hazards is on those chemicals that are gases at ambient conditions.

Technically, the release mechanism of pressurized gases involves a fraction that becomes vapor as the gas depressurizes and a fraction that drops to the ground and forms a boiling pool. The pool-boiling rate is a function of several factors: pool area; the type of substrate material (e.g., soil, concrete, etc.); and the substrate temperature. Another factor that influences the gaseous release is the degree to which liquid droplets became entrained into the flash fraction.

Rather than quantifying each of these factors, an alternate approach was taken based on guidance in the U.S. Environmental Protection Agency's *Technical Guidance for Hazards Analysis* (EPA 1987). In that document, it was recommended that the material at risk be released over a 10-minute duration. This was the approach taken for leaks from process vessels, as well as catastrophic failures of process vessels. However, for scenarios that involve fires that do not directly consume the hazardous chemical, the material at risk was assumed to be released over a 1-minute duration. This is to account for the significant energy driver from the fire that would influence the rate of release.

In addition to being a direct toxic hazard to workers and the public, chemical releases also serve as indirect, external initiators for radiological releases. This release could occur in processes that require significant operator attention and where operator incapacitation could lead to other accidents. Consideration of chemical releases as external events is treated on a case-by-case basis for each alternative activity.

Source Term Identification

As is the case for the selection of the bounding accidents for each of the 24 process elements, Appendix A of DOE (1998a) presents the documentation that supports the source term identification or estimation for the same process elements. The following Table C.4-4 shows the estimation process that was used for the AA01 (New Waste Calcining Facility Continued Operations) source terms; the following paragraph explains the elements of Table C.4-4.

- **Bounding Event.** This section presents the Accident Description, Material Form, Release Mechanism (Initiator), and Rationale for Selection for the bounding event.

Table C.4-4. Source term data for AA01 (example only).

Abnormal event	
Process element	New Waste Calcining Facility Continued Operation
Accident description	The bounding accident was chosen to be a fuel fire in the calciner cell. A kerosene spill due to a failed fuel line could ignite due to the high temperature environment. The equipment in the calciner cell will not be impacted since it was designed to withstand the consequences of a cell fire. However, the products of combustion from a fire could degrade the HEPA filters in the ventilation system and release accumulated radionuclides.
Material form	Material accumulated on HEPA filters.
Release mechanism	Fire. The heat released from the fire is transferred through the heating, ventilation, and air conditioning exhaust duct where the heat flows through the HEPA filters. The heat degrades the heating, ventilation, and air conditioning exhaust filter media releasing the radionuclides.
Rationale for selection	Represents bounding scenario in the "abnormal" frequency range.

Input data		
Parameter	Value	Comment
Available material at risk	See Table 1	The New Waste Calcining Facility Safety Analysis Report, Table 3-9, provides an estimate of the activity on the HEPA filter. This estimate is based on analyses of samples from the Tank Farm SBW from tanks WM-180 and WM-181.
Key radiological components	See Table 1	The New Waste Calcining Facility Safety Analysis Report, Table 3-9, provides an estimate of the activity on the HEPA filter. This estimate is based on analyses of samples from the Tank Farm SBW from tanks WM-180 and WM-181.
Damage ratio	1.0	Bounding value.
Leak path factor	1.0	Bounding value. HEPA filters are assumed to be impacted by scenario and provide no filtration.
Airborne release fraction	1.0×10^{-4}	Per DOE-STD-3010, airborne release fraction applicable for fires impacting HEPA filter contamination.
Respirable fraction	1.0	Per DOE-STD-3010, respirable fraction applicable for fires impacting HEPA filter contamination.
Total material released	See Table 1	The source term is tabulated below.

Isotopic Source Term for New Waste Calcining Facility heating, ventilation, and air conditioning (activity taken from New Waste Calcining Facility Safety Analysis Report Table 3-9)

Isotope	Activity (curies)	Airborne release fraction	Source term (curies)
Am-241	3.5×10^{-3}	1.0×10^{-4}	7.0×10^{-7}
Ba-137m	1.7	1.0×10^{-4}	3.4×10^{-4}
Co-60	0.01	1.0×10^{-4}	2.2×10^{-6}
Cs-134	0.07	1.0×10^{-4}	1.3×10^{-5}
Cs-137	1.8	1.0×10^{-4}	3.6×10^{-4}
Eu-154	0.03	1.0×10^{-4}	5.4×10^{-6}
Eu-155	9.7×10^{-3}	1.0×10^{-4}	1.9×10^{-6}
Pu-238	0.04	1.0×10^{-4}	8.0×10^{-6}
Pu-239	5.9×10^{-3}	1.0×10^{-4}	1.2×10^{-6}
Sb-125	0.02	1.0×10^{-4}	3.2×10^{-6}
Sr-90	1.7	1.0×10^{-4}	3.4×10^{-4}
Y-90	1.7	1.0×10^{-4}	3.4×10^{-4}

- **Input Data.** This section of the table show the input data necessary to calculate the source term (i.e., Available Material at Risk, Key Radiological Components, Damage Ratio, Leak Path Factor, Airborne Release Fraction, Respirable Fraction, and the estimated Total Material Released).

- **Source Term Table.** Table shows all the nuclear isotopes and the associated source terms in curies.

Qualification of Facilities Inventories and Materials at Risk

DOE must identify the optimal source of material/mass balance data for use in generating the source terms from the material at risk values derived during the accident analysis review. In accordance with the Idaho HLW & FD EIS Notice of Intent, the accident analysis team has relied upon existing documents and made use of previously developed information and analyses. On this basis, the accident analysis team developed source terms that support accident evaluation scenarios using information taken from approved references.

During late 1997, D. R. Wenzel, at INTEC, was requested to prepare engineering design files that evaluated the radionuclide inventories associated with zirconium calcine, aluminum calcine, and SBW (Wenzel 1997a,b). At approximately this same time, Fluor Daniel, Inc. was contracted to develop a feasibility studies report that evaluated the potential HLW treatment facilities being considered under the Separations Alternative. However, circumstances prevented Fluor Daniel, Inc. from utilizing the D. R. Wenzel data as part of their references for use in their report.

The designs presented in the Fluor Daniel Study (Fluor Daniel 1997) are based on material balances and flowsheets provided in Barnes et al. (1997). The Fluor Daniel study assumed that the waste characterization data in Barnes et al. (1997) was reasonably accurate and it was assumed that no unknown condition would be identified.

The Wenzel data was generated in October 1997, nearly 6 months after the Barnes data was collected (Wenzel 1997a,b). Wenzel developed Engineering Design Files for aluminum and zirconium calcine and SBW but did not evaluate the isotopic concentrations associated with the various treatment processes included in the Idaho HLW & FD EIS. The Wenzel data provides weighted averages of the radionuclide inventories in all SBW tanks. It also provides the inventory of bin set #1 (aluminum calcine waste) and a composite of the zirconium calcine waste in the other bin sets.

To this end, the radionuclide inventory generated by Wenzel for aluminum and zirconium calcine and SBW (decayed until 2016) was compared against the Fluor Daniel inventory. Table C.4-5 is a summary of this comparison. The ratios of the doses that result from comparison of the two data sets are presented in Tables C.4-6 and C.4-7. Table C.4-6 compares the ratios of the doses resulting from the Fluor Daniel data (undecayed) to the Wenzel data. From these ratios it is apparent that the Fluor Daniel data results in higher doses than the Wenzel data; these ratios range from a factor of 6.00 to 1.52 higher. Table C.4-7 compares the ratio of the doses resulting from the Fluor Daniel data (decayed to 2016) to the Wenzel data. Again the Fluor Daniel data results in doses that are higher by a factor of 4.7 to 1.1.

Table C.4-5. Fluor-Daniel versus Wenzel data.

Scenario	Maximally-exposed individual dose (millirem)	Non-involved worker dose (millirem)	Population dose (person-rem)	Latent cancer fatalities
ABN 03	18	1.2×10^{3}	220	0.11
ABN 03D[a]	14	940	150	0.07
ABN 03W[b]	3	210	110	0.06
DBD 03	460	3.2×10^{4}	4.1×10^{3}	2.1
DBD 03D	370	2.5×10^{4}	2.9×10^{3}	1.5
DBD 03W	270	1.9×10^{4}	2.6×10^{3}	1.3
ABN 24	6.4×10^{-3}	0.43	0.08	4.1×10^{-5}
ABN 24D	5.3×10^{-3}	0.36	0.06	2.8×10^{-5}
ABN 24W	4.2×10^{-3}	0.28	0.04	2.2×10^{-5}

a. D signifies Fluor-Daniel numbers decayed to the year 2016 consistent with Wenzel values.
b. W signifies using the Wenzel concentrations in the year 2016.

Table C.4-6. Ratio of Fluor-Daniel (undecayed) versus Wenzel dose values.

Scenario		Maximally-exposed individual dose ratio	Non-involved worker dose ratio	Population dose ratio	Latent cancer fatalities ratio
Aluminum calcine	D/W ratio	6.0	5.7	2.0	2.0
Zirconium calcine	D/W ratio	1.7	1.7	1.6	1.6
SBW	D/W ratio	1.5	1.5	1.9	1.8

Table C.4-7. Ratio of Fluor-Daniel (decayed) versus Wenzel dose values.

Scenario		Maximally-exposed individual dose ratio	Non-involved worker dose ratio	Population dose ratio	Latent cancer fatalities ratio
Aluminum calcine	D/W ratio	4.7	4.5	1.4	1.2
Zirconium calcine	D/W ratio	1.7	1.3	1.1	1.2
SBW	D/W ratio	1.3	1.3	1.5	1.3

From the data presented in Tables C.4-6 and C.4-7, it becomes clear that the doses resulting from the use of the Wenzel data are bounded by the doses resulting from the use of the Fluor Daniel data. Thus, the accident analysis team could use the Fluor Daniel data for the development of the various accident source terms based on the material at risks they developed. The outcome of using the Fluor Daniel data will result in doses that are conservative.

C.4.1.2.4 Natural Phenomena/External Events

A number of natural phenomena and external events could potentially impact the site and result in releases of radiological and/or chemical inventories. For natural phenomena hazards, DOE-STD-1021 has established performance categorization guidelines for structures, systems, and components (DOE 1996a). The rating system is out of a scale from one (PC-1) to four (PC-4) with four being the most restrictive. However, the PC-4 categorization is reserved for facilities that could result in offsite release consequences greater than or equal to the unmitigated release from a large (>20 MW) Category A reactor accident. The INEEL facilities do pose potential adverse release consequences but do not fall within the definition of a PC-4 facility. Therefore, most INEEL HLW facilities are classified as PC-3.

Per DOE-STD-1020, PC-3 structures, systems, and components are assigned mean annual probabilities of exceeding acceptable behavior limits of 1.0×10^{-4} per year (DOE 1996c). The natural phenomena evaluations in this analysis are linked to the design criteria associated with the 10,000-year event (1.0×10^{-4} per year). Since the structures, systems, and components are to be designed to these criteria, they are not anticipated to fail until a larger magnitude-initiating event with a lower frequency ($<1.0\times10^{-4}$ per year) occurs. Even with larger magnitude initiating events, there is still only a conditional probability (e.g., fragility curves for seismic evaluations) that a structure, system, or component will fail. However, these conditional probabilities vary with the types of initiators and are also dependent upon specific design details of the structure, system, or components. Although this approach may appear overly conservative from a frequency standpoint, there may be no impact from a relative frequency standpoint. The following paragraphs define the frequency ranges assigned to various natural phenomena in this EIS.

Range Fire

A range fire can result in loss of offsite power that, in turn, results in loss of ventilation to the facility and a slow release. Range fires have occurred on or in the vicinity of the INEEL during 1994, 1995, and 1996. While a range fire would not endanger the process element under consideration, due to defoliated zones, facility fence, etc., smoke from the fire could require personnel evacuation and disrupt operations. However, the most severe consequence of a range fire would be a loss of offsite power due to firedamaged transmission lines. Loss of offsite power could result in a loss of zoned building ventilation which, could result in a slow loss of material confinement. Loss of building confinement would create leakage pathways through doorways, airlocks, loading docks, and other building access points. The consequences associated with a range fire are anticipated to be minimal and in most cases would be bounded by operational events such as an electrical panel/motor fire. Unless specific design features of the process element warrant a lower frequency, range fires are generally placed in the abnormal event frequency bin.

Design Basis Seismic Event

A design basis event seismic event can cause failure of the facility structure and/or equipment such that a release occurs with a pathway to the environment. The design basis event seismic scenario frequency is dominated by failure of bin set #1 since its seismically induced failure frequency (5.0×10^{-3} per year) is substantially greater than that of the other six bin sets (5.0×10^{-5} per year). The frequency 5.0×10^{-3} per year was assumed for bin set #1 since the DOE-STD-1021 prescribes that Category 3 facilities withstand a 1.0×10^{-4} per year earthquake (DOE 1996a). Bin set #1 does not meet this standard and its probabilistic performance has been degraded by a factor 5. So instead of a 10,000 year earthquake failing bin set #1, it will fail at a 2,000 year return period.

Analysis of design basis event seismic initiators in the TRD imply that under severe seismic loading one bin set may fail catastrophically. A question has been raised as to why only one bin set can fail, and not the other six bin sets. Failure of bin sets #2 to #7 is considered a design basis event as shown above. Given the well-known “fragility” curve, although a failure could occur at a specific seismic level, it probably will not. Thus, seismicity as a common cause source for failures does not prevent one unit failing and the others not. In fact, reviews of seismic damage to commercial facilities routinely reveal one specific component failing while all others, more or less with the same loading, do not. Thus, it would be overly conservative to assume “complete coupling” in seismic failures of multiple bin sets.

Flood-Induced Failure

A major flood can cause damage to the facility structure and subsequent equipment failures, thereby causing a release of materials from the facility to the environment. In particular, bin set #1 has been determined, by analysis, to be statically unstable. Under flood conditions, the berm surrounding bin set #1 could be undermined with subsequent collapse of the cover onto the four internal vaults. Material released from the vaults would then be transported by flood waters to the surrounding area and released to the environment as dust once the flood recedes. Early predictions of the frequency of such a flood were

1.0×10^{-4} per year at a maximum elevation of 4,916.6-feet mean sea level well above the 4,912 feet needed to wet the bottom of the bin set #1 berm. The site design accounts for this restriction and new facilities are (or would be designed to be) located above this elevation. Additionally, since floodwaters in relatively flat terrain such as the INEEL rise slowly, adequate time should be available to take protective measures to prevent water from entering the facility (DOE orders require re-evaluation if there has been a significant change in understanding that results in an increase in the site natural phenomena hazard). Given that flood induced failure of bin set #1 was estimated at a frequency of 1.0×10^{-4} per year and failure of one of the remaining bin sets is an order of magnitude less likely, the total probability (P) of a flood-induced release would be:

$$P = A \times B + C \times D \times E$$

where:

A = 4.0 = time (years bin set #1 remains operational) of exposure to flood damage for bin set #1

B = 1.0×10^{-4} per year = Frequency of flood for bin set #1

C = 6.0 = number of other bin sets

D = 1.0×10^{2} = time (years bin sets #2-#7 remain operational) of exposure for bin sets #2-#7

E = 1.0×10^{-5} per year = frequency of flood for bin sets #2-#7

thus:

$$P = 4.0\times10^{-4} + 6.0\times10^{-3} = 6.4\times10^{-3} \text{ per year}$$

More recent flood data indicate that a flood threatening bin set #1 may be much less likely than the 10,000-year flood assumed above and that flood-induced failure of bin sets #2 to #7 are not a credible events. If the present frequency of bin set #1 failure (1.0×10^{-4}) is assumed to be a 95 percent (upper) confidence bound on frequency and a 5 percent (lower) confidence bound of 1.0×10^{-7} is used, then a geometric mean of 3.2×10^{-6} per year for flood failure of bin set #1 is estimated. Therefore, $P = 4.0\times3.2\times10^{-6} + 6.0\times10^{-6} = 2.0\times10^{-5}$, again a design basis event. From this data, it is concluded that the frequency of a flood at the INTEC makes this scenario a design basis event.

No arguments have been made that preclude 1.0×10^{-4} from being an upper bound. In addition, even if a lower bound probability of a flood 3 to 4 orders of magnitude lower were used, the geometric mean of two referenceable sources would be P = 4 × Geometric Mean of $(1.0\times10^{-4} + 1.0\times10^{-8}) = 4.0\times10^{-4}$. Unless specific design features of the process element warrant a lower frequency, flood-induced failure of bin set #1 is placed in the design basis event frequency bin.

Aircraft Crash

NRC's *Standard Review Plan* [Section 3.5.1.6 in NRC (1997)] assesses the risk of commercial aircraft crashes into nuclear facilities to be on a sliding scale ranging from 1.67×10^{-7} (crashes per square mile – aircraft movement) within a mile of an active runway to 1.2×10^{-9} (crashes per square mile – aircraft movement) at 10 miles. As the distance from the runway increases, the drop in frequency becomes noticeably less, such that it can be assumed conservatively that anywhere beyond 10 miles the frequency of aircraft crashes is 1.0×10^{-9} (crashes per square mile – aircraft movement). Evaluations performed under DOE-STD-3014, for a reactor located near a runway used by military aircraft (McClellan AFB), tend to validate these frequencies for military aircraft (DOE 1996d). There are currently no scheduled flights in or out of Idaho Falls by aircraft heavy enough to penetrate facilities at INTEC; however, it is reasonable to assume that at sometime in the future there may again be flights in and out of the Idaho Falls Airport by aircraft heavy enough to penetrate facilities at INTEC. By this measure, there are at least 2,190 aircraft movements per year that could be a hazard to INTEC facilities, producing a frequency of crashes at INEEL of 2.2×10^{-6} (crashes per square mile – year). INTEC facilities occupy nearly a square mile of area at the INEEL. However, critical facilities such as the bin sets, Tank Farm tanks, and future waste processing facilities associated with various waste processing alternatives do not occupy nearly as much surface area of land. Additionally, previous evaluations of facility vulnerabilities to aircraft impacts at INTEC indicate that a direct release of radioactive or hazardous materials due to an aircraft crash is feasible only if a direct impact to the facility occurs. As such, the average surface area of a critical facility is estimated to be approximately 6 acres or 9.4×10^{-3} square miles. Therefore,

$$\text{Frequency of Critical Facility Aircraft Crash at INTEC} = 2.2\times10^{-6} \times 9.4\times10^{-3} = 2.1\times10^{-8} \text{ per year.}$$

It is noted that this frequency is outside of the 1.0×10^{-6} per year to 1.0×10^{-7} per year range for beyond design basis events. However, due to the potentially catastrophic effects of aircraft crashes into INTEC facilities and to account for likely future increases in flights out of the Idaho Falls Airport, aircraft crashes will be included as an accident initiator in the beyond design basis frequency category.

Based on data available to the accident analysis team, it was determined that past turbulence studies are no longer a concern and that air traffic near INTEC has greatly reduced since generation of previous reports. Thus, the accident frequencies developed above are considered accurate. Previous evaluations of aircraft impacts into bin sets tend to agree on several points: (a) the large, heavy engine assemblies of commercial passenger jets (i.e., 737 and larger) could penetrate the top of bin sets and other enclosed facilities, and (b) smaller aircraft probably would not. Currently, there may be small aircraft flying in the vicinity of INTEC facilities but the only large aircraft capable of penetrating INTEC facilities are those serving the Idaho Falls Airport 50 miles away. The frequency of such an impact (2.1×10^{-8} per year) is estimated based on present aircraft crash data and large aircraft usage at the Idaho Falls Airport. Unless other site activities are proposed that would require use of large aircraft near INTEC, these estimates would not be revised upward. Thus, aircraft crash will remain a beyond design basis event for this EIS.

Extreme-Lightning Damage

Lightning strikes can cause damage to the facility structures, loss of electric power, and damage to operating and safety equipment. The result would be a release of material and a direct pathway to the environment. Three or four lightning strikes have occurred at the INTEC in the last 20 years. These lightning strikes resulted in minor damage but did not lead to releases of radiological and/or chemical inventories. The facility structures are or will be equipped with lightning protection systems designed in accordance with the requirements of NFPA (1997); thus, failures as a result of lightning strikes would be extremely unlikely. In addition to defeating the lightning protection system, a lightning strike would have to be powerful enough to damage facility structures and create a direct leak path to the environment. The frequency of such a strike is deemed to be in the beyond design basis bin, although a fire could be self-sustaining in many locations and raise the likelihood of a material release.

High Wind-Induced Failure

High winds, in the form of tornadoes or straight-line winds, can cause failure of facility structures, operating equipment, safety equipment, or electric power and may result in releases of material and create pathways to the environment. The design basis wind for PC-3 facilities is 95 miles per hour with an annual probability of 1.0×10^{-4} per year. The INEEL Wind Hazard Curve indicates that a straight-line wind with this return frequency would be approximately 90 miles per hour. The wind design criteria for the newly constructed buildings would exceed this threshold. Stronger winds would have an annual probability of less than 1.0×10^{-4} per year and would have to be strong enough to breach the facility structure and internal process systems in order to create a leakage pathway to the environment. Little if any material is at risk. Although the high wind initiator itself would be placed in the design basis frequency bin, the high wind-induced failure scenarios are placed in the beyond design basis frequency bin. Unlike seismic events, which impact the facility structure and internal equipment concurrently, high winds primarily impact the external facility structure. An additional sequence of events would have to occur before contained material inventories are impacted.

Beyond Design Basis Seismic Event

The beyond design basis event earthquake would have a peak ground acceleration that exceeds the design capacity of the facilities and would have a return period greater than 1,000,000 years (1.0×10^{-6} to 1.0×10^{-7} per year). The event would be powerful enough to breach internal process systems (high-efficiency particulate air filters, doors, airlocks, etc.) in order to create a leakage pathway(s) to the environment. This event could be as severe as an airplane crash in the bounding accident determination. The frequency of such an event is deemed to be in the beyond design basis event bin.

Volcanism

Volcanic activity (volcanism) occurring at near field and distant volcanic sources represents a potential external event that could lead to releases of radiological or chemical inventories associated with the waste processing alternatives.

The information in the INEEL Three Mile Island-2 Safety Analysis Report (DOE 1998b) and EDF-TRA-ATR-804 (Hackett and Khericha 1993) indicate that the bounding volcanism-related hazard is due to basaltic volcanism (Hackett and Khericha 1993). Impact to the INTEC due to the other volcanism initiators is considered very unlikely due to geologic changes in the region over millions of years, limited impact areas, and the physical distance to the potential sources. When considering volcanism, mitigation measures to either divert the lava flow or cool the lava are likely to be effective, due mainly to the relatively long period of time (up to a month) between the time of an eruption and the time at which the flow reaches INTEC facilities, the frequency of a basaltic eruption that impacts facilities at INTEC is on the order of 7.0×10^{-7} per year, which places it in the beyond design basis frequency range. This would place basaltic eruptions in the same frequency bin with initiators such as aircraft crashes. As a beyond design basis event, basaltic eruptions are considered bounded from a consequence standpoint by other initiators such as aircraft crashes that involve impact and explosions as well as exposure to high temperatures. This is because the lava flow from the eruption would likely cover the affected structures and limit the release from process vessels and piping.

C.4.1.2.5 Methodology for Integrated Analysis of Risk to Involved Workers

Health and safety risk to involved workers (workers associated with the construction, operation, or decontamination/decommissioning of facilities that implement a waste processing alternative) constitutes a potentially significant "cost" of implementing waste processing alternatives, a source that is being systematically characterized and reported in the HLW EIS. Together with health and safety risk to the public, evaluation of involved worker risk provides a comprehensive basis for comparing waste processing alternatives on the basis of contribution to the implementation risk due to accidents. Unlike health and safety risk to collocated workers and the public that results mainly from facility accidents and accidents occurring during transportation, health and safety risk to involved workers can result from three sources, industrial accidents, exposure to radioactive materials during normal operations, and facility accidents.

- Industrial accident risk to involved workers is the result of accidents that may occur during industrial activities to complete major projects associated with each treatment alternative. Industrial accidents may occur during any of the three major phases of a project, construction, operation, or decontamination/decommissioning. An example of a project, as defined here, would be the Borosilicate Vitrification of calcine waste. Borosilicate Vitrification includes the construction, operation, and decontamination/decommissioning of a vitrification facility plus tasks associated with movement of waste into and out of the facility itself.

- Occupational risk to involved workers results from routine exposure to radioactive materials during the portion of implementation activities that involve exposure to radiation. Occupational risk is not the result of accidents, but is considered along with accident risks as part of the integrated risk to involved workers during implementation of alternatives. Occupational exposures occur mainly during the operation and decontamination/decommissioning phases of a project.

- Facility accident risk to involved workers results from accidents that release radioactive or chemically hazardous materials, accidents (e.g., criticality) that could result in direct exposure to radiation, or energetic accidents (e.g., explosions) that can directly harm workers. Facility accidents pose risk to involved workers in a manner analogous to noninvolved workers and the public, that is, health consequences are the result of workers being receptors for radioactive or chemically hazardous materials that might be released during an accident. For purposes of the EIS, facility accidents are assumed to occur mainly during the operational phase of a project. Facility accidents could occur during the decontamination/decommissioning phase of project activity. However, an accident analysis of facility disposition alternatives, performed for this EIS, evaluated the potential for accidents during the decontamination/decommissioning of existing facilities to be several orders of magnitude smaller than for the same facilities during operation. The assumption is made here that new facilities needed to implement waste processing alternatives would be no worse than existing facilities. Given this assumption, facility accident risk is confined to the operational phase of a project.

Risk to involved workers from occupational exposures and industrial accidents is appraised as part of the health and safety evaluation in the EIS (Appendix C.3). The accident analysis evaluations, include consequences to facility workers. In the integrated involved worker risk evaluation, information used to assess worker risk from industrial accidents and occupational exposures is integrated with results of the facility accidents evaluation to produce a comprehensive perspective on involved worker risk.

The methodology used to evaluate integrated involved worker risk over the life cycle of an waste processing alternative is shown in Figure C.4-6. The total commitment of time, budget, or risk required for implementing a waste processing alternative can be referred to as a life cycle cost. Thus, the life cycle integrated involved worker risk is the sum of worker risk associated with implementation all major projects associated with an alternative. Figure C.4-6 describes how the three types of risk to involved workers are evaluated based on information from the EIS, its supporting documents, and its references.

- Industrial accident risk is the product of total exposure to industrial accidents (number of 100 worker year increments) over the life cycle of an alternative and the rate of fatalities due to industrial accidents (fatalities per 100 worker years).

- Occupational risk is the product of total life cycle exposure to performance of work in a radiation environment (worker years), the average annual dose to workers (rem/worker year), and the rate of latent cancer fatalities to workers (0.0004 fatalities per mrem of exposure).

- Facility accident risk to involved workers is evaluated as the sum of contributions of bounding accidents identified for that alternative. Over the life cycle of an alternative, each contribution is the product of the total probability of accident occurrence (anticipated events during the life cycle), the dose to a population of workers as a result of the accident (mrem), and the rate of latent cancer fatalities. Consequences for involved workers are estimated for bounding accidents with the highest potential consequences to noninvolved workers and the public in the three frequency categories (ABN, DBE, and BDB). Doses to involved workers from an accidental release (of radioactivity) are assumed to be equivalent to doses to persons at 100 meters from the release [for consistency with the definition of facility worker utilized in the SNF & INEL EIS (DOE 1995)] and proportional to doses to noninvolved workers at 640 meters. An evaluation of nuclide contributors to dose at 100 meters was performed for bounding accident scenarios in the EIS. This evaluation identified five nuclides as

Figure C.4-6. Methodology for integrated worker risk evaluation responsible for nearly all the dose to workers at 100 meters. The evaluation also indicated that on average, the dose at 100 meters was a factor of approximately 9 greater than that at 640 meters. Due to limitations on the accuracy of the consequence code at locations near the origin of a release, the factor of 9 was applied to noninvolved worker doses identified for the bounding accidents.

Two types of evaluations integrated involved worker risk evaluations were performed.

- Point estimates were developed by incorporating data from the EIS, its supporting documents, and references into the equations described in Figure C.4-6. These point estimates provide a baseline for comparing waste processing alternatives using integrated involved worker risk, a baseline that is consistent with other alternative comparisons made in the EIS.

- Due to the relatively large uncertainties involved in estimating involved worker risk, the accident analysis methodology for involved worker risk includes the use of Monte Carlo simulation as means of gaining perspective on the importance of sensitivities and uncertainties in the information base. Probabilistic estimates of involved worker risk were developed using the relationships given in Figure C.4-6, information from the EIS, supporting documents, references, and additional information sources to establish bounds on distributed parameters.

Table C.4-8 describes examples of distributions used to perform a probabilistic simulation of integrated involved worker risk over the life cycle of each waste processing alternative.

- Distributions for total exposure were assumed to be triangular, with the point estimate considered the likeliest value. A factor of 2, applied to project a maximum distribution values for life cycle exposure, was determined using published evaluations of cost and schedule overruns for DOE and other Federally funded projects. As one example, a report on the causes of cost growth for DOE and other Federally funded projects suggest that a factor of 50 percent to 300 percent could be used to predict the life cycle cost of a new project (Merrow et al. 1981).

- A distribution for industrial accident fatality rate was assumed to be lognormal, with the point estimate as the geometric mean of the distribution. Although the true shape of the fatality rate distribution is unknown, use of a lognormal is consistent with probabilistic risk assessment treatment of mechanical and electrical system failures that are infrequent but catastrophic in nature. A 95 percent bound was projected using a Bayesian update in an analysis of industrial accident fatality data for the INEEL for the years 1992 through 1998 (Fong 1999).

Table C.4-8. Example parameters for probabilistic simulation of integrated involved worker risk.

Contributor	Distribution type	Distribution parameters	References
Life cycle exposure to industrial accidents	Triangular	Minimum = 2223 wk-yr Likeliest = 5267 wk-yr Maximum = 5336 wk-yr	Appendix C.3 (Merrow et al. 1981)
Rate of fatal industrial accidents	Lognormal	Geo mean = 0.011 fatalities/ 100 wk-yr 95% bound = 0.0141 fatalities/ 100 wk-yr	Millet (1998); Fong (1999)
Life cycle occupational exposure to radiation	Triangular	Minimum = 2223 wk-yr Likeliest = 5267 wk-yr Maximum = 5336 wk-yr	Appendix C.3 (Merrow et al. 1981)
Occupational dose rate to workers	Lognormal	10% bound = 0.18 rem/wk-yr 90% bound = 0.24 rem/wk-yr	Appendix C.3
Risk to workers from facility accidents	Lognormal	Geo mean = 1.94 fatalities 95% bound = 19.4 fatalities	TRD Appendices C & 1

- A distribution for facility accident risk was assumed to also be lognormal, with the point estimate as the geometric mean of the distribution. A 95 percent bound was projected using experience from probabilistic risk assessments of commercial nuclear power facilities.

C.4.1.3 Accidents with Potential Release of Radioactive Materials

C.4.1.3.1 Screening for Radioactive Material Accidents

This section discusses the results of the first level of screening evaluations used to select process elements for analysis in the TRD. Results of the preliminary prioritization of process elements based on potential hazards and safety vulnerabilities is summarized in Table C.4-9 with supporting information given in Table C.4-10. In Table C.4-9, process elements are ranked as:

I. Inventory at risk and frequency of accidental release are likely to produce bounding accident for treatment alternative.

II. Inventory at risk and frequency of accidental release could credibly produce a bounding accident scenario.

III. Process element does not contain sufficient inventory or driving release energy to result in bounding scenario.

Process elements prioritized as I- or II-level vulnerabilities in the initial screening receive a detailed accident analysis. In Table C.4-9, those process elements that would result in level II vulnerabilities are shaded. Table C.4-10 provides a cross-reference between the screening review and the accident analysis performed in Appendix A of the TRD. In particular, Table C.4-10 identifies the minimum set of accident analysis (22) required to comprehensively evaluate the process elements in Table C.4-9 that would result in level I or II vulnerabilities. Using the screening and cross-referencing process to define accident analyses requirements assures that all major vulnerabilities associated with the waste processing alternatives are considered in the selection process.

Not all process elements require a separate accident analysis. Table C.4-10 identifies a minimum set of accident analyses necessary to fully assess the accident potential for all ranks I and II process elements. There are a total of 22 required accident evaluations that are indicated in Table C.4-10. However, two of these evaluations (13 and 19) were subsequently not used.

C.4.1.3.2 Potentially Bounding Abnormal Event Accidents

Twenty-four potentially bounding events accidents were evaluated and discussed in Section 3.2.1 of the TRD. These 24 abnormal events are summarized in Table C.4-11. Detailed frequency range characterization and source terms for each potentially bounding abnormal event accident can be found in the TRD.

C.4.1.3.3 Potentially Bounding Design Basis Event Accidents

Twenty-four potentially bounding design basis event accidents were evaluated and discussed in Section 3.2.2 of the TRD. These 24 design basis events are summarized in Table C.4-12. Detailed frequency range characterization and source terms for each potentially bounding design basis event accident can be found in the TRD.

C.4.1.3.4 Potentially Bounding Beyond Design Basis Event Accidents

Twenty-four potentially bounding beyond design basis event accidents were evaluated and discussed in Section 3.2.3 of the TRD. These 24 beyond design basis events are summarized in Table C.4-13. Detailed frequency range characterization and source terms for each potentially bounding beyond design basis event accident can be found in the TRD.

C.4.1.4 Accidents with Potential Release of Toxic Chemicals

C.4.1.4.1 Screening for Accidents Involving Hazardous Chemicals

A significant number of chemical compounds are stored at and used at INTEC facilities. Such chemical compounds could be released during accidents that would result in human health risk or environmental consequences. Therefore, a comprehensive evaluation of facility accidents for waste processing alternatives requires identification of potentially bounding accidents involving release of chemical hazardous materials.

Hazardous chemical releases may directly result in offsite injuries, illnesses, or fatalities. Direct impact from a release of a toxic gas such as ammonia in sufficient quantity to form a vapor cloud could endanger involved workers at the facility, noninvolved workers on the site, and members of the general public traveling on or near the site boundaries. Alternatively, such releases may initiate a sequence of indirect events that result in a release of radioactive materials. An indirect impact, such as an undetected release of a toxic chemical such as chlorine, could find its way into a building ventilation system and could incapacitate facility operators in the facility and prevent the shutdown process for equipment containing radioactive materials. Without operator control, the process equipment malfunctions could result in an accidental release of radioactive material. Two potentially bounding accident scenarios from the detailed accident evaluation process produced chemical (kerosene) releases to the groundwater. In theory, groundwater releases of chemicals can be mitigated, with little ultimate impact on the public. However, both of these accident scenarios are described below.

The purpose of the screening evaluation is to identify conditions associated with implementation of the waste processing alternatives, such as the presence of significant hazardous material inventories in or near facilities or use of several incompatible materials in proximity to each other, that could be initiators of accident scenarios.

Systematic review of process elements of Table C.4-9 and accident analysis of Table C.4-10 was performed to identify conditions where hazardous chemical inventories were required, processes could result in the formation of hazardous chemicals, or equipment accidents could result in conditions where hazardous chemicals could be produced and released.

This review of process elements yielded the following observations:

- To meet expected maximum achievable control technology upgrade requirements, the presently designed offgas treatment system utilizes a significant quantity of kerosene to achieve elevated temperatures and more complete combustion of offgas constituents.

- Several HLW treatment processes such as separations require additional offgas treatment capabilities not currently performed at INEEL. Current feasibility studies for several waste processing alternatives identify a need for additional offgas treatment to meet EPA environmental requirements during separation, vitrification and other functions associated with alternative implementation. These same feasibility studies have identified an ammonia-based treatment process as being most likely to meet the technical requirements of the HLW alternatives. Thus ammonia has been identified as a chemical substance posing a potentially significant hazard to workers and the public during HLW alternative implementation. Recent design studies have identified alternative processes for meeting environmental compliance requirements. However, at this time the ammonia-based process is still considered a potential source of bounding accidents.

- Some batch processes, such as cesium separation, require the use of potentially incompatible chemicals to clean and revitalize equipment.

- Fires in some process equipment could result in the evolution and release of hazardous materials.

Using this screening approach, accident evaluations 2, 4, 6, and 15 for “abnormal events” were identified as having potential hazardous chemical release scenarios. Accident evaluations 2 and 15 for “design basis events” were identified for potential hazardous chemical release, and accident evaluations 2 and 15 for “beyond design basis” were also identified for potential hazardous chemical release. The screening approach employed here is considered sufficient to identify accidents resulting from chemical releases in the process. The following Sections C.4.1.4.2 to C.4.1.4.4 describe these accident evaluations that have potential for hazardous chemical release.

C.4.1.4.2 Potentially Bounding Abnormal Events Accidents Involving Release of Toxic Chemical

Four potentially bounding abnormal event accidents involving release of toxic chemical were evaluated and discussed in Section 4.2.1 of the TRD. These four abnormal events are summarized in Table C.4-14.

C.4.1.4.3 Potentially Bounding Design Basis Accidents Involving Release of Toxic Chemicals

Two potentially bounding design basis event accidents involving release of toxic chemical were evaluated and discussed in Section 4.2.2 of the TRD. These two design basis events are summarized in Table C.4-15.

C.4.1.4.4 Potentially Bounding Beyond Design Basis Accidents Involving Release of Toxic Chemicals

Two potentially bounding beyond design basis event accidents involving release of toxic chemical were evaluated and discussed in Section 4.2.3 of the TRD. These two beyond design basis events are summarized in Table C.4-16.

C.4.1.5 Facility Accident Consequences Assessment

Consequences Assessment

Radiological source terms were used as input into the computer program Radiological Safety Analysis Computer Program (RSAC-5) to estimate human health consequences for radioactive releases (King 1999a). DOE used this program to determine the radiation doses at receptor locations from the airborne release and transport of radionuclides from each accident sequence. Meteorological data used in the program was selected to be consistent with previous INEEL EIS analyses (i.e., SNF and INEL EIS) and are for 95 percent meteorological conditions. The 95 percent meteorological condition represents the meteorological conditions that could produce the highest calculated exposures. This is defined as that condition which is not exceeded more than 5 percent of the time or is the worst combination of weather stability class and wind speed.

The population radiation doses from the computer output were then converted into expected latent cancer fatalities using dose-to-risk conversion factors recommended by the National Council on Radiation Protection and Measurements. No data indicate that small radiation doses cause cancer; to be conservative, however, the National Council on Radiation Protection and Measurements assumes that any amount of radiation carries some risk of inducing cancer. DOE has adopted the National Council on Radiation Protection and Measurements factor of 5×10^{-4} latent cancer fatalities for each person-rem of radiation dose to the general public for doses less than 20 rem. For larger doses, when the rate of exposure would be greater than 10 rads (radiation absorbed dose) per hour, the increased likelihood of

latent cancer fatality is doubled, assuming the body's diminished capability to repair radiation damage. DOE calculated the expected increase in the number of latent cancer fatalities above those expected for the population.

The consequences from accidental chemical releases were calculated using the computer program Areal Locations of Hazardous Atmospheres (ALOHA). Because chemical consequences are based on concentration rather than dose, the computer program calculated air concentrations at a selected receptor location. Meteorological assumptions used for chemical releases were the same as used for radiological releases.

The HLW & FD EIS accident analysis consequence modeling was performed for three receptors:

- Maximally-exposed individual
- Noninvolved worker
- Offsite population (population dose)

For each of these evaluations, conservative assumptions were applied to obtain bounding results. For the most part, the assumptions in the HLW & FD EIS were consistent with those applied in other EIS documents prepared at the INEEL, such as the SNF & INEL EIS (DOE 1995). However, there were some assumptions that differed.

The approach that was taken in the HLW & FD EIS consequence modeling was to ensure that a "safety envelope" was provided. This approach differs from the approach taken in other EISs, such as the SNF & INEL EIS where certain mitigation actions were credited up front and other probabilistic arguments were applied to reduce the predicted consequences. Due to this, the results presented in the HLW & FD EIS are larger than the results that would have been obtained by applying the SNF & INEL EIS assumptions (DOE 1995). However, the key issue at hand is that the Idaho HLW & FD EIS is providing a likely upper bound to the potential consequences for the accidents associated with the candidate alternatives. In addition, these conservative assumptions were incorporated in a consistent manner. Although adjustments to these assumptions will modify the absolute magnitudes of the predicted consequences, they will not modify the relative ranking. So the set of bounding scenarios are anticipated to remain the same.

DOE decided not to evaluate impacts from some initiators (i.e., volcanoes) because they determined that these initiators would not provide new opportunities to identify bounding accidents. Based on evaluations in the TRD, volcanic activity impacting the INTEC was considered a beyond design basis event. This would place the event with initiators such as aircraft crashes and beyond design basis earthquakes. However, based on the phenomena associated with these initiators, volcanic activity-initiated events are considered bounded by other initiators. This is because the lava flow from the eruption (basaltic volcanism) would likely cover the affected structures. Therefore, the amount that is released from process vessels and piping due to lava flow would be limited and would be bounded by events such as aircraft crashes, where the entire inventory would be impacted and available for release. See Section C.4.1.2.4 of this Appendix for more detail on volcanism.

Accidents that resulted in a release only to groundwater were not generally evaluated since the time between their occurrence and their impact on the public was assumed to be long enough to take comprehensive mitigation measures. The one exception, DOE did identify bounding groundwater release accidents for which effective mitigation might not be feasible.

C.4.1.5.1 Radiological Impacts of Implementing the Alternatives

This section analyzes the impacts or consequences of implementing the HLW processing alternatives and their options. It describes (1) the major processes of each alternative, (2) the bounding accident scenarios applicable to the major processes, and (3) the resulting impact to INEEL workers and the general public. The systematic accident analysis process employed by DOE identified potentially bounding accidents for each alternative/option. The results for radiological releases are expressed in terms of the estimated impacts for the maximally-exposed individual, noninvolved worker, offsite population, and the latent cancer fatalities for the offsite population. After evaluating the human health consequences associated with these potentially bounding accidents, DOE selected three bounding accidents (one abnormal, one design basis, and one beyond design basis) for each of the processes with the particular alternative/option. Consequences for each of the potentially bounding accident scenarios are given in the tabular summaries associated with each alternative and each frequency category in the TRD.

In general, the process used in selecting the bounding accident scenario was to select the scenario with the highest consequence within each frequency bin. In some cases, one scenario had the highest consequence for the maximally-exposed individual and noninvolved worker but another scenario had higher consequences for the offsite population and latent cancer fatalities. In these cases, the scenario with the higher consequences for the offsite population/latent cancer fatalities was selected. Although this is the rule of thumb, there were several exceptions to this.

1. Abnormal and Design Basis Events for the "Active" Alternatives – Operational failures associated with the removal of calcine from bin set 1 and flood-induced failure of bin set #1 are bounding abnormal and design basis events respectively that affect all waste processing alternatives/options. In order to compare waste processing alternatives, these two accidents have been shown separately in Table C.4-17 as accidents that cross cut treatment alternatives. In order to provide additional resolution in determining the highest risk alternatives, the scenario with the second highest consequence is also highlighted as a "bounding" scenario.

2. Highest Risk vs. Highest Consequence Scenario – Risk is defined as the product of frequency and consequence. In some cases, the scenario with the perceived higher risk was selected even though another scenario had higher consequences. The frequency bands considered in the analysis were fairly wide. For instance, the design basis frequency band is from 1.0×10^{-3} per year to 1.0×10^{-6} per year. From a risk standpoint, a scenario that is a 1,000 times more likely (e.g., 1.0×10^{-3} per year vs. 1.0×10^{-6}, per year), has a higher risk than another scenario that has a consequence that is 100 times greater. Therefore, the approach taken was to select the higher frequency/lower consequence scenario as the bounding scenario. These are identified on a case by case basis and identified in the relevant sections following.

3. Reconsideration of Conservatism in Model – In some scenarios, assumptions used in the development of source terms for the accident scenarios were determined to be highly conservative under different operating conditions. For instance, the beyond design basis accident for AA14 was assumed to be the same as for AA4. This is true for most alternatives except for the Continued Current Operations Alternative due to the differences in process requirements. These are noted on a case-by-case basis and identified in the relevant sections following.

Summary tables in the TRD describe potentially bounding accidents and their forecasted consequences. The TRD also provides additional information with respect to the process used to identify potentially bounding accidents, their source terms, and consequences. Table C.4-17 provides a summary of bounding radiological events for the various waste processing alternatives. It should be noted that it is a misconception that a DBE should have a smaller consequence than a BDB event. Table C.4-17 shows

that the No Action Option, Continued Current Operations Option, and the Hot Isostatic Pressed Waste Option all have higher DBE consequences than their DBD consequences. This phenomena is not common but it is not wrong.

The following paragraphs describe the accident consequences associated with each of the waste processing alternatives.

No Action Alternative

Alternative/Process Data – Three major processes or functions apply to and form the basis of this accident analysis for the No Action Alternative. These three processes are listed below and described in more detail in the TRD.

1. Calcine Retrieval and Onsite Transport (bin set 1 only) (AA03).
2. Long-Term Onsite Storage of Calcine in Bin Sets (AA20).
3. Long-Term Onsite Storage of SBW (AA22).

Accident Consequence – The systematic accident analysis process employed by DOE identified potentially bounding accidents for the No Action Alternative associated with the three functional activities described above. After evaluating the human health consequences associated with these potentially bounding accidents, DOE selected three bounding accidents (one abnormal, one design basis, and one beyond design basis) for each of the three processes. Summary tables in the TRD describe potentially bounding accidents and their forecasted consequences. The TRD also provides additional information with respect to the process used to identify potentially bounding accidents, their source terms, and consequences. Table C.4-17 provides a summary of the bounding radiological events for the No Action Alternative. This summary table (C.4-17) shows that degradation of the bin sets over time (after 2095, ABN20), seismic failure of a bin set (after 2095, DBE20), and an aircraft crash into a bin set (BDB20) result in the bounding abnormal, design basis, and beyond design basis accidents, respectively, for this alternative.

Continued Current Operations Alternative

Alternative/Process Data – Eight major processes or functions apply to and form the basis of this accident analysis for the Continued Current Operations Alternative. These eight processes are listed below and described in more detail in the TRD.

1. New Waste Calcining Facility Continued Operation (AA01).

2. New Waste Calcining Facility High Temperature and Maximum Achievable Control Technology Modifications (Off-Gas Treatment Facility Only)(AA02).
3. Calcine Retrieval and On-Site Transport (Bin Set 1 Only) (AA03).
4. Cesium Separation (Cesium Ion Exchange Only) (AA06).
5. Liquid Waste Stream Evaporation (AA14).
6. Long Term Onsite Storage of Calcine in Bin Sets (AA20).
7. Transuranic Stabilization and Preparation for Transport to Waste Isolation Pilot Plant (Transuranic or Transuranic and Strontium Feedstocks) (AA21).
8. SBW Retrieval and Onsite Transport (AA24).

Accident Consequence – The systematic accident analysis process employed by DOE identified potentially bounding accidents for the Continued Current Operations Alternative associated with the eight functional activities described above. After evaluating the human health consequences associated with these potentially bounding accidents, DOE selected three bounding accidents (one abnormal, one design basis, and one beyond design basis) for each of the eight processes. Summary tables in the TRD describe potentially bounding accidents and their forecasted consequences. The TRD also provides additional information with respect to the process used to identify potentially bounding accidents, their source terms, and consequences. Table C.4-17 provides a summary of the bounding radiological events for the Continued Current Operations Alternative. This summary table (C.4-17) shows that degradation of the bin sets over time (after 2095, ABN20), seismic failure of a bin set (after 2095, DBE20), and an aircraft crash into a bin set (BDB20) result in the bounding abnormal, design basis, and beyond design basis accidents, respectively, for this alternative.

Separations Alternative – Full Separations Option

Alternative/Process Data – Six major processes or functions apply to and form the basis of the accident analysis for the Full Separations Option. These six processes are listed below and described in more detail in the TRD.

1. Calcine Retrieval and Onsite Transport (AA03).
2. Full Separation (Cesium Ion Exchange, Transuranic Extraction, and Strontium Extraction (AA04).
3. Borosilicate Vitrification (Cesium, Transuranic, and Strontium Feedstocks) (AA08).
4. Liquid Waste Stream Evaporation (AA14).

5. Additional Off-Gas Treatment (AA15).

6. SBW Retrieval and Onsite Transport (AA24).

Accident Consequence – The systematic accident analysis process employed by DOE identified potentially bounding accidents for the Full Separations Option associated with the six functional activities described above. After evaluating the human health consequences associated with these potentially bounding accidents, DOE selected three bounding accidents (one abnormal, one design basis, and one beyond design basis) for each of the six processes. Summary tables in the TRD describe potentially bounding accidents and their forecasted consequences. The TRD also provides additional information with respect to the process used to identify potentially bounding accidents, their source terms, and consequences. Table C.4-17 provides a summary of the bounding radiological events for the Full Separations HLW Treatment Option. This summary table (C.4-17) shows that a failure during SBW retrieval (ABN24), an operational failure during the full separations processes (DBE04), and an aircraft crash into the Borosilicate Vitrification Facility (BDB08) result in the bounding abnormal, design basis, and beyond design basis events, respectively, for this alternative.

Separations Alternative – Planning Basis Option

Alternative/Process Data – Nine major processes or functions apply to and form the basis of the accident analysis for the Planning Basis Option. These nine processes are listed below and described in more detail in the TRD.

1. New Waste Calcining Facility Continued Operation (AA01).

2. New Waste Calcining Facility High Temperature and Maximum Achievable Control Technology Modifications (AA02).

3. Calcine Retrieval and Onsite Transport (AA03).

4. Full Separation (Cesium Ion Exchange, Transuranic Extraction, and Strontium Extraction) (AA04).

5. Borosilicate Vitrification (Cesium, Transuranic, and Strontium Feedstocks) (AA08).

6. Liquid Waste Stream Evaporation (AA14).

7. Additional Off-Gas Treatment (AA15).

8. Transuranic Stabilization and Preparation for Transport to the Waste Isolation Pilot Plant (Transuranic or Transuranic and Strontium Feedstocks) (AA21).

9. SBW Retrieval and Onsite Transport (AA24).

Accident Consequence – The systematic accident analysis process employed by DOE identified potentially bounding accidents for the Planning Basis Option associated with the nine functional activities described above. After evaluating the human health consequences associated with these potentially bounding accidents, DOE selected three bounding accidents (one abnormal, one design basis, and one beyond design basis) for each of the six processes. Summary tables in the TRD describe potentially bounding accidents and their forecasted consequences. The TRD also provides additional information with respect to the process used to identify potentially bounding accidents, their source terms, and consequences. Table C.4-17 provides a summary of the bounding radiological events for the Planning Basis Option. This summary table (C.4-17) shows that an operational failure during SBW retrieval (ABN24), a failure during continued operation of the calcining facility (DBE01), and an aircraft crash into the Borosilicate Vitrification Facility (BDB08) result in the bounding abnormal, design basis, and beyond design basis accidents respectively, for this alternative.

Separations Alternative – Transuranic Separations Option

Alternative/Process Data – Eight major processes or functions apply to and form the basis of this accident analysis for the Transuranic Separations Option. These eight processes are listed below and described in more detail in the TRD.

1. Calcine Retrieval and Onsite Transport (AA03).
2. Transuranic Separation (Transuranic Extraction Only) (AA05).
3. Class C Grout (AA07).
4. Liquid Waste Stream Evaporation (AA14).
5. Additional Off-Gas Treatment (AA15).
6. Class C Grout Disposal (AA16).
7. Transuranic Stabilization and Preparation for Transport to the Waste Isolation Pilot Plant (Transuranic or Transuranic and Strontium Feedstocks) (AA21).
8. SBW Retrieval and Onsite Transport (AA24).

Accident Consequence – The systematic accident analysis process employed by DOE identified potentially bounding accidents for the Transuranic Separations Option associated with the eight functional activities described above. After evaluating the human health consequences associated with these potentially bounding accidents, DOE selected three bounding accidents (one abnormal, one design basis, and one beyond design basis) for each of the eight processes. Summary tables in the TRD describe potentially bounding accidents and their forecasted consequences. The TRD also provides additional information with respect to the process used to identify potentially bounding accidents, their source terms, and consequences. Table C.4-17 provides a summary of the bounding radiological events for the Transuranic Separations Option. This summary table (C.4-17) shows that an operational failure during Class C Grout Disposal (ABN11), an operational failure during the transuranic separations process (DBE05), and an aircraft crash into the transuranic separations facility (BDB05) result in the bounding abnormal, design basis, and beyond design basis accidents, respectively, for this alternative.

Non-Separations Alternative – Hot Isostatic Pressed Waste Option

Alternative/Process Data – Eight major processes or functions apply to and form the basis of this accident analysis for the Hot Isostatic Pressed Waste Option. These eight processes are listed below and described in more detail in the TRD.

1. New Waste Calcining Facility Continued Operations (AA01).
2. New Waste Calcining Facility High-Temperature and Maximum Achievable Control Technology Modifications (Off-Gas Treatment Facility Only) (AA02).
3. Calcine Retrieval and Onsite Transport (AA03).
4. High-Level Waste/SBW Immobilization for Transport (Hot Isostatic Press) (AA11).
5. Liquid Waste Stream Evaporation (AA14).
6. Additional Off-Gas Treatment (AA15).
7. Transuranic Stabilization and Preparation for Transport to the Waste Isolation Pilot Plant (Transuranic or Transuranic and Strontium Feed stocks) (AA21).
8. SBW Retrieval and Onsite Transport (AA24).

Accident Consequence – The systematic accident analysis process employed by DOE identified potentially bounding accidents for the Hot Isostatic Pressed Waste Option associated with the eight functional activities described above. After evaluating the human health consequences associated with these potentially bounding accidents, DOE selected three bounding accidents (one-abnormal, one-design basis, and one-beyond design basis) for each of the eight processes. Summary tables in the TRD describe potentially bounding accidents and their forecasted consequences. The TRD also provides for additional information with respect to the process used to identify potentially bounding accidents, their source terms, and consequences. Table C.4-17 provides a summary of the bounding radiological events for the Hot Isostatic Pressed Waste Option. This summary table (C.4-17) shows that an operational failure during SBW retrieval (ABN24), a failure during continued operation of the calcining facility (DBE01), and an aircraft crash into the liquid waste evaporation process (BDB14) result in the bounding abnormal, design basis, and beyond design basis accidents, respectively, for this alternative.

Non-Separations Alternative – Direct Cement Waste Option

Alternative/Process Data – The Direct Cement Waste Option has eight major processes or functions that have applicability to this accident analysis. These eight processes are listed below and described in more detail in the TRD.

1. New Waste Calcining Facility Continued Operation (AA01).
2. New Waste Calcining Facility with High-Temperature and Maximum Achievable Control Technology Modifications (Off-Gas Treatment Facility Only) (AA02).
3. Calcine Retrieval and Onsite Transport (AA03).
4. Direct Cement Waste Immobilization for Transport (AA12).
5. Liquid Waste Stream Evaporation (AA14).
6. Additional Off-Gas Treatment (AA15).
7. Transuranic Stabilization and Preparation for Transport to the Waste Isolation Pilot Plant (Transuranic or Transuranic and Strontium Feedstocks) (AA21).
8. SBW Retrieval and Onsite Transport (AA24).

Accident Consequence – The systematic accident analysis process employed by DOE identified potentially bounding accidents for the Direct Cement Waste Option associated with the eight functional activities described above. After evaluating the human health consequences associated with these potentially bounding accidents, DOE selected three bounding accidents (one abnormal, one design basis, and one beyond design basis) for each of the eight processes. Summary tables in the TRD describe potentially bounding accidents and their forecasted consequences. The TRD also provides additional information with respect to the process used to identify potentially bounding accidents, their source terms, and consequences. Table C.4-17 provides a summary of the bounding radiological events for the Direct Cement Waste Option. This summary table (C.4-17) shows that an operational failure during SBW retrieval (ABN24), a failure during continued operation of the calcining facility (DBE01), and an aircraft crash into the direct cement process facility (BDB12) result in the bounding abnormal, design basis, and beyond design basis accidents, respectively, for this alternative.

Non-Separations Alternative - Early Vitrification Option

Alternative/Process Data - The Early Vitrification Option has five major processes or functions that have applicability to this accident analysis. These five processes are listed below and described in more detail in the TRD.

1. Calcine Retrieval and Onsite Transport (AA03). See the description of this process under the No Action Alternative.
2. Borosilicate Vitrification (Calcine and SBW Feedstocks) (AA09).
3. Additional Off-Gas Treatment (AA15).
4. SBW Stabilization and Preparation for Transport to Waste Isolation Pilot Plant (AA23).
5. SBW Retrieval and Onsite Transport (AA24).

Accident Consequence - The systematic accident analysis process employed by DOE identified potentially bounding accidents for the Early Vitrification Option associated with the five functional activities described above. After evaluating the human health consequences associated with these potentially bounding accidents, DOE selected three bounding accidents (one abnormal, one design basis, and one beyond design basis) for each of the five processes. Summary tables in the TRD describe potentially bounding accidents and their forecasted consequences. The TRD also provides additional information with respect to the process used to identify potentially bounding accidents, and their source terms, and consequences. Table C.4-17 provides a summary of the bounding radiological events for the Early Vitrification Option. This summary table (C.4-17) shows that an operational failure during SBW retrieval (ABN24), an operational failure during operation of the Borosilicate Vitrification Facility (DBE09), and an aircraft crash into the Borosilicate Vitrification Facility (BDB09), result in the bounding abnormal, design basis, and beyond design basis accidents, respectively, for this alternative.

Minimum INEEL Processing Alternative

Alternative/Process Data - The Minimum INEEL Processing Alternative has nine major processes or functions that have applicability to this accident analysis. These nine processes are listed below and described in more detail in the TRD.

1. Calcine Retrieval and On-Site Transport (AA03).
2. Cesium Separation (Cesium Ion Exchange Only) (AA06).
3. Class C Grout Process (AA07).
4. HLW/SBW Immobilization for Transport (Calcine and Cesium Ion Exchange Resin Feedstocks) (AA10).
5. Additional Off-Gas Treatment (AA15).
6. High-Level Waste Interim Storage for Transport (AA17).
7. High-Level Waste/High-Activity Waste Stabilization and Preparation for Transport (Calcine and Cesium Resin Feedstocks) (AA18).
8. Contact-Handled Transuranic Stabilization and Preparation for Transport to Waste Isolation Pilot Plant (Transuranic or Transuranic and Strontium Feedstocks) (AA21).
9. SBW Retrieval and Onsite Transport (AA24).

Accident Consequence - The systematic accident analysis process employed by DOE identified potentially bounding accidents for the Minimum INEEL Processing Alternative associated with the nine functional activities described above. After evaluating the human health consequences associated with these potentially bounding accidents, DOE selected three bounding accidents (one abnormal, one design basis, and one beyond design basis) for each of the nine processes. Summary tables in the TRD describe potentially bounding accidents and their forecasted consequences. The TRD also provides additional information with respect to the process used to identify potentially bounding accidents, their source terms, and consequences. Table C.4-17 provides a summary of the bounding radiological events for the Minimum INEEL Processing Alternative. This summary table (C.4-17) shows that an operational failure during high level waste interim storage (ABN17), an inadvertent criticality during transuranic stabilization and packaging (DBE21), and an aircraft crash into casks awaiting transport to the Hanford Site (BDB17) result in the bounding abnormal, design basis, and beyond design basis accidents, respectively, for this alternative.

C.4.1.5.2 Impacts of Chemical Release Accidents to Implement the Alternatives

This section analyzes the impacts or consequences of chemical releases from accidents that could occur as a result of implementing the HLW processing alternatives and their options. It identifies (1) the major processes that contribute chemicals to the atmosphere during an accident and (2) the impacts to INEEL workers and the general public in terms of Emergency Response Planning Guideline values at 3,600 meters.

Alternative/Process Data – Two major processes or functions can produce chemical releases from accidents resulting during implementation of waste processing alternatives.

1. New Waste Calcining Facility High Temperature and Maximum Achievable Control Technology Modifications (AA02).

2. Additional Off-Gas Treatment (AA15).

Accident Consequence – Summary Tables C.4-18 through C.4-20 present the chemical accidents and the impacts of these accidents.

C.4.1.5.3 Groundwater Impacts of Implementing the Alternatives

The bounding accident scenarios described in the preceding sections produce human health consequences mainly as a result of inhalation of air releases. In the National Environmental Policy Act accident analysis, it is generally assumed that the inhalation pathway is the predominant source of human health consequences since an air release does not provide an opportunity for intervention and mitigation.

Several potentially bounding accident scenarios from the detailed accident evaluation process produced mainly groundwater releases. In theory, all groundwater releases can be mitigated with little ultimate impact on the public. However, since significant groundwater releases would produce a substantive risk to the environment and the opportunity to mitigate may be limited by time and resource constraints, the impact of accident scenarios resulting in groundwater releases is considered in the facility accidents evaluation.

Table C.4-18. Abnormal events that produce chemical impacts.

AA	Process title	Abnormal event	Contaminant	Peak atmospheric concentration (ERPG)
15	**Additional Off-Gas Treatment**	**Failure of ammonia tank connections results in a spill of 150 pounds per minute of liquid ammonia. A fraction of the ammonia would flash to vapor as it escapes the tank. The remainder would settle and form a boiling pool.**	**Ammonia**	**Less than ERPG-2 at 3,600 meters**

ERPG = Emergency Response Planning Guidance.

Table C.4-19. Design basis events that produce chemical impacts.

AA	Process title	Design basis events	Contaminant	Peak atmospheric concentration (ERPG)
02	New Waste Calcining Facility High Temperature & Maximum Achievable Control Technology Modifications	A carbon filter bed fire. Inadequate nitrous oxide destruction in the reduction chamber of the multi-stage combustion system leads to exothermic reactions in the filter bed. The heat buildup could result in a carbon bed fire and a release of radioactive material (iodine-129) and mercury embedded in the filter bed and corresponding HEPA filter fire.[a]	Mercury	Greater than ERGP-2[b] at 3,600 meters.
15	**Additional Off-Gas Treatment**	**Failure of ammonia tank connections results in a spill of 1,500 pounds per minute of liquid ammonia. A fraction of the ammonia would flash to vapor as it escapes the tank. The remainder would settle and form a boiling pool.**	**Ammonia**	**Greater than ERPG-2 at 3600 meters**

ERPG = Emergency Response Planning Guideline.

a. This accident also results in a chemical release to the atmosphere. This accident has been evaluated as a potential atmospheric release in Section C.4.5.2 to assess its potential as an additional source of human health and environmental risk.

b. There is no standard ERPG value for mercury vapor. However, there is a standard method to calculate an ERPG using the Threshold Limit Value – Time Weighted Average (TLV-TWA). In this case the equivalent ERPG-2 value is [(3) (TLV-TWA)] = 0.1 ppm.

Table C.4-20. Beyond design basis events that produce chemical impacts.

AA	Process title	Beyond design basis	Contaminant	Peak atmospheric concentration (ERPG)
15	**Additional Off-Gas Treatment**	**Failure of ammonia tank connections results in a spill of 15,000 pounds per minute of liquid ammonia. A fraction of the ammonia would flash to vapor as it escapes the tank. The remainder would settle and form a boiling pool.**	**Ammonia**	**Greater than ERPG-2 at 3,600 meters**

ERPG = Emergency Response Planning Guideline.

Environmental risk is usually presented in the Remedial Investigation/Feasibility Study process in terms of expected contamination at the site boundary as a function of time. Therefore, the metrics of environmental risk such as Maximum Contaminant Level can be used to estimate the potential for future adverse human health impacts. Specifically, expected contamination due to a postulated release can be compared with Maximum Contaminant Level values to assess the severity of environmental risk associated with a release. In this way, accident scenarios resulting in a release to groundwater can be appraised for their potential contribution to environmental risk and the overall economic impact of the accident.

Alternative/Process Data – Two major processes or functions can produce groundwater releases from accidents resulting during implementation of waste processing alternatives.

1. New Waste Calcining Facility High Temperature and Maximum Achievable Control Technology Modifications (AA02).

2. Long-Term Onsite Storage of SBW (AA22).

Accident Consequence – For the purposes of the Idaho HLW & FD EIS, the complex subsurface transport calculations used to negotiate performance requirements for the INEEL Environmental Management Program are not needed. Potential impacts that could result from previous spills have already been evaluated at the Waste Area Group using subsurface modeling at INTEC as well as a simple screening model approach. The following paragraphs discuss the simplified screening method used to estimate the impacts from major groundwater release accidents identified in this Idaho HLW & FD EIS accident analysis. More detail on the methods used are presented in King (1999b). Abnormal and beyond design basis events for AA02, a leak of kerosene to the environment due to equipment failures, result in the release of 15,000 gallons and 30,000 gallons, respectively, of kerosene to the surface soil and subsequent infiltration through the vadose zone to groundwater, the primary concern is the migration of the toxic constituents of the kerosene. A primary toxic constituent of kerosene is benzene, which has an EPA Maximum Contaminant Level of 5 micrograms/liter. The expected peak groundwater concentration of benzene for the 15,000-gallon spill is approximately 120 micrograms/liter at the edge of the spill when assuming infiltration from normal precipitation. The expected peak groundwater concentration of benzene for the 30,000-gallon spill is approximately 180 micrograms/liter at the edge of the spill when assuming infiltration from normal precipitation. The groundwater impact from such spills is that the Maximum Contaminant Level for benzene would be exceeded by a factor of 24 for the 15,000-gallon spill and a factor of 36 for the 30,000-gallon spill. Both accidents assume that the kerosene would form a pool about 3 inches deep before seeping into the subsurface. The benzene component of the kerosene may require about 200 years to reach the groundwater under normal precipitation conditions.

The simplified modeling approach used to evaluate groundwater impacts from kerosene could not be used to evaluate the results of a major earthquake that ruptures a SBW tank in the design basis event for AA22. Therefore, the migration of the radionuclides present in the SBW located in the tank farm tanks was evaluated using the same numerical modeling approach for assessing the potential risk via groundwater ingestion as outlined in the OU3-13 RI/BRA report (Rodriguez et al. 1997). This approach evaluates risk via ingestion of groundwater based on modeling of geologic and hydrologic conditions, natural and anthropogenic sources of water, contaminant source locations, contaminant masses, activities, as well as release history and geochemical characteristics of existing contaminants. For the SBW tank failure due to a major earthquake, the radionuclide bearing waste was assumed to be released to the subsurface soil, infiltrate and disperse through the vadose zone and migrate in the groundwater. Numerical models were utilized to predict peak groundwater activities resulting from SBW tank failure. Detailed explanations of models and parameters are provided in Shafer (1999) and OU3-13 RI/BRA (Rodriguez et al. 1997).

A screening analysis was performed to assess the impact of the modeled peak groundwater activities by comparing the modeled activities to MCLs as outlined in OU3-13 RI/BRA (Rodriguez et al. 1997). The predicted groundwater activity for I-129 is 0.9 pCi/L, which is below the 1.0 pCi/L MCL for I-129. The predicted groundwater activity for plutonium total (Pu-239, Pu-240, and Pu-242) is 0.9 pCi/L, which does not exceed the 15 pCi/L MCL for alpha-particle emitters such as plutonium. The predicted groundwater activities for other radionuclides (i.e., Am-241, Sr-90, Tc-99, U-234, U-238) present in the SBW tank are less than their respective MCLs (Table C.4-21).

For comparison purposes, the predicted effects of historical releases from INTEC operations were compared to predicted releases associated with DBE22. Predicted peak groundwater activities from historical releases for I-129 (9.0 pCi/L), Sr-90 (8.1 pCi/L) and plutonium-total (36 pCi/L) would exceed the MCLs in the year 2025, 2095, and 3585, respectively. The expected I-129 activities would increase 9 percent from 9.0 pCi/L to 9.9 pCi/L if the accident associated with DBE22 should occur. The expected Sr-90 activities would not increase if this major earthquake should occur and result in SBW release from the tank. Likewise, the expected plutonium radionuclide activities would not substantially increase (from 36 pCi/L) if this accident should occur.

Table C.4-21. Design basis events that produce groundwater impacts.

AA	Process title	Design basis events	Constituent	MCL (µg/L or pCi/L)	Peak groundwater concentration (µg/L or pCi/L)
22	Long-Term Onsite Storage of SBW	An earthquake causes the failure of a SBW tank vault with subsequent tank rupture and a release of SBW directly to groundwater.	Iodine-129	1	0.9
			Plutonium-total	15	0.9
			Strontium-90	8	<8.0

MCL = Maximum Contaminant Level; µg/L = micrograms per liter; pCi/L = picocuries per liter.

The abnormal event for AA22 (Table C.4-22), intrusion into an SBW tank, would result in the migration of the radionuclides present in the SBW located in the Tank Farm tanks and was evaluated using a linear approximation, the impact of a 10 percent release would be about 10 percent of the results calculated for the seismic failure of a tank discussed above. Thus, the predicted groundwater activity for iodine-129 is 0.09 picocuries per liter, which is below the 1.0 picocuries per liter Maximum Contaminant Level for iodine-129. The predicted groundwater activity for plutonium total (plutonium-238, plutonium-239, plutonium-240, and plutonium-242) is 0.09 picocuries per liter, which is below the 15 picocuries per liter Maximum Contaminant Level for alpha-particle emitters such as plutonium. The predicted groundwater activities for other radionuclides present in the SBW tanks provide groundwater radionuclide concentrations that are small fractions of their respective Maximum Contaminant Levels.

Table C.4-22. Abnormal events that produce groundwater impacts.

AA	Process title	Abnormal events	Constituent	MCL (µg/L or pCi/L)	Peak groundwater concentration (µg/L or pCi/L)
02	New Waste Calcining Facility High Temperature & Maximum Achievable Control Technology Modification	A leak of kerosene through failed process connections. The entire contents of the tank could be released. Damage to the environment could be incurred if kerosene enters the groundwater.	Benzene in kerosene	5	120
22	Long-Term Onsite Storage of SBW	Accidental intrusion by unauthorized persons unprepared for contact with radioactive materials could result in a groundwater release of materials.	Iodine-129	1	0.9
			Plutonium-total	15	0.9
			Strontium-90	8	<0.8

MCL = Maximum Contaminant Level; µg/L = micrograms per liter; pCi/L = picocuries per liter.

The predicted maximum contaminant levels from accident scenarios resulting in major groundwater releases are summarized in Table C.4-21 to C.4-23. In these summary tables, the organic and radioactive release contamination predictions are compared with EPA Maximum Contaminant Level values. From the summary, it can be concluded that groundwater releases involving organic constituents add substantially to the remediation requirements for INTEC while those involving radioactive constituents (ABN22 and DBE22) may not exceed the cost-effective limits of current remediation technology. Detailed explanation of modeling input parameters, source inventories, and results are contained in DOE (1998a) supporting this accident evaluation.

Table C.4-23. Beyond design basis events that produce groundwater impacts.

AA	Process title	Beyond design basis	Constituent	MCL (µg/L) or pCi/L)	Peak groundwater concentration (µg/L or pCi/L)
02	New Waste Calcining Facility High Temperature & Maximum Achievable Control Technology Modification	An aircraft impact results in the failure of both kerosene storage tanks and a subsequent fire. The primary hazard of this accident is not in the combustion products themselves but in the potential to result in an "external event fire" that impacts other processes.	Benzene	5	180

MCL = Maximum Contaminant Level; µg/L = micrograms per liter; pCi/L = picocuries per liter.

C.4.1.6 Integrated Risk to Involved Workers

Results of the point estimates of involved worker risk are given in Figure C.4-7, while mean values of the Monte Carlo simulations are summarized in Figure C.4-8. In Figures C.4-7 and C.4-8, the relative contributions from industrial accidents, occupational exposures, and facility accidents are delineated for each HLW processing alternative. A comparison of the simulated life cycle means versus point estimates is provided in Figure C.4-9.

From Figures C.4-7 through C.4-9 several conclusions can be drawn:

- Mean values of involved worker risk from the simulations are higher than those obtained from point estimates. Involved worker risk for all alternatives are sensitive to parameters such as the number of worker years of exposure, the rate of industrial accident fatalities, and the frequency of radiological

Figure C.4-7. Point estimates of integrated industrial worker risk for HLW processing alternatives

Figure C.4-8 Simulation of integrated industrial worker risk for HLW processing alternatives

Figure C.4-9 Comparison of integrated involved worker risk simulation means with point estimates for HLW processing alternatives release accidents. The simulated means tend to bound the potential for involved worker risks by encompassing in the distributions of these variables, particularly upper bounds that represent relatively unlikely but possible conditions. Consistent with the state of knowledge regarding projects and activities associated with implementation of alternatives, the simulations provide a more bounding and hence more reliable basis for comparing alternatives at this time.

- Estimates of involved worker risk due to industrial accidents do not favor alternatives that require the largest amount of manpower during implementation. Thus, alternatives such as Planning Basis that encompass the largest requirements for facility construction as well as the longest facility operation campaigns, could pose risk to involved workers from industrial accidents that is a full order of magnitude higher than that posed by less ambitious alternatives.

- Estimates of involved worker risk due to facility accidents do not favor alternatives that are vulnerable to bounding accident scenarios with high probabilities of occurrence or large radioactive or chemical releases. Alternatives such as No Action and Continued Current Operations that do not address the basic issue of reducing releasable material inventories have the highest predicted combinations of likelihood and consequences for bounding accidents. As such, the contribution of facility accidents to involved worker risk for these alternatives are as much as an order of magnitude higher than the contribution for the other alternatives that actively reduce health and safety risk over time.

- Industrial accidents are, for most of the alternatives, the largest contributors to involved worker risk. Therefore, estimates of integrated involved worker risk (including all sources) favor the alternatives such as No Action, Continued Current Operations, and Minimum INEEL Processing that involve less site activity over time. It should be remembered, however, that risks posed by transportation and activities at the Hanford site are not included in the estimates of involved worker risk for the Minimum INEEL alternative.

C.4.1.7 Conclusions and Comments

C.4.1.7.1 Integrated Accident Analysis Cross Section by Alternative

The accident evaluations presented in Sections C.4.1.3 and C.4.1.4 provide information on bounding scenarios for each HLW alternative that result from implementing each process element. This evaluation identifies those process elements that may pose higher accident risks than others. Integrating this information provides a clearer picture of the overall risk associated with each alternative. Thus, the decisionmaker can determine if a waste processing alternative has one dominant accident sequence or a series of accidents with similar consequences.

An additional benefit of alternative correlation is determining if there are common cause initiators for multiple accident scenarios for a given treatment alternative. For instance, a seismic event may result in structural damage and release of radiological or chemical inventories from several process elements. Individually, the accidents initiated by a seismic event may not have significant consequences. The seismic event may produce severe consequences when the effects from the individual scenarios are summed together for an alternative.

Table C.4-24 summarizes the crosscut evaluation of the applicable accidents for each alternative. As shown in the table, Process Element 3, “Calcine Retrieval and Transport,” and Process Element 15, “Additional Off-Gas Treatment Processes” produced bounding radiological or chemical accidents for each alternative/option except the No Action and Continued Current Operations Alternatives. AA02 and AA22 produce bounding groundwater releases for the various alternatives.

C.4.1.7.2 Groundwater versus Airborne Releases

The focus of this evaluation was on airborne releases capable of producing health effects due to acute exposures. There were also several groundwater releases that were identified in the evaluation that could result in health effects due to prolonged exposures. Typically, in the National Environmental Policy Act accident analysis, it is assumed that chronic pathways to the environment can be remediated or at least can be prevented from severely impacting human receptors. If the evaluation were conducted without taking into consideration these types of mitigation measures, several groundwater releases could produce bounding accidents.

Nevertheless, since historic experience with nuclear weapons, weapons testing, and nuclear accidents tends to validate concerns over the public health impacts of accidental air releases while groundwater releases can only be theorized as impacting a member of the public in the far future, preferences for waste processing alternatives based on accident analysis should be based mainly on the results of projected air release accidents.

C.4.1.7.3 Localized Hazards

The evaluation of several process elements identified accident scenarios resulting from operational errors (e.g., contact of incompatible materials during maintenance) that could result in localized hazards to personnel. The consequences associated with these accidents can be mitigated by protective gear that is donned during operations in hazardous environments. It was not anticipated that toxic and/or radiological hazards would be posed to co-located personnel or the public from these operational accidents since the release-producing mechanisms were not found to present an immediate threat to the integrity of buildings and containments used to control accidents at DOE nuclear facilities.

C.4.1.7.4 Common Cause Initiators

Common cause initiators were evaluated only in a limited sense. Toxic gas releases associated with Process Element 15, “Additional Off-Gas Treatment Processes” were identified as possible initiators in accident sequences involving operator incapacitation. Additionally, other initiators could also produce accidents in multiple process elements associated with an alternative/option. The primary concern in this area is in seismic events that could impact multiple facilities.

C.4.1.7.5 Sensitivity Discussion

The Idaho HLW & FD EIS accident analysis consequence modeling was performed for three receptors.

For each of these analyses, conservative assumptions were applied to obtain bounding results. For the most part, the assumptions in the HLW & FD EIS were consistent with those applied in other EIS documents prepared at the INEEL, such as the SNF & INEL EIS (DOE/EIS-0203-F) (DOE 1995). However, there were some assumptions that differed. Of the assumptions incorporated in the HLW & FD EIS consequence modeling, exposure pathways, exposure time, breathing rate, meteorology, and location (for the population dose) were some that had significant impact on the results. Appendix H (Table H-1) in the TRD summarizes the potential effects that may be observed if these assumptions are changed.

The approach that was taken in the Idaho HLW & FD EIS consequence modeling was done to ensure that a “safety envelope” was provided. As discussed above, this approach differs from the approach taken in other EIS’s, such as the SNF & INEL EIS. Due to this, the results presented in the HLW & FD EIS are larger than the results that would have been obtained by applying the SNF & INEL EIS assumptions. However, the key issue at hand is that the Idaho HLW & FD EIS is providing a likely upper bound to the potential consequences for the accidents associated with the candidate alternatives. In addition, these conservative assumptions were incorporated in a consistent manner. Although adjustments to these assumptions will modify the absolute magnitudes of the predicted consequences, they will not modify the relative ranking of the modeled scenarios. So the set of bounding scenarios are anticipated to remain the same. More detail can be found in King (1999a).

C.4.1.7.6 Comparison of HLW Processing Alternatives Based on Facility Accidents

Bounding accident scenarios in the HLW EIS bound the consequences of accidents that could occur as a result of implementing a waste processing alternative. Bounding accident scenarios contribute much but not all of the risk associated with implementation of an alternative. In order to compare the risk of implementing an HLW processing alternative based on facility accidents, it is appropriate to construct a basis for estimating the total risk of implementation rather than simply comparing the largest accidents posed by an alternative. As a prelude to this comparison, an understanding of the relationship between risk due to bounding accident scenarios and the total risk of implementation must be developed.

The process used to compare health and safety risk to the public as a result of implementing each of the HLW processing alternatives is described in Table C.4-25 and its accompanying description information.

Table C.4-25 provides an integrated perspective on risk to collocated workers and the public as a result of bounding facility accidents for all the waste processing alternatives. In Table C.4-25, the contribution to public risk (in LCF) from identified bounding accident scenarios is presented as a fractional increase over the background cancer rates for the total affected population in the EIS.

The information in Table C.4-25 supports comparison of treatment alternatives based on the risk of facility accidents.

- Alternatives that are vulnerable to bounding accident scenarios with the highest probabilities of occurrence and estimated consequences exhibit the highest potential for risk due to facility accidents. Alternatives such as No Action and Continued Current Operations, that do not address the basic issue of reducing releasable material inventories have the highest predicted combinations of likelihood and consequences for bounding accidents, thus posing risk to the public several orders of magnitude greater than alternatives that actively reduce risk over time.

- Alternatives requiring the use of separation technology could pose relatively high risk from facility accidents. Historical experience indicates that such processes could have a relatively high likelihood of accidents that result in significant and energetic release of materials. The Transuranic Separations Option, in particular, illustrates this vulnerability for the design basis event.

- Some alternatives could be vulnerable to release producing events that would make DOE safety criteria and guidelines difficult to adhere to. This conclusion is based on very preliminary information however, and it indicates only a need for careful consideration of facility safety as part of alternative implementation.

C.4.2 FACILITY DISPOSITION ACCIDENTS

C.4.2.1 Introduction

C.4.2.1.1 Purpose

The purpose of Section C.4.2 is to analyze alternatives for the disposition of INTEC facilities. Each waste processing alternative and facility disposition option requires an analysis of potential facility accidents as one of the environmental impacts, particularly to human health and safety, associated with its implementation. DOE has performed an accident analysis to identify environmental impacts associated with accidents that would not necessarily occur, but which are reasonably foreseeable and could result in significant impacts. Since the potential for accident and their consequences varies among different facility disposition options, facility disposition accidents may provide a key discriminator among the HLW & FD EIS alternatives. Accidents are defined according to the National Environmental Policy Act as undesired events that can occur during or as a result of implementing an alternative and that have the potential to result in human health impacts or indirect environmental impacts.

Potential facility disposition accidents pose health impacts to several groups of candidate recipients. Along with workers performing disposition activities at each facility (involved workers), workers at nearby INEEL facilities (noninvolved workers) and the offsite population could be exposed to hazardous materials released during some accident scenarios. Potential facility disposition impacts to human health arise from the presence of radiological, chemical, and industrial (physical) hazards.

Each EIS alternative for the treatment, storage, and disposal of HLW at INTEC affects or includes several major INTEC facilities, such as the New Waste Calcining Facility, Tank Farm, and bin sets. Clean closure, performance-based closure, and closure to landfill standards are the three major alternatives that are being considered by DOE for each HLW facility disposition.

Approach

The approach adopted by DOE is illustrated in Figure C.4-10. As shown, potential facility disposition impacts for noninvolved workers and members of the offsite population are analyzed differently than for involved workers. Only involved workers are subject to industrial accident hazards, such as falls or electrical shocks; however, all three groups could be exposed to radioactivity and/or hazardous chemicals released by a severe accident.

For noninvolved workers and the offsite population, the maximum plausible accident identified for disposition of each facility is compared to the maximum credible accident postulated for normal operation of that facility. (In this appendix, the term "maximum plausible accident" is used to indicate the bounding accident during facility disposition, while the term "maximum credible accident" is used to indicate the bounding accident during facility operation.) If the maximum credible accident during facility operation bounds the maximum plausible accident during facility disposition, then facility disposition accidents are presumed to be bounded by those events already considered in facility operation. As such, facility disposition activities would not be expected to introduce new or previously undisclosed sources of risk to noninvolved workers and the offsite population.

Data sources used to establish maximum credible accidents during facility operation include safety assurance documentation such as safety analyses for HLW processes at INTEC, and EIS estimates for bounding facility events that are included in waste processing alternatives. Comparisons between disposition events and corresponding operations accidents are based on relative differences in inventories of radioactive materials and hazardous chemicals, changes in mobility of these substances, and changes in the energy available for accident initiation and propagation. These changes occur to some extent while a facility undergoes deactivation. For individual facilities, the combination of inventory reductions, immobilization of residuals, and removal of energy sources produce potential disposition impacts that are less severe than those posed by acceptable hazards from current operations. This analysis indicates that a maximum plausible disposition event for a given facility has significantly less potential impact than a corresponding operations accident infers and that risks at that facility would not be increased by prospective actions taken to implement an EIS alternative.

Involved workers would be exposed to numerous industrial physical hazards during facility disposition activities, in addition to hazards from residual chemicals and radioactive materials following facility deactivation. The industrial hazards to involved workers likely would not diminish when inventories of

Figure C.4-10. Impact assessment methodology for hypothetical disposition accidents in INTEC facilities chemicals and radioactive substances are removed or immobilized. These accidents such as falls from scaffolding are essentially independent of the radioactive and chemical inventories, the mobility of these materials, and the energy available to release these inventories. Furthermore, the likelihood of industrial accidents may increase during facility disposition, relative to facility operations, because more industrial labor is required during active phases of disposition.

There is another reason why occupational impacts to involved facility workers cannot simply be bounded by the maximum postulated accident for operations in the same manner as for potential impacts to noninvolved workers and members of the offsite population. Many facility systems that mitigate consequences of operations accidents to involved workers, such as fire protection systems, may no longer be available during disposition, especially during the latter phases such as demolition. It is also possible that involved workers may encounter unforeseen radiological or chemical hazards during disposition without the benefit of adequate protective equipment. For example, process tanks or lines that are declared empty in facility documentation may still contain enough radioactivity to require shielding or remote handling for disassembly.

For these reasons the strategy for involved workers reflected in Figure C.4-10 is to compare the potential impacts from disposition accidents with respect to the closure options under consideration. For industrial hazards, potential impacts (injuries/illnesses and fatalities) are assumed proportional to disposition labor hours. As discussed below, a clean closure option requires more disposition labor than a performance-based closure, which requires more labor than closure to landfill standards. Consequently, clean closure poses the largest total risk of industrial accidents to involved workers, while closure to landfill standards poses the least total risk. Similarly, impacts from radiological hazards in terms of total rem exposure are bounded from below by allowable cumulative doses to workers and are calculated from the estimated duration (hours) of radiation worker labor. Facility-specific hazards from hazardous chemical residues are more difficult to quantify with available information. However, inferences can be drawn by assuming that impacts are related to amounts of disposition labor under hazardous conditions, because clean closure requires more disposition activity in close proximity to chemical hazards, followed by performance-based closure and then closure to landfill standards. Thus, potential impacts to involved workers from chemical residues should demonstrate the same trend among closure options as industrial and radiological accidents.

Scope

This analysis postulates facility disposition accidents that could occur during facility closure and have the potential to harm workers, the offsite population, and the environment. This analysis of facility disposition accidents was applied only to those existing INTEC facilities that are significant to the treatment, storage, or generation of HLW. New facilities required for the waste processing alternatives are not considered in the analysis because the design of these facilities has not been finalized, and the designs would include features to facilitate dispositioning (DOE 1989). Thus, new HLW facilities are assumed to have minimal radioactive and hazardous material inventories remaining at the time of disposition and a low potential for significant accidents.

As described in Section 3.2.2 of this EIS, DOE used a systematic process to identify which existing INTEC facilities would be analyzed in detail for this EIS. These facilities selected for detailed analysis are assumed to have material inventories that require careful consideration of the potential for accidental release into the environment at closure. The results of the DOE facility selection process are documented in Section 3 of this EIS in Table 3-4. Table 3-4 has been validated as an appropriate basis for the analysis of potential disposition impacts to involved workers in Section C.4.2.4. This section also is applicable to inter-facility transport lines that are not directly associated with individual INTEC facilities.

Facilities that pose short-term radiological and chemical hazards to noninvolved workers and the offsite population are presented in Table C.4-26; the emphasis was on those facilities where potential accidents could rapidly disperse radionuclides and/or hazardous chemicals beyond the immediate working area. Selection guidance was obtained from a prior study, the *Comprehensive RI/FS for the Idaho Chemical Processing Plant OU 3-13 at the INEEL Part A, RI/BRA Report (Rodriguez et al. 1997)*, which identified those facilities with airborne release and direct exposure pathways.

For purposes of the facility disposition accident analysis, HLW facilities that have only “groundwater pathways” for hazardous material releases were not assessed for potential impacts to noninvolved workers and the offsite population. Facility disposition accident releases to the groundwater pathway would not be expected to produce a short-term health impact to the public because DOE could remediate the affected media or restrict public access to it. Groundwater impacts are presented in the TRD only when the potential for the consequence of an accident is so great that the cost of remediation was intractable and had to be assessed. Also, due to limitations on material, accessibility, and available energy for release, the possibility of such large events can be categorically eliminated or least assumed to be bounded by the

Table C.4-26. Existing INTEC facilities with significant risk of accidental impacts to noninvolved workers and to the offsite population.

Tank Farm	
CPP-713	Vault containing Tanks VES-WM-187, 188, 189, and 190 with supporting equipment and facilities
CPP-780	Vault containing Tank VES-WM-180 with supporting equipment and facilities
CPP-781	Vault containing Tank VES-WM-181 with supporting equipment and facilities
CPP-782	Vault containing Tank VES-WM-182 with supporting equipment and facilities
CPP-783	Vault containing Tank VES-WM-183 with supporting equipment and facilities
CPP-784	Vault containing Tank VES-WM-184 with supporting equipment and facilities
CPP-785	Vault containing Tank VES-WM-185 with supporting equipment and facilities
CPP-786	Vault containing Tank VES-WM-186 with supporting equipment and facilities
Bin Sets	
CPP-729	Bin set #1 with supporting equipment and facilities
CPP-742	Bin set #2 with supporting equipment and facilities
CPP-746	Bin set #3 with supporting equipment and facilities
CPP-760	Bin set #4 with supporting equipment and facilities
CPP-765	Bin set #5 with supporting equipment and facilities
CPP-791	Bin set #6 with supporting equipment and facilities
CPP-795	Bin set #7 with supporting equipment and facilities
Process Equipment Waste Evaporator and Related Facilities	
CPP-604	Process Equipment Waste Evaporator
CPP-605	Blower Building
CPP-649	Atmospheric Protection Building
CPP-708	Main Exhaust Stack
CPP-756	Prefilter Vault
CPP-1618	Liquid Effluent Treatment and Disposal Facility
Fuel Processing Building and Related Facilities	
CPP-601	Fuel Processing Building
CPP-627	Remote Analytical Facility
CPP-640	Head End Process Plant
Other Facilities	
CPP-659	New Waste Calcining Facility
CPP-666/767	Fluorinel Storage Facility and Stack
CPP-684	Remote Analytical Laboratory

a. Derived from Table 3-4 and Rodriguez et al. (1997).

facility accidents already considered. Because current facility data on the type and quantities of miscellaneous hazardous materials were not available, no definitive analysis was done with respect to the chemical content and potential impact of incidental, hazardous materials at the facilities. Hazardous materials expected to be present during facility disposition activities include kerosene, gasoline, nitric acid, decontamination fluids, and paints. The assumption was made that closure activities would include the disposal and cleanup of hazardous materials to the maximum extent practicable in accordance with the current decommissioning manuals and regulations. Moreover, during INTEC-wide operations, the bounding release scenario for hazardous chemicals with the greatest potential consequences to noninvolved workers and the offsite population is a catastrophic failure of a 3,000-gallon ammonia tank. This scenario results in ammonia releases greater than ERPG-2 concentrations at 3,600 meters. Here "exposures to airborne concentrations greater than ERPG-2 values for a period greater than 1 hour results in an unacceptable likelihood that a person would experience or develop irreversible or other serious health effects or symptoms that could impact a person's ability to take protective action." This accident scenario also bounds potential chemical releases for the facility disposition analysis cases.

End Products

There are two end products of this HLW facility disposition analysis: (1) for potential impacts to noninvolved workers and to members of the offsite population, a comparison of "Maximum Plausible Accident Scenarios" for each applicable facility disposition activity and closure option with impacts anticipated during facility operation and (2) for involved workers, estimates of relative health and safety risk among the facility closure options. In both cases risks will not be estimated in terms of absolute impact on the health and the environment.

C.4.2.2 Facility Closure

The three facility disposition alternatives considered by DOE and included in this analysis are defined below. (Subsequent use of the Tank Farm and bin sets as a Low-Activity Waste Disposal Facility is not included here because accidents associated with this activity were addressed in the TRD.

Clean Closure

Hazardous wastes and radiological and chemical contaminants, including contaminated equipment, would be removed from the facility or treated so that residual radiological and chemical contamination is indistinguishable from background concentrations. Use of facilities (or the facility sites) after clean closure would present no risk to workers or the public from radiological or chemical hazards. Clean closure may require total dismantlement and removal of facilities.

Performance-Based Closure

For radiological and chemical hazards, performance-based closure would be in accordance with risk-based criteria. The facilities would be decontaminated so that residual waste and contaminants no longer pose any unacceptable exposure (or risk) to workers or to the public. Post-closure monitoring may be required on a case-by-case basis. Closure methods would be dictated on a case-to-case basis depending on risk.

Closure to Landfill Standards

The facility would be closed in accordance with Federal and state requirements for closure of landfills. Closure to landfill standards is intended to protect the health and safety of the workers and the public from releases of contaminants from the facility. This could be accomplished by installing an engineered cap; establishing a groundwater monitoring system; and providing post-closure monitoring and care of the waste containment system, depending on the type of contaminants.

C.4.2.3 Analysis Methodology for Noninvolved Workers and the Offsite Population

The accident analysis team for the facility disposition options performed a systematic review of available data from applicable INTEC safety analysis reports, safety reviews, HLW facility closure studies, and EIS technical requirements data that were generated in the TRD. The maximum plausible accident scenario, selected for the HLW facilities with airborne release and direct exposure pathways, is compared to a bounding accident scenario that was postulated during normal facility operations in safety analysis reports or in the TRD. In some cases, the best available references have not been updated to reflect cessation of fuel processing operations at INTEC. Criticality may still be cited as the maximum postulated operations accident as a result of previous processing or storage operations at the facility. Although such an event would no longer be possible, its potential for occurrence has been evaluated and “accepted” as part of the facility safety management requirements by DOE.

A seven-step process is used to select and compare the bounding accident scenarios for facility disposition activities.

Facility Description

DOE collected and reviewed facility descriptions that were obtained from current EIS alternative treatment studies, EIS facility closure studies, INTEC reports and studies, Lockheed Martin Idaho Technologies Company feasibility studies, and previous DOE HLW studies. The facility description reviews focused on the facility's operational function; primary activities; location at INTEC; structural materials; type of equipment and process lines; shielding provisions; heating, ventilation, and air conditioning systems; material inventories; and other factors pertinent to potential facility disposition accidents. Particular attention was placed on structure design and materials that could impact the safe, efficient, and complete removal of radioactive and hazardous materials.

Facility Closure Condition

DOE identified three types of facility closures appropriate for HLW facility disposition: clean closure, performance-based closure, and closure to landfill standards. For the INTEC Tank Farm and bin sets, which would contain most of the residual radioactivity, all three facility disposition alternatives were evaluated and are active considerations. For the remaining INTEC facilities, a single facility disposition alternative was selected, except for the FAST Facility and Stack (CPP-666 and -767) where two facility disposition alternatives were evaluated. The material inventories associated with these facilities would be much less than that of the Tank Farm and bin sets. Therefore, the overall residual risk to noninvolved workers and the offsite population from closure of INTEC HLW facilities would not change significantly due to the contribution of a potential accident for these facilities. Also, the type of closure is considered in estimation of critical factors that could impact the maximum plausible accident: material at risk, energy, and mobility.

Material at Risk at Closure

The severity or eventual consequences of any potential facility disposition accident is directly proportional to the type, quantity, and potential energy of material at risk and the resultant source term. For this analysis, it is assumed that the most of the materials at risk would be removed during the facility cease-use period prior to closure activities. However, the estimated material at risk could be much greater if significant quantities of radioactive and hazardous materials were inadvertently "left behind" in areas that are assumed to be clean.

In the case of the bin sets, the Calcine Retrieval and Transport Project along with subsequent closure activities would reduce the quantities of material at risk by nearly two orders of magnitude below normal operation levels. This significant reduction in material inventory during facility closure activities is one of the primary assumptions that supports the selection of bounding accidents from facility operations accidents to bound potential closure accidents.

Contaminant Mobility at Closure

Contaminant mobility in the facility environment is a function of the type and construction of the facility, the location of the facility with respect to exposure pathways, the characterization and location of the contaminants, and the type of closure operations. These mobility factors and others were considered by DOE in estimating the potential contaminant mobility for each type of HLW facility. In facilities where most of the residual contamination was left in tanks or internal bins or otherwise inaccessible places, the contaminant materials were deemed relatively unavailable for release and not susceptible to natural or external phenomena accident initiators.

Available Energy for Accident at Closure

As was the case for determining bounding accident scenarios during the treatment alternative operations, the accident "initiating events" considered for the facility closure options include fires, explosions, spills, nuclear criticality, natural phenomena, and external events. Internal initiators such as human error and equipment failures occur during operations that trigger the fires, explosions, and spills. Natural phenomena initiators include floods, tornadoes, and seismic events. External initiators include human-caused events during decommissioning, decontamination, closure, or a non-related aircraft crash. Generally, the external initiators are the most probable initiators for bounding facility accidents that cause major structure damages and materials releases to the environment.

Maximum Plausible Accident at Closure

The maximum plausible accident is the largest credible accident during facility closure that could be hypothesized using available information. Determination of the maximum plausible accident provides an "accident benchmark" compared with the maximum credible accident for facility operations. Also, the maximum plausible accident during closure may highlight the need for additional safety procedures or equipment to be considered in future safety analysis reports.

Table C.4-27 summarizes the results of the analyses of facility closure accidents. For additional information on the contents of Table C.4-27, the reader may refer to the appropriate facility discussion in the TRD for relevant details.

C.4.2.4 Industrial Hazards to Involved Workers During Facility Disposition

Since the risk of additional impacts on non-involved workers and the public as a result of radiological and chemical release accidents is small, additional risk to involved workers may supply a key discriminant among facility disposition alternatives. Involved workers may incur health effects from three sources during the implementation of facility disposition alternatives.

1. Industrial accidents, particularly those occurring in the course of decontamination, construction, and demolition activities. An example would be the use of heavy equipment in unstable surroundings during removal of equipment or materials.

2. Increased occupational doses as a result of exposure to contaminated ground and facilities, under conditions where exposures are unplanned for or the level of shielding and protection is reduced. An example would be exposure of workers to unmarked or highly contaminated transport lines between facilities.

3. Chemical release accidents that impact involved workers but not uninvolved workers or the public.

Specific hazards and their relative contributions to involved worker risk will vary among facilities and the closure options selected for them. In general, clean closure requires more interaction between workers and hazards than a performance-based closure, while a closure to landfill standards requires the least interaction.

Industrial Hazards. The purpose of this analysis to estimate the potential impacts to involved workers from these hazards during disposition of the HLW facilities pertinent to this EIS. Industrial impacts are estimated in terms of injuries, illnesses, and fatalities that are sustained on the job and reported according to Occupational Safety and Health Administration regulations. The total number of injuries/illness and fatalities that could occur at each of the existing HLW facilities during the facility disposition period are estimated according to total labor hours. Thus, the EIS alternative evaluators are provided with an additional discriminator, a relative assessment of the total number of reportable injuries/illness and fatalities for disposition of the existing HLW facilities. The absolute numbers of calculated industrial incidents are dependent on preliminary estimates of disposition labor for each facility, which are highly uncertain given the preliminary nature of facility disposition plans. For example, the estimates also do not include disposition of transport lines between individual facilities, for which projection of labor are not yet available. Nevertheless, the relative numbers of injuries/illnesses and fatalities among facility disposition options offers a valuable perspective on the potential impacts to involved workers.

Methodology. The basic assumption of this analysis is that industrial incidents are directly proportional to the total number of worker hours for the disposition of each facility. Thus, the total number of injury/illnesses and fatality cases for each existing facility is determined by multiplying the estimated total worker hours during facility disposition times an assumed incident rate for injuries/illnesses and fatalities. It should be noted that exact frequency of injuries/illnesses and fatalities is less critical than the consistency with which these rates are applied to different facility disposition alternatives, so that the impact of facility disposition to involved workers can be put in perspective as a potential discriminating factor for evaluating EIS alternatives.

The estimated total worker hours for each facility disposition were obtained from several Lockheed Martin Idaho Technologies Company Engineering Design Files and Project Data Sheets performed for the existing facility closures associated with this HLW & FD EIS. Specific Engineering Design Files and Project Data Sheets are listed in the TRD.

The average hazard incident rates were obtained by reviewing several historical DOE and U.S. Government records for actual injury/illness and fatality rates during construction work in the recent past. The average INEEL and private industry injury/illnesses and fatality incident rates in the *SNF & INEL EIS* (DOE 1995), from the Computerized Accident Incident Reporting System industrial accident database through 1997, and from a Bayesian update to include 1998 data (Fong 1999). The exact estimators used in this industrial accident risk comparison are discussed in the TRD. The incident rates are per 100 man-years or 200,000 construction hours, which is a common benchmark used by DOE, Occupational Safety and Health Administration, and the Bureau of Labor Statistics. These selected rates are 6.2 and 13.0 injuries/illnesses per 200,000 worker hours, and 0.011 and 0.034 fatalities per 200,000 worker hours for INEEL and private industry, respectively. Corresponding ranges of estimated impacts are provided in the TRD. Actual rates for INTEC HLW disposition activities likely would be equal to or greater than the DOE construction rates but less than the private industry construction rates. Thus, the lower and upper estimates of expected incidents were averaged for calculating the results in the summary table (Table C.4-28).

Table C.4-28 presents the analysis results for industrial impacts to involved workers. The available DOE data do not consistently disclose the type of facility closure type assumed for the "Other Facilities." Therefore, for purposes of this table, the estimated total labor hours and resultant incidents for the "Other Facilities" are assumed to be equal for all three types of closure.

Table C.4-28. Industrial hazard impacts during disposition of existing HLW facility groups using "average DOE-private industry incident rates" (per 200,000 hours).

Facility groups	Total removal clean closure		Performance-based closure/clean fill		Closure to landfill standards/clean fill	
	Injuries/illnesses	Fatalities	Injuries/illnesses	Fatalities	Injuries/illnesses	Fatalities
Tank Farm	750	1.79	30	0.07	16	0.04
Bin sets	134	0.32	103	0.24	48	0.11
Other facilities	149	0.33	149	0.33	149	0.33
Total incidents	1,033	2.44	282	0.64	213	0.48

Table C.4-28 shows the estimated number of injuries/illnesses and fatalities for the three major closure options, based on the average DOE-Private Industry rate. This incident rate used in Table C.4-28 is the average of the "lower bound DOE rate" and the "upper bound Private Industry rate" for construction work. This table shows that the estimated number of incidents varies considerably with the type of closure option. Note that the Clean Closure Alternative has by far the greatest number of injuries/illnesses and fatalities; the Performance-Based Closure Alternative has fewer incidents and the Closure to Landfill Standards Alternative has the least number of estimated incidents. This result can be attributed to the large number of disposition man-hours and project years required by the Clean Closure Alternative. This option also involves more demolition and heavy equipment operation than the other two closure alternatives. The total number of incidents for the Performance-Based and Landfill Closure Alternatives are nearly equal, within the limitations on the data currently available for the "Other Facilities."

Accident/Injury rate for INEEL from CAIRS are slightly lower than those in the SNF & INEL EIS that are derived from complex-wide experience while the fatality rate for INEEL from the same information base is an order or magnitude higher. There are two possible explanations. It could be argued that fatalities are stochastic events and the small size of the fatality data base for INEEL does not provide an acceptable statistical basis for projecting a radically different fatality rate from the underlying complex-wide rate that is consistent with accident/injury experience at the site. Alternatively, it could be argued that the currently high fatality rate does represent a systemic safety issue at the site, one that is currently being addressed through aggressive Integrated Safety Management and related safety improvement efforts.

Radiological Hazards. In addition to estimating the nonradiological impacts of occupational hazards to the INTEC involved worker, it is important to estimate the radiological impacts that could be sustained during facility disposition. For this purpose, estimates for the total radiation dosage sustained by the involved workers during the facility disposition period were used for this analysis. Data for this radiological parameter were obtained from Engineering Design Files and Project Data Sheets listed in the TRD and provide the EIS analyst additional inputs for relative comparisons among the EIS alternatives. As for industrial hazards, specific information is not currently available for transport lines that are not associated with any individual facility. This omission could be significant if any contamination has leaked from transport lines to the surrounding soil, which could pose a distinct risk of accidental radiation exposure to unsuspecting involved workers.

Facility totals for worker radiation dosage are assumed to be directly proportional to the total number of radiation worker-years needed for each facility disposition alternative. Radiation worker-years are defined as the product of the number of workers working in radiation areas times the number of closure years for each facility. Thus, to determine the total radiation dosage per facility, the number of radiation man-years was multiplied by the dosage rate, i.e. total rem per worker per year.

Table C.3-8 presents the total radiation dosage to the exposed radiation workers for each facility group by closure type. An average dosage rate for each facility closure was obtained from the Engineering Design Files and Project Data Sheets mentioned previously. The available DOE data do not disclose the type of facility closure assumed for the “Other Facilities.” Therefore, for purposes of this table, the estimated total labor hours and resultant incidents for the “Other Facilities” are assumed to be equal for all three types of closure. The latent cancer fatalities that result from this population exposure can be estimated by multiplying the total dosage (person-rem) by 4×10^{-4} latent cancer fatalities per person-rem. This dose-to-risk factor is based on the *1990 Recommendations of the International Commission on Radiation Protection* (ICRP 1991).

As was the case for the industrial incidents shown in Table C.4-28, the greatest negative impacts to the involved worker are predicted for clean closure, followed by performance-based clean closure, and then by closure to landfill standards.

As discussed further below for chemical hazards, the above analysis does not fully cover unforeseen, stochastic events with local consequences that may be difficult to predict in statistical fashion. One hypothetical example is a work team being exposed to strong radioactivity at an unexpected location, such as by excavating a buried source of powerful gamma radiation without warning and without adequate shielding. Even if the work team promptly evacuates, the amount of worker exposure during such an incident would be of major occupational significance. Events of this nature may be more likely during facility activities than during standard operational conditions. Therefore, impacts of major unforeseen events are not necessarily reflected in these exposure predicitions, because the dosage rate used was primarily derived from facility operations data.

Chemical Hazards. Available data related to chemical hazards were evaluated in the facility disposition Engineering Design Files. The objective was to find a relative indicator of worker exposure to chemical hazards by which Occupational Safety and Health Administration-reportable events could be predicted. Unlike radiation worker labor hours, however, no prediction of labor hours under chemically hazardous conditions is reported in the Engineering Design Files. Efforts also were made to utilize an indirect indicator, such as generation of hazardous waste, but sufficient information is not available for a valid estimator of relative impacts to involved workers. Because Engineering Design File data are preliminary, varying assumptions and estimating techniques have been employed among Engineering Design File authors. In addition, Engineering Design Files are updated frequently and new formats are introduced in the process, which prevents the compilation and interpretation of consistently comparable data for chemical hazards.

Even with more consistent, comprehensive Engineering Design File data, the purpose of this particular analysis would have been difficult to accomplish for the same reason as mentioned for radiological hazards. That is, databases drawn from DOE operations or the commercial chemical industry would not fully encompass the unique challenges facing involved workers during disposition of INTEC HLW facilities. By the time demolition occurs, some of these facilities will have been inactive for decades. Some facilities already have been in a shutdown condition for extensive periods. Under these circumstances, unanticipated exposures can be expected during active phases of disposition. For example, lines and tanks indicated as “drained and flushed” on facility documents are occasionally found with significant chemical and radiological inventories. However, whereas radioactivity often provides an easily detected warning, this is less true for chemical hazards. Characteristics of chemical residues also may change or deteriorate with time, posing hazards never encountered during normal handling and processing steps. Thus, consequences of an accidental chemical exposure to a work team can be worse than a comparable radiological event.

It is very likely that incidents of worker exposure to hazards chemical residues during disposition will follow the same pattern as found for industrial and radiological hazards. Clean closure would generally be labor-intensive and require the greatest worker effort during disposition. Performance-based disposition would need less overall labor than clean closure, but a performance-based option still would require extensive worker interaction in close proximity to potential hazards. Meanwhile, closure to landfill standards would be both relatively rapid and more amenable to remote, mechanized equipment such as cranes and bulldozers. This line of reasoning on relative impacts among the closure options is likely to be especially true for unforeseen interactions with particularly dangerous chemical hazards. Thus, preliminary indications for chemical hazards are in harmony with the analyses of industrial and radiological impacts to involved workers.

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Table C.4-9. Preliminary accident review of alternative process elements.

Process elements / **HLW Option**	NWCF Continued Operations	NWCF Hi-Temp & MACT Mods	Long Term On-Site Storage of SBW	Calcine Retrieval & On-Site Transport	SBW Retrieval & On-Site Transport	Separation	Class C Grout	Borosilicate Vitrification	HLW/SBW Immobilization for Transport (e.g., FUETAP, HIP, Polymer)	Liquid Waste Stream Evaporation	Additional Offgas Treatment	Class C Grout Disposal	LLW, MLLW Disposal	HLW On-Site Storage for Transport	Long Term On-Site Storage of Calcine in Bin Sets	HLW/HAW/SBW Stabilization & Preparation for Transport	TRU Stabilization & Preparation for Transport	TRU On-Site Storage	INTEC Infrastr. / Lab Upgrades, Hanf Vit Activities, NGR or WIPP Shipment / Disposal
Process Element Designator	E1	E2	E3	E4	E5	E6	E7	E8	E9	E10	E11	E12	E13	E14	E15	E16	E17	E18	
Separations Alternative																			
Full Separations Option				IIC	IIA	IC	IIIB	IC		IB	IIB		IIIB	IIIC		IIIC			Not Part of AA
Planning Basis Option	IB	IIC		IIC	IIA	IC	IIIB	IC		IB	IIB		IIIB	IIIC		IIIC			Not Part of AA
Transuranic Separations Option				IIC	IIA	IC	IIC			IB	IIB	IIB					IIB	IIIA	Not Part of AA
Non-Separations Alternative																			
Hot Isostatic Pressed Waste Option	IB	IIC		IIC	IIA				IC	IB	IIB		IIIC	IIIC		IIIC	IIB		Not Part of AA
Direct Cement Waste Option	IB	IIC		IIC	IIA				IC	IB	IIB		IIIC	IIIC		IIIC	IIB		Not Part of AA
Early Vitrification Option				IIC	IIA			IC			IIB		IIIC	IIIC		IIIC	IIIB	IIIA	Not Part of AA
Minimum INEEL Processing Alternative																			
Minimum INEEL Processing				IIC	IIA	IIC	IIC		IIC		IIB			IIC		IIB	IIB	IIIA	Not Part of AA
No ActionAlternative																			
No-Action			IIC	IIC											IB				
Continued Current Operations Alternative																			
Continued Current Operations	IB	IIC		IIC	IIA	IIC				IIB					IB		IIB		

Requires evaluation of accidents that includes systematic scenario identification, estimation of accident frequencies, estimation of accident source terms.

Does not require evaluation for bounding accidents based on currently available information.

Table C.4-10. Accident evaluations required.

Process elements / HLW Option	NWCF Continued Operations	NWCF Hi-Temp & MACT Mods	Long Term On-Site Storage of SBW	Calcine Retrieval & On-Site Transport	SBW Retrieval & On-Site Transport	Separation	Class C Grout	Borosilicate Vitrification	HLW/SBW Immobilization for Transport (e.g., FUETAP, HIP, Polymer)	Liquid Waste Stream Evaporation	Additional Offgas Treatment	Class C Grout Disposal	LLW, MLLW Disposal	HLW On-Site Storage for Transport	Long Term On-Site Storage of Calcine in Bin Sets	HLW/HAW/SBW Stabilization & Preparation for Transport	TRU Stabilization & Preparation for Transport	TRU On-Site Storage
Process Element Designator	E1	E2	E3	E4	E5	E6	E7	E8	E9	E10	E11	E12	E13	E14	E15	E16	E17	E18
Separations Alternative																		
Full Separations Option				AA3	AA24	AA4		AA8		AA14	AA15							
Planning Basis Option	AA1	AA2		AA3	AA24	AA4		AA8		AA14	AA15						AA21	
Transuranic Separations Option				AA3	AA24	AA5	AA7			AA14	AA15	AA16					AA21	
Non-Separations Alternative																		
Hot Isostatic Pressed Waste Option	AA1	AA2		AA3	AA24				AA11	AA14	AA15						AA21	
Direct Cement Waste Option	AA1	AA2		AA3	AA24				AA12	AA14	AA15						AA21	
Early Vitrification Option				AA3	AA24			AA9			AA15					AA23		
Minimum INEEL Processing Alternative																		
Minimum INEEL Processing Alternative				AA3	AA24	AA6	AA7		AA10		AA15			AA17		AA18	AA21	
No Action Alternative																		
No Action Alternative			AA22	AA3											AA20			
Continued Operations Alternative																		
Continued Operations Alternative	AA1	AA2		AA3	AA24	AA6				AA14					AA20		AA21	

(shaded box) Requires evaluation of accidents that includes systematic scenario identification, estimation of accident frequencies, estimation of accident source terms.

(unshaded box) Does not require evaluation for bounding accidents based on currently available information.

Table C.4-11. Potentially bounding abnormal radiological events.

Accident analysis	Title	Description	Assumptions	Applicable alternatives
ABN 01	Fuel fire in calciner cell	This scenario is initiated by a kerosene spill-in the calciner cell. The products of combustion from a fire will degrade the HEPA filters in the ventilation system and release accumulated radionuclides on the filters.	The fuel fire is of sufficient magnitude to impact and degrade the HEPA filters. The HEPA filter activity data from the NWCF SAR is applicable. Radioactive inventories in other sections of the calciner cell are not assumed to be impacted. The source term is modeled as a fire-involving material on HEPA filters with corresponding release fraction data from DOE-STD-3010 (DOE 1994). The HEPA filter failure is assumed to result in a direct leak path to the environment. During normal operation, the building is equipped with active HEPA filtration, which would limit releases from other scenarios to the environment. The source term was decayed to 2000.	Planning Basis Option, Hot Isostatic Pressed Waste Option, Direct Cement Waste Option, and Continued Operations Alternative.
ABN 02	Kerosene leak through failed process connections	This accident resulted in a chemical release rather than a radiological release.	NA	NA
ABN 03	Bin set #2 cyclone housing failure	This scenario is initiated by failure of the bin set #2 cyclone housing by abnormal loads. This scenario could occur from earthquakes or human error. The bin set #2 cyclone housing presently contains about 1m^3 of calcine. The calcine released to the environment as a result of such a failure will be able to migrate away from the source and impact the environment.	The entire content of the bin set #2 cyclone housing is released and 40% of the calcine released is fines. Source term developed assuming potential inventory is the entire contents of the bin set #2 cyclone housing. Radioactive inventories in other sections of the bin sets are assumed to not be impacted. Radiological inventories based on bin set #1 activities because bin set #1 represents the highest inventory of all bin sets. The cyclone failure would create an open pathway to the atmosphere. During normal operation, the contents of the bin sets cyclone housing do not have direct access to the environment. Source term was decayed to 2016.	Full Separations Option; Planning Basis Option; TRU Separations Option; Hot Isostatic Pressed Waste Option; Direct Cement Waste Option; Early Vitrification Option; Minimum INEEL Processing Alternative; No Action Alternative; and Continued Operations Alternative.

Table C.4-11. Potentially bounding abnormal radiological events (continued).

Accident analysis	Title	Description	Assumptions	Applicable alternatives
ABN 04	Ion exchanger toxic release	This accident resulted in a chemical release rather than a radiological release.	NA	NA
ABN 05	Explosion from reaction of incompatible chemicals	This scenario is postulated to be initiated by human error or inadequate procedures during the chemical adjustment of SBW entering the separations process that results in the mixing of incompatible chemicals and results in a potentially energetic exothermic reaction. Consequences include release of SBW to material confinement.	The reaction breaches the process piping; the spill volume is assumed to be equivalent to the volume of one high-activity waste (HAW) surge tank (73 m^3 or 19,290 gal); operators take appropriate actions to terminate process flow after the explosion; all of the material spilled participates in the release; the release will be filtered by at least one stage of HEPA filtration with an efficiency of 99.95%; the cited source term value is appropriate for free fall spills of aqueous solutions; during normal operation, the contents of the Separations Facility do not have direct access to the environment; and source term was decayed to 2015.	TRU Separations Option.
ABN 06	Ion exchanger toxic release of hydrogen cyanide vapor	This accident resulted in a chemical release rather than a radiological release.	NA	NA
ABN 07	An electrical panel or motor fire in the Class C Grout process causes degradation of exhaust HEPA filters	This scenario is postulated to be initiated by an electrical panel or motor fire in the Class C Grout Facility. The equipment in the Grout Facility will be impacted to some extent because it was not designed to withstand the consequences of a fire. The products of combustion from a fire could degrade the HEPA filters in the ventilation system and release accumulated radionuclides.	The fire is of sufficient magnitude to impact the HEPA filters; source term developed assuming a fire impacting the radionuclide inventory on the HEPA filters after one year of accumulation. Radioactive inventories in other sections of the facility are assumed to not be impacted; the HEPA filter failure is assumed to result in a direct leak path to the environment; during normal operation, the building is equipped with active HEPA filtration, which would limit releases from other scenarios to the environment; source term was decayed to 2015.	Transuranic Separations Option and Minimum INEEL Processing Alternative.

Table C.4-11. Potentially bounding abnormal radiological evens (continued).

Accident analysis	Title	Description	Assumptions	Applicable alternatives
ABN 08	Melter insulation fire causes a HEPA filter failure	Electrical equipment failure initiates a fire in the melter insulation and causes equipment failures and loss of power. Melter heater controller fails in the "energized" condition. An insulation fire could generate massive amounts of smoke, which could overload and possibly collapse the heating, ventilation, and air conditioning (HVAC) HEPA filters. This could release the radioactive material trapped in the filters, as well as any radioactive material suspended in the building atmosphere, to the environment.	The fire is of sufficient magnitude to impact the HEPA filters; source term developed assuming a fire impacting the radionuclide inventory on the HEPA filters after one year of accumulation. Radioactive inventories in other sections of the facility are assumed to not be impacted; the HEPA filter failure is assumed to result in a direct leak path to the environment; during normal operation, the building is equipped with active HEPA filtration, which would limit releases from other scenarios to the environment; source term was decayed to 2015.	Full Separations Option and Planning Basis Option.
ABN 09	Melter insulation fire causes a HEPA filter failure	Electrical equipment failure initiates a fire in the melter insulation and causes equipment failures and, loss of power. Melter heater controller fails in the "energized" condition. An insulation fire could generate massive amounts of smoke, which could overload and possibly collapse the HVAC HEPA filters. This could release the radioactive material trapped in the filters, as well as any radioactive material suspended in the building atmosphere, to the environment.	The fire is of sufficient magnitude to impact the HEPA filters; source term developed assuming a fire impacting the radionuclide inventory on the HEPA filters after one year of accumulation. Radioactive inventories in other sections of the facility are assumed to not be impacted; the HEPA filter failure is assumed to result in a direct leak path to the environment; during normal operation, the building is equipped with active HEPA filtration, which would limit releases from other scenarios to the environment; and source term was decayed to 2015.	Early Vitrification Option.

Table C.4-11. Potentially bounding abnormal radiological events (continued).

Accident analysis	Title	Description	Assumptions	Applicable alternatives
ABN 10	Electrical panel/motor fire causes a HEPA filter failure	Electrical equipment failure initiates a fire, which causes equipment failures and loss of power. An electrical panel/motor fire could generate smoke, which could overload and possibly collapse the HVAC HEPA filters. This could release the radioactive material trapped in the filters, as well as any radioactive material suspended in the building atmosphere, to the environment.	The radioactive inventory of the filters distributed between 3 sets of 2-stage filters with each having an efficiency rating of 0.9995. The filters have been in operation for 1 year. Radioactive inventories in other sections of the Waste Packaging Facility are assumed to not be impacted. The HEPA filter failure would create an open pathway to the atmosphere. During normal operation, the contents of the Waste Packaging Facility do not have direct access to the environment. Source term was decayed to 2011.	Minimum INEEL Processing Alternative.
ANB 11	HIP machine insulation fire causes a HEPA filter failure	Electrical equipment failure initiates a fire in the HIP machine insulation and causes equipment failures and loss of power. HIP machine heater controller fails in the "energized" condition. An insulation fire could generate massive amounts of smoke, which could overload and possibly collapse the HVAC HEPA filters. This could release the radioactive material trapped in the filters, as well as any radioactive material suspended in the building atmosphere, to the environment.	The fire is of sufficient magnitude to impact the HEPA filters. Source term developed assuming a fire impacting the radionuclide inventory on the HEPA filters after one year of accumulation. Radioactive inventories in other sections of the facility are assumed to not be impacted. The HEPA filter failure is assumed to result in a direct leak path to the environment. During normal operation, the building is equipped with active HEPA filtration, which would limit releases from other scenarios to the environment. Source term was decayed to 2015.	Hot Isostatic Pressed Waste Option.

Table C.4-11. Potentially bounding abnormal radiological events (continued).

Accident analysis	Title	Description	Assumptions	Applicable alternatives
ABN 12	Autoclave insulation fire causes a HEPA filter failure	Electrical equipment failure initiates a fire in the autoclave insulation and causes equipment failures and loss of power. Autoclave heater controller fails in the "energized" condition. An insulation fire could generate massive amounts of smoke, which could overload and possibly collapse the HVAC HEPA filters. This could release the radioactive material trapped in the filters, as well as any radioactive material suspended in the building atmosphere, to the environment.	The fire is of sufficient magnitude to impact the HEPA filters. Source term developed assuming a fire impacting the radionuclide inventory on the HEPA filters after one year of accumulation. Radioactive inventories in other sections of the facility are assumed to not be impacted. The HEPA filter failure is assumed to result in a direct leak path to the environment. During normal operation, the building is equipped with active HEPA filtration, which would limit releases from other scenarios to the environment. Source term was decayed to 2015.	Direct Cement Waste Option.
ABN 13	Electrical panel/motor fire causes a HEPA filter failure	Electrical equipment failure initiates a fire, which causes equipment failures and loss of power. An electrical panel/motor fire could generate smoke, which could overload and possibly collapse the HVAC HEPA filters. This could release the radioactive material trapped in the filters, as well as any radioactive material suspended in the building atmosphere, to the environment.	The radioactive inventory of the filters distributed between 3 sets of 2-stage filters with each having an efficiency rating of 0.9995. The filters have been in operation for 1 year. Radioactive inventories in other sections of the Waste Packaging Facility are assumed to not be impacted. The HEPA filter failure would create an open pathway to the atmosphere. During normal operation, the contents of the Waste Packaging Facility do not have direct access to the environment. Source term was decayed to 2011.	Minimum INEEL Processing Alternative.

Table C.4-11. Potentially bounding abnormal radiological events (continued).

Accident analysis	Title	Description	Assumptions	Applicable alternatives
ABN 14	Leak from high activity waste surge tank	This scenario is initiated by a leak from the high-activity waste surge tank through failed process connections. A portion of the spilled material could be entrained as aerosol droplets in the vault ventilation and subsequently be released to the environment.	The released inventory is the volume of one high-activity waste surge tank (19,290 gallons). The activity/ radiological inventory in the high-activity waste surge tanks is assumed to be the same as the high-activity waste evaporator feed stream. The bounding condition is assumed to be based on evaporator operation when treating dissolved calcine from bin sets #1 and #4. At least one stage of HEPA filtration will be unaffected by the scenario and provide filtration to 99.95% efficiency prior to release to the environment. The source term is modeled as a spill involving an aqueous solution with corresponding release fraction data from DOE-STD-3010 (DOE 1994). Source term was decayed to 2016.	Continued Operations Alternative, Full Separations Option, Planning Basis Option, and Transuranic Separations Option.
ABN 15	Ammonia tank faillure	This accident resulted in a chemical release rather than a radiological release.	NA	NA
ABN 16	Failure of the Class C grout transfer line	This scenario is initiated by an unknown event that causes failure of the Class C grout transfer line, which would result in the loss of grout to the environment. The maximum material at risk is considered to be the maximum volume of grout pumped (2000 gal/hr) for a 1-hour period. The grout released to the environment as a result of such a failure will be able to migrate away from the source and impact the environment.	The radioactive inventory is the volume released to the environment during a piping failure that remains undetected for 1 hour (2,000 gallons). The entire quantity of grout is spread on the surface of the ground. The escaped grout solidifies very rapidly. The piping failure results in the wet grout being pumped directly to the surface of the ground, outside of any confinement. There is no energy source available to suspend additional material. During normal operations, the entire Class C grout transfer system does not have direct access to the environment. Source term was decayed to 2015.	Transuranic Separations Option.

Table C.4-11. Potentially bounding abnormal radiological events (continued).

Accident analysis	Title	Description	Assumptions	Applicable alternatives
ABN 17	Spill of material during canister filling	This scenario is initiated by a spill of material during canister filling operations. This could occur due to misalignment of the canister with the fill nozzle or overfilling of the canister. Some of the spilled material will be entrained in the ventilation system and exhausted into the environment, with potential consequences to the co-located workers and public.	The spilled inventory is equivalent to a spill from an operation proceeding at the maximum calcine retrieval rate (2,700 kg/hr) over an 8-hour shift. The HEPA filtration system is in operation and is 99.95% effective in filtering out particulate material. The inventory data is based on the contents of bin set #1. The source term is modeled as a free-fall spill of powder with the corresponding release fraction data from DOE-STD-3010 (DOE 1994). Source term was decayed to 2016.	Minimum INEEL Processing Alternative.
ABN 18	Spill of material during canister filling	This scenario is initiated by a spill of material during canister filling operations. This could occur due to misalignment of the canister with the fill nozzle or overfilling of the canister. Some of the spilled material will be entrained in the ventilation system and exhausted into the environment, with potential consequences to the co-located workers and public.	The operation is proceeding at the maximum calcine retrieval rate (2,700 kg/hr) and the spill is undetected for an 8-hour shift. The HEPA filtration system is in operation and is 99.95% effective in filtering out particulate material. The inventory data is based on the contents of bin set #1. The source term is modeled as a free-fall spill of powder with the corresponding release fraction data from DOE-STD-3010 (DOE 1994). Source term was decayed to 2016.	Minimum INEEL Processing Alternative.

Table C.4-11. Potentially bounding abnormal radiological events (continued).

Accident analysis	Title	Description	Assumptions	Applicable alternatives
ABN 19	Spill of material during canister filling	This scenario is initiated by a spill of material during canister filling operations. This could occur due to misalignment of the canister with the fill nozzle or overfilling of the canister. Some of the spilled material will be entrained in the ventilation system and be exhausted into the environment with potential consequences to the co-located workers and public.	The consequences from the calcine operation bound the consequences from the SBW operation. The operation is proceeding at the maximum calcine retrieval rate (2,700 kg/hr), and the spill is undetected for an 8-hour shift. The HEPA filtration system is in operation and is 99.95% effective in filtering out particulate material. The inventory data is based on the contents of bin set #1. The source term is modeled as a free-fall spill of powder with the corresponding release fraction data from DOE-STD-3010 (DOE 1994). Source term was decayed to 2016.	Minimum INEEL Processing Alternative.
ABN 20	Failure of bin set #1 structure	This scenario is initiated by a partial failure of a bin set as a result of a structural failure. Over many years, especially after the site is no longer under the jurisdiction of the DOE, the probability of a structural failure increases as tank monitoring is no longer performed and the tank ages. There is a potential that the released material could be exposed to the ground surface and get entrained in the air stream. This scenario is relatively likely after 2095 after the site is no longer under government control since monitoring systems and maintenance requirements would no longer be met.	A partial failure in one of the four bins in bin set #1 is postulated. Approximately 1% of the contents of 1 of the 4 bins is released. 40% of the calcine released is fines. The spilled material is exposed directly at the ground surface. The source term is modeled as the entrainment of powder in the air flow over the spill. The release fraction data from DOE-STD-3010 (DOE 1994) indicate that the airborne resuspension rate for powder is 4×10^{-5}/hr and the respirable fraction is 1.0. The spill is not contained and controlled in a manner such that the spilled material is shielded from the wind for a period of 30 days. Source term decayed to 2095.	Continued Operations Alternative and No Action Alternative.

Table C.4-11. Potentially bounding abnormal radiological events (continued).

Accident analysis	Title	Description	Assumptions	Applicable alternatives
ABN 21	A remote handled waste isolation pilot plant container drops and breaks open causing a spill	The forklift or crane operator drops a cask during transport. If operations personnel forget to fasten a cask lid so that if a cask is dropped material can spill out, or a cask drop occurs during transport within the transfer operations due to equipment failure or operator error, then localized consequences would result.	Only the material on the surface area of the unsolidified grout container is subject to material release. The facility structure and the ventilation system remains intact. During normal operations, the RH-TRU Stabilization and Preparation Facility does not have direct access to the environment. Source term decayed to 2015.	Continued Operations Alternative, Transuranic Separations Option, Planning Basis Option, Hot Isostatic Pressed Waste Option, Direct Cement Waste Option, and Minimum INEEL Processing Alternative.
ABN 22	Accident intrusion	Intrusion by unauthorized persons unprepared for contact with radioactive materials, from one or more tank results in significant exposures and potential groundwater release of materials.	Ten percent of the contents of the fullest pillar-and-panel tanks is released to the environment. Source term developed assuming radioactive inventory is the fullest of the five pillar-and-panel tanks. Radioactive inventories in other tanks in the tank farm are assumed to not be impacted. The vault failure would create an open pathway to subsurface soil with subsequent impact to groundwater. Since the spill is in liquid form, it is assumed that there is great downward mobility. Therefore, there is no airborne release for this scenario. Source term decayed to 2095.	No Action Alternative.
ABN 23	A dropped cask causes a release to the building interior	A forklift or crane operator dropping a cask during transport, which would result in the loss of material confinement, initiates this scenario. This scenario could occur if operations personnel forgot to fasten a cask lid and the vitrified SBW within the cask had not set-up prior to the accident. The spill of one cask within the SBW Packaging and Preparation Building will result in localized consequences.	The entire content of one RH-WIPP container is released to the facility interior. Only 50% of the molten SBW spills from the container. Radioactive inventories in other containers are not impacted. During this scenario, the content of the spilled container does not have direct access to the environment. Source term decayed to 2015.	Early Vitrification Option.

Table C.4-11. Potentially bounding abnormal radiological events (continued).

Accident analysis	Title	Description	Assumptions	Applicable alternatives
ABN 24	Failure of SBW collection tank in solidification facility	A spill of liquid SBW occurs due to collection tank failure from an unknown cause. The result is a localized consequence considered to be the contents of the SBW released will not be able to migrate away from the source and impact the environment.	The entire content of one of the two SBW receiving tanks is released to the interior of the facility. All other systems remain operational. The tank failure occurs on the tank bottom so the entire contents are drained. The ventilation system HEPA filters remain operational and the facility is intact. During normal operation, the contents of the collection tank vault do not have direct access to the environment. Source term decayed to 2015.	Continued Operations Alternative, Full Separations Option, Planning Basis Option, Transuranic Separations Option, Hot Isostatic Pressed Waste Option, Direct Cement Waste Option, Early Vitrification Option, and Minimum INEEL Processing Alternative.

Table C.4-12. Potentially bounding design basis radiological events.

Accident analysis	Title	Description	Assumptions	Applicable alternatives
DBE 01	Fuel explosion in calciner vessel	This scenario is initiated by a build up of excess fuel in the calciner bed followed by ignition causing a "roman candle" explosion and concurrent failure of the HEPA filtration system.	The calciner cell activity data from the NWCF SAR is applicable. The calciner cell activity is assumed to be the same as the calciner vessel activity. No credit is taken for the HEPA filter. The building is no longer leak tight. The spill involves the calcined product and the release properties for a powder explosion per DOE-STD-3010 (DOE 1994) are applicable. Source term decayed to 2000.	Planning Basis Option, Hot Isostatic Pressed Waste Option, Direct Cement Waste Option, and Continued Operations Alternative.
DBE 02	Carbon bed filter fire	Inadequate nitrous oxide destruction in the reduction chamber of the multi-stage combustion system leads to exothermic reactions in the filter bed. The heat buildup could result in a fire and a release of radioactive material (I-129) and mercury embedded in the filter bed.	The amount of I-129 trapped in the mercury filters is 6.2 kg (0.78 Ci). All of the I-129 is assumed to be available for release. Approximately 10% of the material is released into the surrounding area. Of that, 10% is released to the environment. No credit is taken for additional HEPA filtration. Source term decayed to 2011.	Planning Basis Option, Hot Isostatic Pressed Waste Option, Direct Cement Waste Option, and Continued Operations Alternative.
DBE 03	A flood causes failure of bin set #1	This scenario is initiated by a flood, which would result in a buckling failure of the bin set #1 vault and severe, immediate, and catastrophic consequences with the floodwaters filling the bin set confinement and causing the bin contents to mix with floodwaters in the vault. The calcine released could be brought to the surface where it would be exposed to the sunlight and dried.	10% of the contents of 1 of the 4 bins that comprise bin set #1 is released. In addition, it is assumed that 40% of the calcine released is fines. The spilled material is exposed directly at the ground surface. The source term is modeled as the entrainment of powder in the air flow over the spill. The release fraction data from DOE-STD-3010 (DOE 1994) indicate that the airborne resuspension rate for powder is 4×10^{-5}/hr. The spill is not contained and controlled in a manner such that the spilled material is shielded from the wind for a period of 30 days. Source term decayed to 2000.	No Action Alternative, Continued Operations Alternative, Full Separations Option, Planning Basis Option, Transuranic Separations Option, Hot Isostatic Pressed Option, Direct Cement Waste Option, Early Vitrification Option, and Minimum INEEL Processing Alternative.

Table C.4-12. Potentially bounding design basis radiological events (continued).

Accident analysis	Title	Description	Assumptions	Applicable alternatives
DBE 04	Organic-oxidant (red-oil) explosion during solvent treatment in the transuranic extraction or strontium extraction separations process results in failure of confinement	This scenario is postulated to be initiated by an organic-oxidant (red-oil) explosion during solvent treatment or evaporation of aqueous process streams containing solvents in the TRUEX or SREX separation processes that results in release of a significant quantity of radioactive and chemically hazardous material and simultaneous failure of operational confinement.	The explosion damages the three HAW surge tanks (73 m^3 or 19,290 gal each). The activity/radiological inventory in the HAW surge tanks is the same as the evaporator feed stream. The condition is based on evaporator operation when treating dissolved calcine from bin sets #1 and #4. All of the material is spilled from the tanks. The source term is appropriate for boiling aqueous solutions. Source term decayed to 2016.	Full Separations Option and Planning Basis Option.
DBE 05	Organic-oxidant (red-oil) explosion during solvent treatment in the transuranic extraction separations process results in failure of confinement	This scenario is postulated to be initiated by an organic-oxidant (red-oil) explosion during solvent treatment or evaporation of aqueous process streams containing solvents in the TRUEX separation processes that results in release of a significant quantity of radioactive and chemically hazardous material and simultaneous failure of operational confinement.	The explosion damages the three HAW surge tanks (73 m^3 or 19,290 gal each). The activity/radiological inventory in the HAW surge tanks is the same as the TRUEX strip stream. The condition is based on evaporator operation when treating dissolved calcine from bin sets #1 and #4. All of the material is spilled from the tanks. The source term is appropriate for boiling aqueous solutions. Source term decayed to 2015.	Transuranic Separations Option.
DBE 06	Liquid waste system failure with degradation of HEPA filtration	This scenario is initiated by a break in the liquid waste system that could result in flooding of equipment, release of materials to confinement, and if wetted, degraded functioning of the HEPA filtration system.	Failure of one of the two waste feed tanks for the Cs ion exchange system. The tank fails while filled to capacity. The activity/radiological inventory of the dissolved calcine stream bounds the SBW stream. All of the material spilled participates in the release. The filter wetting impairs the HEPA filters. The source term value is appropriate for free fall spills of aqueous solutions. The HEPA filter failure would create an open pathway to the atmosphere. Source term decayed to 2009.	Continued Operations Alternative and Minimum INEEL Processing Alternative.

Table C.4-12. Potentially bounding design basis radiological events (continued).

Accident analysis	Title	Description	Assumptions	Applicable alternatives
DBE 07	A seismic event causes failure of the denitrated solids feed vessel and facility structure	This scenario is initiated by a design basis seismic event which causes failure of the Class C Grout Facility structure and equipment which would result in the failure of the denitrated solids feed vessel and the loss of the primary and secondary vault containment barriers. The maximum material at risk is considered to be the maximum feed case, which is SBW and zirconia calcine prior to grouting.	The entire inventory of denitrated solids is released to the Class C Grout Facility non-containment area and 30% of the calcine released is in the respirable range. Source term developed assuming radioactive inventory is the entire contents of the denitrated solids containment vessel. The vault failure would create an open pathway to the atmosphere. During normal operation, the contents of the Class C Grout Facility do not have direct access to the environment. Source term decayed to 2015.	Transuranic Separations Option and Minimum INEEL Processing Alternative.
DBE 08	Steam explosion causes catastrophic melter failure	A steam explosion occurs in the borosilicate vitrification melter due to intrusion of water into the melter cell, which causes a catastrophic failure of the melter and release of vitrified waste material.	The steam explosion ruptures the melter and the entire contents of the melter are spilled in the melter cell. The explosion is of sufficient force to breach the Borosilicate Vitrification Facility. The radioactive inventory is assumed to be the contents of the operating melter. During normal operation, the content of the melter does not have direct access to the environment. Source term decayed to 2015.	Full Separations Option and Planning Basis Option.
DBE 09	Steam explosion causes catastrophic melter failure	A steam explosion occurs in the borosilicate vitrification melter due to intrusion of water into the melter cell, which causes a catastrophic failure of the melter and release of vitrified waste material.	The steam explosion ruptures the melter and the entire contents of the melter are spilled in the melter cell. The explosion is of sufficient force to breach the Borosilicate Vitrification Facility. The radioactive inventory is assumed to be the contents of the operating melter. During normal operation, the content of the melter does not have direct access to the environment. Source term decayed to 2015.	Early Vitrification Option.

Table C.4-12. Potentially bounding design basis radiological events (continued).

Accident analysis	Title	Description	Assumptions	Applicable alternatives
DBE 10	Chemical release nearby causes incapacitation or evacuation with equipment failure	Assuming the ventilation system is not designed to protect the facility from externally generated hazardous gases/materials, enough of a passing toxic chemical cloud of sufficient concentration could be drawn into the building through the ventilation system requiring personnel evacuation or causing personnel incapacitation.	The radioactive inventory of the filters distributed between 3 sets of 2-stage filters. The filters have been in operation for one year. Radioactive inventories in other sections of the Waste Packaging Facility are not impacted. The HEPA filter failure would create an open pathway to the atmosphere. During normal operation, the contents of the Waste Packaging Facility do not have direct access to the environment. Source term decayed to 2011.	Minimum INEEL Processing Alternative.
DBE 11	Hot isostatic press vessel ruptures and causes catastrophic failure of the hot isostatic press machine	A HIP Vessel rupture occurs in a HIP machine at nominal HIP conditions due to improper vessel manufacture, causing catastrophic failure of the HIP machine and release of blended calcine waste material.	The HIP Vessel failure causes the HIP can being processed to fail so that 10% of the contents of the can are ejected, of which 70% of the calcine is fines (the force of the explosion will create more fines). The explosion is of sufficient force to breach the facility. The radioactive inventory is assumed to be the contents of one HIP can. During normal operation, the content of the HIP machine does not have direct access to the environment. Source term decayed to 2015.	Hot Isostatic Pressed Waste Option.
DBE 12	Autoclave explosion causes catastrophic autoclave failure	An autoclave explosion occurs at nominal autoclave conditions due to improper vessel manufacture and causes catastrophic failure of the autoclave and release of blended calcine grout material.	The explosion ruptures the autoclave and releases blended calcine grout material. The explosion is of sufficient force to breach the facility. The radioactive inventory is assumed to be the contents of one canister. During normal operation, the content of the Direct Cementitious Waste Process does not have direct access to the environment. Source term decayed to 2015.	Direct Cement Waste Option.

Table C.4-12. Potentially bounding design basis radiological events (continued).

Accident analysis	Title	Description	Assumptions	Applicable alternatives
DBE 13	Chemical release nearby causes incapacitation or evacuation with equipment failure	Assuming the ventilation system is not designed to protect the facility from externally generated hazardous gases/materials, enough of a passing toxic chemical cloud of sufficient concentration could be drawn into the building through the ventilation system requiring personnel evacuation or causing personnel incapacitation.	The radioactive inventory of the filters distributed between 3 sets of 2-stage filters. The filters have been in operation for one year. Radioactive inventories in other sections of the Waste Packaging Facility are assumed to not be impacted. The HEPA filter failure would create an open pathway to the atmosphere. During normal operation, the contents of the Waste Packaging Facility do not have direct access to the environment. Source term decayed to 2011.	Minimum INEEL Processing Alternative.
DBE 14	Organic-nitric acid (red-oil) explosion	This scenario is initiated by an organic-nitric acid (red-oil) explosion in the evaporator. This could occur if the fugitive organics from upstream operations reacted with nitric acid.	The released inventory is the volume of three HAW surge tanks (19,290 gallons, each, or 57,870 gallons, total). The activity/radiological inventory in the HAW surge tanks is assumed to be the same as the HAW Evaporator feed stream. The condition is assumed to be based on evaporator operation when treating dissolved calcine from bin sets #1 and #4. At least one stage of HEPA filtration will be unaffected by the scenario. The source term is modeled as a boiling aqueous solution with corresponding release fraction data from DOE-STD-3010 (DOE 1994). Source term decayed to 2016.	Continued Operations Alternative, Full Separations Option, Planning Basis Option, Transuranic Separations Option, and Hot Isostatic Pressed Waste Option.
DBE 15	Ammonia tank failure	This accident analysis resulted in a chemical release rather than a radiological release.	NA	NA

Table C.4-12. Potentially bounding design basis radiological events (continued).

Accident analysis	Title	Description	Assumptions	Applicable alternatives
DBE 16	A seismic event causes failure of the Class C grout transfer line	This scenario is initiated by a design basis seismic event that causes failure of the Class C grout transfer line, which would result in the loss of grout to the environment. The maximum material at risk is considered to be the maximum volume of grout pumped (2000 gal/hr) for a 1-hour period.	The radioactive inventory is the volume released to the environment during a piping failure that remains undetected for 1 hour (2,000 gallons). The escaped grout solidifies very rapidly. The piping failure results in the wet grout being pumped directly to the surface of the ground, outside of any confinement. There is no energy source available to suspend additional material. During normal operations, the entire Class C grout transfer system does not have direct access to the environment. Source term decayed to 2015.	Transuranic Separations Option.
DBE 17	Spill of multiple canisters during transport	This scenario is initiated by a spill of multiple canisters during transport. Some of the spilled inventory will be entrained into the ventilation system and exhausted into the environment.	All three canisters are impacted and that one of the three canisters is spilled. It is assumed that the operation is proceeding at the maximum calcine retrieval rate (2,700 kg/hr). The HEPA filtration system is in operation and is 99.95% effective in filtering out particulate material. The inventory data is based on the contents of bin set #1. The source term is modeled as a free fall spill of powder with the corresponding release fraction data from DOE-STD-3010 (DOE 1994). Source term decayed to 2016.	Minimum INEEL Processing Alternative.

Table C.4-12. Potentially bounding design basis radiological events (continued).

Accident analysis	Title	Description	Assumptions	Applicable alternatives
DBE 18	Spill of multiple canisters during transport	This scenario is initiated by a spill of multiple canisters during transport. Some of the spilled inventory will be entrained into the ventilation system and exhausted into the environment.	All three canisters are impacted and that one of the three canisters is spilled. It is assumed that the operation is proceeding at the maximum calcine retrieval rate (2,700 kg/hr). The HEPA filtration system is in operation and is 99.95% effective in filtering out particulate material. The inventory data is based on the contents of bin set #1. The source term is modeled as a free fall spill of powder with the corresponding release fraction data from DOE-STD-3010 (DOE 1994). Source term decayed to 2016.	Minimum INEEL Processing Alternative.
DBE 19	Spill of multiple canisters during transport	This scenario is initiated by a spill of multiple canisters during transport. Some of the spilled inventory will be entrained into the ventilation system and exhausted into the environment.	Only the calcine operation is considered in the source term development. All three canisters are impacted and that of the three canisters is spilled. It is assumed that the operation is proceeding at the maximum calcine retrieval rate (2,700 kg/hr). The HEPA filtration system is in operation and is 99.95% effective in filtering out particulate material. The inventory data is based on the contents of bin set #1. The source term is modeled as a free fall spill of powder with the corresponding release fraction data from DOE-STD-3010 (DOE 1994). Source term decayed to 2016.	Minimum INEEL Processing Alternative.

Table C.4-12. Potentially bounding design basis radiological events (continued).

Accident analysis	Title	Description	Assumptions	Applicable alternatives
DBE 20	A seismic event causes failure of bin set #5	This scenario is initiated by a seismic event, which would result in buckling and failure of the bin set #5 vault and severe, immediate, and catastrophic consequences as the bin set bin contents escape into the environment. The maximum material at risk is considered to be the contents of bin set #5.	10% of the contents of 2 of the 7 bins that comprise bin set #5 is released. 40% of the calcine released is fines. Rubble covering the tank limits its contents from getting into the environment. The spilled material is exposed directly at the ground surface. The source term is modeled as the entrainment of powder in the air flow over the spill. The release fraction data from DOE-STD-3010 (DOE 1994) indicate that the airborne resuspension rate for powder is 4×10^{-5}/hr. The spill is not contained and controlled in a manner such that the spilled material is shielded from the wind for a period of 30 days. Source term decayed to 2095.	Continued Operations Alternative and No Action Alternative.
DBE 21	A criticality during TRUPACT container loading operations	A criticality in an unshielded area of the transport package assembly operations. It is assumed that waste canisters are in a critical geometric configuration, which allows a fissile release of energy.	The radioactive inventory is assumed to be the contents of one TRUPACT shipping container (14 drums). The building and the ventilation system remain intact. 100% of the noble gas fission products, 25% of the iodine radionuclides, and 0.05% of the TRU particulate produced in the event are released directly to the room atmosphere. Source term decayed to 2015.	Continued Operations Alternative, Planning Basis Option, Transuranic Separations Option, Hot Isostatic Pressed Waste Option, Direct Cement Waste Option, and Minimum INEEL Processing Alternative.

Table C.4-12. Potentially bounding design basis radiological events (continued).

Accident analysis	Title	Description	Assumptions	Applicable alternatives
DBE 22	A seismic event causes failure of a SBW tank	This scenario is initiated by failure of a pillar-and-panel vault by increased ground acceleration loads, which would result in the breach of the tank within the vaults. This scenario could occur from increased static loads created by a vault failure during an earthquake.	One hundred percent of the contents of the fullest pillar-and-panel tanks is released to the vault. Radioactive inventories in other tanks in the tank farm are not impacted. The vault failure would create an open pathway to subsurface soil with subsequent impact to groundwater. Since the spill is in liquid form, it is assumed that there is great downward mobility. Therefore, there is no airborne release for this scenario. Source term decayed to 2000.	No Action Alternative.
DBE 23	A seismic event causes failure of the SBW packing and preparation facility structure and equipment	This scenario is initiated by failure of the SBW Packing and Preparation Facility by abnormal stress, which would result in the loss of radioactivity containment. This scenario could occur from increased building stress created during an earthquake.	Only one of the 410 containers is ruptured during a seismic event. Radioactive inventories in other containers is assumed to not be impacted. The one ruptured container contains unsolidified borosilicate glass. The building (ISF) failure would create an open pathway to the atmosphere. During normal operation, the contents of the ISF do not have direct access to the environment. Source term decayed to 2015.	Early Vitrification Option.
DBE 24	A seismic event causes failure of the SBW retrieval and transport lines	This scenario is initiated by failure of the SBW retrieval and transport line by seismic stress, which would result in the loss of containment.	Source term developed assuming radioactive inventory is the entire contents of the SBW that is pumped in six hours (3,567 gallons). The transfer line failure would create an open pathway to the atmosphere. During normal operation, the contents of the SBW retrieval and transport system do not have direct access to the environment. Source term decayed to 2015.	Continued Operations Alternative, Full Separations Option, Planning Basis Option, Transuranic Separations Option, Hot Isostatic Pressed Waste Option, Direct Cement Waste Option, Early Vitrification Option, and Minimum INEEL Processing Alternative.

Table C.4-13. Potentially beyond design basis radiological events.

Accident analysis	Title	Description	Assumptions	Applicable alternatives
BDB 01	Aircraft crash	This scenario is initiated by an aircraft crash resulting in structural damage to the building and the blend and hold vessel with a subsequent fire.	The blend and hold cell activity data from the NWCF SAR is applicable. The blend and hold cell activity is assumed to be the same as the blend and hold vessel activity. The failure of the blend and hold vessel results from falling debris. The building failure provides a direct release path to the environment. The source term is modeled as a boiling pool of aqueous solutions with corresponding release fraction data from DOE-STD-3010 (DOE 1994). Source term decayed to 2000.	Planning Basis Option, Hot Isostatic Pressed Waste Option, Direct Cement Waste Option, and Continued Operations Alternative.
BDB 02	Aircraft crash	This accident resulted in a chemical release rather than a radiological release.	NA	NA
BDB 03	Aircraft crash	This scenario is initiated by a crash of a large aircraft into bin set #1. The accident is assumed to result in the loss of radioactive material confinement caused by penetration of aircraft parts into the vault and bin structures and an ensuing fire in the vault involving ignition of aviation fuel carried by the aircraft.	The engine will retain sufficient kinetic energy upon penetration of the vault to still be able to damage one bin. This damage would occur in such a manner as to allow 10% of the contents to be released to the vault. Since the aircraft fuel is contained within the fuselage and wings an aviation fuel-caused fire within the vault occurs, which results in large convection currents to release dust to atmosphere. Source term decayed to 2000.	No Action Alternative, Continued Operations Alternative, Full Separations Option, Planning Basis Option, Transuranic Separations Option, Hot Isostatic Pressed Waste Option, Direct Cement Waste Option, Early Vitrification Option, and Minimum INEEL Processing Alternative.

Table C.4-13. Potentially beyond design basis radiological events (continued).

Accident analysis	Title	Description	Assumptions	Applicable alternatives
BDB 04	Seismically induced failure of the three–high activity waste surge tanks with concurrent HEPA filter failure.	This scenario is postulated to be initiated by a seismic event. This seismic event causes failure of facility structure and equipment such that a release occurs with a direct pathway to the environment. Release of significant quantities of radioactive material could occur along with a significant fire to drive release of materials.	The earthquake damages the three high-activity waste surge tanks (73 m^3 or 19,290 gal each). It is assumed that all 3 of these tanks fail while filled to capacity. The activity/radiological inventory in the high-activity waste surge tanks is the same as the high-activity waste evaporator feed stream. The condition is based on evaporator operation when treating dissolved calcine from bin sets #1 and #4. The organic solutions do not pose an airborne toxic hazard. The subsequent fire and structural damage to the building provide a direct leak path to the environment. The spill results in a large pool of boiling aqueous material. The source term value is appropriate for fires involving boiling aqueous solutions. During normal operation, the building is equipped with active HEPA filtration, which would limit releases from other scenarios to the environment. Source term decayed to 2016.	Full Separations Option and Planning Basis Option.

Table C.4-13. Potentially beyond design basis radiological events (continued).

Accident analysis	Title	Description	Assumptions	Applicable alternatives
BDB 05	Seismically induced failure of the three-high activity waste surge tanks with concurrent HEPA filter failure.	This scenario is postulated to be initiated by a seismic event that would be powerful enough to create a leakage pathway to the environment. Release of significant quantities of radioactive material could occur along with a significant fire to drive release of materials.	The earthquake damages the three high-activity waste surge tanks (73 m^3 or 19,290 gal each). It is assumed that all 3 of these tanks fail while filled to capacity. The condition is based on evaporator operation when treating dissolved calcine from bin sets #1 and #4. The activity/radiological inventory in the high-activity waste surge tanks is assumed to be the same as the TRUEX strip stream. The organic solutions do not pose an airborne toxic hazard. The subsequent fire and structural damage to the building provide a direct leak path to the environment. The spill results in a large pool of boiling aqueous material. The source term value is appropriate for fires involving boiling aqueous solutions. During normal operation, the building is equipped with active HEPA filtration, which would limit releases from other scenarios to the environment. Source term decayed to 2015.	Transuranic Separations Option that requires the transuranic separation process.
BDB 06	Seismically induced failure of both feed tanks with concurrent HEPA filter failure	This scenario is postulated to be initiated by a seismic event that would be powerful enough to create a leakage pathway to the environment. Release of significant quantities of radioactive material could occur along with a significant fire to drive release of materials.	There are two feed tanks for the cesium ion exchange column. It is assumed that both of these tanks fail while filled to capacity. All of the material is spilled from the tanks that are impacted. The subsequent fire and structural damage to the building provide a direct leak path to the environment. The spill results in a large pool of boiling aqueous material. The source term value is appropriate for fires involving boiling aqueous solutions. During normal operation, the building is equipped with active HEPA filtration, which would limit releases from other scenarios to the environment. Source term decayed to 2009.	Continued Operations Alternative and Minimum INEEL Processing Alternative.

Table C.4-13. Potentially beyond design basis radiological events (continued).

Accident analysis	Title	Description	Assumptions	Applicable alternatives
BDB 07	Aircraft crash	This scenario is initiated by a crash of a large aircraft into the Class C Grout Facility, which results in the loss of radioactive material confinement and a fire in the vault involving ignition of aviation fuel carried by the aircraft.	The entire content of the denitrated solids containment vessel is released to the vault and that 1% of the calcine released to the vault is in the respirable fraction. The ensuing aviation fuel fire causes large convection currents to release material fines into the atmosphere. The vault failure would create an open pathway to the atmosphere. During normal operation, the contents of the Class C Grout Facility do not have direct access to the environment. Source term decayed to 2015.	Transuranic Separations Option and Minimum INEEL Processing Alternative.
BDB 08	Aircraft crash	This scenario is initiated by a crash of a large aircraft into the Borosilicate Vitrification Facility. The accident is assumed to result in the loss of radioactive material confinement caused by penetration of aircraft parts into the melter vault and an ensuing fire in the vault involving ignition of aviation fuel carried by the aircraft.	The engine will retain sufficient kinetic energy upon penetration of the vault to still be able to damage the melter. Since the aircraft fuel is contained within the fuselage and wings an aviation fuel-caused fire within the vault occurs, which results in large convection currents to release material to atmosphere. The radioactive inventory is the contents of the operating melter, the melter seal pot, and the glass canister. Source term decayed to 2015.	Full Separations Option and Planning Basis Option.
BDB 09	Aircraft crash	This scenario is initiated by a crash of a large aircraft into the Borosilicate Vitrification Facility. The accident is assumed to result in the loss of radioactive material confinement caused by penetration of aircraft parts into the melter vault and an ensuing fire in the vault involving ignition of aviation fuel carried by the aircraft.	The engine will retain sufficient kinetic energy upon penetration of the vault to still be able to damage the melter. Since the aircraft fuel is contained within the fuselage and wings an aviation fuel-caused fire within the vault occurs, which results in large convection currents to release material to atmosphere. The radioactive inventory is the contents of the operating melter, the melter seal pot, and the glass canister. Source term decayed to 2015.	Early Vitrification Option.

Table C.4-13. Potentially beyond design basis radiological events (continued).

Accident analysis	Title	Description	Assumptions	Applicable alternatives
BDB 10	Aircraft crash	This scenario is initiated by a crash of a large aircraft into the Waste Packaging Facility. The accident is assumed to result in the loss of radioactive material confinement caused by penetration of aircraft parts into the facility and an ensuing fire involving ignition of aviation fuel carried by the aircraft.	The engine will retain sufficient kinetic energy upon penetration of the wall to still be able to damage the Dispensing Tank. Since the aircraft fuel is contained within the fuselage and wings an aviation fuel-caused fire within the facility occurs, which results in large convection currents to release material to atmosphere. The radioactive inventory is the contents of the Dispensing Tank and the waste container being filled. Source term decayed to 2011.	Minimum INEEL Processing Alternative.
BDB 11	Aircraft crash	This scenario is initiated by a crash of a large aircraft into the HIP Facility. The accident is assumed to result in the loss of radioactive material confinement caused by penetration of aircraft parts into one of the two calcine blending tanks and an ensuing fire in the vault involving ignition of aviation fuel carried by the aircraft.	The engine will retain sufficient kinetic energy upon penetration of the vault to still be able to damage the calcine blending tank. Since the aircraft fuel is contained within the fuselage and wings an aviation fuel-caused fire within the vault occurs which results in large convection currents to release material to atmosphere. The radioactive inventory is the contents of one of the two calcine blending tanks. Source term decayed to 2015.	Hot Isostatic Pressed Waste Option.
BDB 12	Aircraft crash	This scenario is initiated by a crash of a large aircraft into the DCW Facility. The accident is assumed to result in the loss of radioactive material confinement caused by penetration of aircraft parts into the facility and an ensuing fire in the vault involving ignition of aviation fuel carried by the aircraft.	The engine will retain sufficient kinetic energy upon penetration of the vault to still be able to damage the Static Gravity Mixer. Since the aircraft fuel is contained within the fuselage and wings an aviation fuel-caused fire within the facility occurs, which results in large convection currents to release material to atmosphere. The radioactive inventory is the contents of the operating Static Gravity Mixer. Source term decayed to 2015.	Direct Cement Waste Option.

Table C.4-13. Potentially beyond design basis radiological events (continued).

Accident analysis	Title	Description	Assumptions	Applicable alternatives
BDB 13	Aircraft crash	This scenario is initiated by a crash of a large aircraft into the Waste Packaging Facility. The accident is assumed to result in the loss of radioactive material confinement caused by penetration of aircraft parts into the facility and an ensuing fire involving ignition of aviation fuel carried by the aircraft.	The engine will retain sufficient kinetic energy upon penetration of the vault to still be able to damage the Dispensing Tank and the waste container being filled. Since the aircraft fuel is contained within the fuselage and wings an aviation fuel-caused fire within the facility occurs which results in large convection currents to release material to atmosphere. The radioactive inventory is the contents of the Dispensing Tank and a waste container that is being filled. Source term decayed to 2011.	Minimum INEEL Processing Alternative.
BDB 14	Aircraft crash	This scenario is initiated by an aircraft crash resulting in structural damage to the building and the HAW surge tanks with a subsequent fire. A direct leak path to the environment exists.	The released inventory is the volume of three HAW surge tanks (19,290 gallons, each, or 57,870 gallons, total). The activity/radiological inventory in the HAW surge tanks is the same as the HAW Evaporator feed stream. The condition is assumed to be based on evaporator operation when treating dissolved calcine from bin sets #1 and #4. The building breach provides a direct release path to the environment. The source term is modeled as a fire involving large organic pools with the corresponding release fraction data from DOE-STD-3010 (DOE 1994). Source term decayed to 2016.	Continued Operations Alternative, Full Separations Option, Planning Basis Option, Transuranic Separations Option, and Hot Isostatic Pressed Waste Option.
BDB 15	Aircraft crash	This accident resulted in a chemical release rather than a radiological release.	NA	NA

Table C.4-13. Potentially beyond design basis radiological events (continued).

Accident analysis	Title	Description	Assumptions	Applicable alternatives
BDB 16	Aircraft crash	This scenario is initiated by a crash of a large aircraft into the Class C grout transfer line. The accident is assumed to result in the loss of radioactive material confinement caused by penetration of aircraft parts into the line structures and an ensuing fire involving ignition of aviation fuel carried by the aircraft.	The radioactive inventory is the volume released to the environment during a piping failure that remains undetected for 1 hour (2,000 gallons). Any grout released to the environment solidifies rapidly and this solidification process reduces any off-site consequences significantly. The piping failure results in the wet grout being pumped directly to the surface of the ground, outside of any confinement. Large convection currents release dust to atmosphere. During normal operations, the entire Class C grout transfer system does not have direct access to the environment. Source term decayed to 2015.	Transuranic Separations Option.
BDB 17	Aircraft crash	This scenario is initiated by an aircraft crash resulting in structural damage to the building and a railcar containing four casks (total of 12 canisters) with a subsequent fire.	All four casks in the railcar shipment are impacted. The operation is proceeding at the maximum calcine retrieval rate (2,700 kg/hr). The building breach provides a direct release path to the environment. The inventory data is based on the contents of bin set #1. The source term is modeled as a fire involving powder with the corresponding release fraction data from DOE-STD-3010 (DOE 1994). Source term decayed to 2016.	Minimum INEEL Processing Alternative.
BDB 18	Aircraft crash	This scenario is initiated by an aircraft crash resulting in structural damage to the building and a railcar containing four casks (total of 12 canisters) with a subsequent fire.	All four casks in the railcar shipment are impacted. The operation is proceeding at the maximum calcine retrieval rate (2,700 kg/hr). The building breach provides a direct release path to the environment. The inventory data is based on the contents of bin set #1. The source term is modeled as a fire involving powder with the corresponding release fraction data from DOE-STD-3010 (DOE 1994). Source term decayed to 2016.	Minimum INEEL Processing Alternative.

Table C.4-13. Potentially beyond design basis radiological events (continued).

Accident analysis	Title	Description	Assumptions	Applicable alternatives
BDB 19	Aircraft crash	This scenario is initiated by an aircraft crash resulting in structural damage to the building and a railcar containing four casks (total of 12 canisters) with a subsequent fire.	Only the calcine operation is considered in the source term development. All four casks in the railcar shipment are impacted. The operation is proceeding at the maximum calcine retrieval rate (2,700 kg/hr). The building breach provides a direct release path to the environment. The inventory data is based on the contents of bin set #1. The source term is modeled as a fire involving powder with the corresponding release fraction data from DOE-STD-3010 (DOE 1994). Source term decayed to 2016.	Minimum INEEL Processing Alternative.
BDB 20	Aircraft crash	This scenario is initiated by a crash of a large aircraft into bin set #5. The accident is assumed to result in the loss of radioactive material confinement caused by penetration of aircraft parts into the facility and an ensuing fire involving ignition of aviation fuel carried by the aircraft.	The penetration causes an open path to the environment. The engine will retain sufficient kinetic energy upon penetration of the vault to still be able to damage a bin (or bins). This damage would occur to the upper part of a bin because the majority of the bins are below grade. The bin breaches are sufficiently large. Ten percent of the contents of two of the 7 bins are released to the bin set #5 vault and that 40% of the calcine released to the vault is fines. Since the aircraft fuel is contained within the fuselage and wings an aviation fuel caused fire within the vault occurs which results in large convection currents to release calcine dust to the atmosphere. Radiological inventory is based on bin set #5 which has the largest inventory. Source term decayed to 2000.	No Action Alternative and Continued Operations Alternative.

Table C.4-13. Potentially beyond design basis radiological events (continued).

Accident analysis	Title	Description	Assumptions	Applicable alternatives
BDB 21	Aircraft crash	This scenario is initiated by a crash of a large aircraft into the RH-TRU Stabilization and Preparation Facility. The accident is assumed to result in the loss of radioactive material confinement caused by penetration of aircraft parts into the facility and an ensuing fire involving ignition of aviation fuel carried by the aircraft.	The entire content of one WIPP shipping container is released to the facility. The ensuing aviation fuel fire causes material to be released. The building failure would create an open pathway to the atmosphere. During normal operation, the contents of the RH-TRU Stabilization and Preparations Facility do not have direct access to the environment. Source term decayed to 2015.	Continued Operations Alternative, Planning Basis Option, Transuranic Separations Option, Hot Isostatic Pressed Waste Option, Direct Cement Waste Option, and Minimum INEEL Processing Alternative.
BDB 22	Aircraft crash	This scenario is initiated by a crash of an aircraft into the tank farm, which would result in the failure of a tank of SBW.	The radioactive inventory is assumed to be the tank containing the largest volume of SBW. The vault tank failure would create a restricted pathway to the atmosphere and no release to groundwater. During normal operation, the contents of the tank farm tanks do not have direct access to the environment. Source term decayed to 2000.	No Action Alternative.
BDB 23	Aircraft crash	This scenario is initiated by a crash of a large aircraft into the RH-TRU Stabilization and Preparation Facility. The accident is assumed to result in the loss of radioactive material confinement caused by penetration of aircraft parts into the facility and an ensuing fire involving ignition of aviation fuel carried by the aircraft.	At the end of 3 years of production, there will be 410 containers in the ISF awaiting transport to WIPP. Only one of these is ruptured during an aircraft crash. The one ruptured container contains liquid unsolidified borosilicate glass. The building (ISF) failure would create an open pathway to the atmosphere. During normal operation, the contents of the ISF do not have direct access to the environment. Source term decayed to 2015.	Early Vitrification Option.

Table C.4-13. Potentially beyond design basis radiological events (continued).

Accident analysis	Title	Description	Assumptions	Applicable alternatives
BDB 24	Flood causes failure of a SBW tank.	This scenario is initiated by a flood, which would result in the loss of the "heel" from one of the five empty SBW tanks to the groundwater. The flood would cause the empty SBW tank to float within its vault.	The flood floats one of the five empty tanks in the tank vaults and that all piping connections to the tanks are severed. It is further assumed that 10% of the tank heels mix with the floodwater in the tank vault and escapes to the environment. The tank failure results in the SBW leaking directly to the surface, outside of the vault. During normal operations, the contents of an empty SBW tank does not have direct access to the environment. Source term decayed to 2015.	Continued Operations Alternative, Full Separations Option, Planning Basis Option, Transuranic Separations Option, Hot Isostatic Pressed Waste Option, Direct Cement Waste Option, Early Vitrification Option, and Minimum INEEL Processing Alternative.

Table C.4-14. Potentially bounding abnormal events involving release of toxic chemicals.

Accident analysis	Title	Description	Assumptions	Applicable alternatives
ABN 02	Kerosene leak through failed process connections	This scenario is initiated by a kerosene spill from a kerosene storage tank caused during fuel loading operations. Although the tanks are double contained, all of the material (15,000 gallons) is assumed to enter the groundwater.	The entire storage tank contents (approximately 15,000 gallons) is released. The entire release enters the groundwater. No radiological inventories are impacted. Since the kerosene storage tanks are stored away from radiological inventories, a fire or explosion involving ignited kerosene would have limited consequences.	Planning Basis Option, Hot Isostatic Pressed Waste Option, Direct Cement Waste Option, and Continued Current Operations Alternative.
ABN 04	Ion exchanger toxic release of hydrogen cyanide vapor	This scenario is postulated to be initiated by human error or inadequate procedures during the cleaning or change-out operations associated with the ion exchange resin. This could result in the mixing of strong acid and cyanide compounds and a sudden energetic release of hydrogen cyanide gas within material confinement. Acid decomposition of the resin could liberate hydrogen cyanide gas. Toxic hazards to nearby workers can occur, as well as excessive radiation exposures from volatilized or entrained materials.	Operators take appropriate actions to terminate release of hydrogen cyanide vapor after the incident. The release of hydrogen cyanide vapor would be routed to the INTEC offgas cleanup system that contains an independent high-efficiency particulate air filter system and ensures a long release path to encourage dilution and plate-out of the gas. During normal operation, the offgas from the ion exchange column does not have direct access to the environment.	Full Separations Option and the Planning Basis Option.
ABN 06	Ion exchanger toxic release of hydrogen cyanide vapor	This scenario is postulated to be initiated by human error or inadequate procedures during the cleaning or change-out operations associated with the ion exchange resin. This could result in the mixing of strong acid and cyanide compounds and a sudden energetic release of hydrogen cyanide gas within material confinement. Acid decomposition of the resin could liberate hydrogen cyanide gas. Toxic hazards to nearby workers can occur as well as excessive radiation exposures from volatilized or entrained materials.	Operators take appropriate actions to terminate release of hydrogen cyanide vapor after the incident. The release would be routed to the INTEC offgas cleanup system that contains an independent high-efficiency particulate air filter system and ensures a long release path to encourage dilution and plate-out of the gas. During normal operation, the offgas from the ion exchange column does not have direct access to the environment.	Continued Current Operations Alternative and the Minimum INEEL Processing Alternative.

Table C.4-14. (Continued).

Accident analysis	Title	Description	Assumptions	Applicable alternatives
ABN 15	Ammonia tank failure	This scenario is initiated by a failure of the ammonia tank connections, resulting in a spill of ammonia. A fraction of the ammonia would flash to vapor as it escapes the tank. The remainder would settle and form a boiling pool.	The ammonia storage tank has a volume of 3,000 gallons. Ten percent of the ammonia is spilled from the tank. There is no absorption into the underlying surface and no groundwater impact.	Full Separations Option, Planning Basis Option, Transuranic Separations Option, Hot Isostatic Pressed Waste Option, Direct Cement Waste Option, Early Vitrification Option, and Minimum INEEL Processing Alternative.

Table C.4-15. Potentially bounding design basis event involving release of toxic chemicals.

Accident analysis	Title	Description	Assumptions	Applicable alternatives
DBE 02	Carbon Bed Filter Fire	A carbon filter bed fire initiates this scenario. Inadequate nitrous oxide destruction in the reduction chamber of the multi-stage combustion system leads to exothermic reactions in the filter bed. The heat buildup could result in a fire and a release of radioactive material (iodine-129) and mercury embedded in the filter bed.	An approximate value for the amount of mercury trapped in the mercury filters is 2,700 kilograms. All of the mercury is assumed to be available for release. Approximately 10 percent of the material is released into the surrounding area. Of that, 10 percent is released to the environment.	Planning Basis Option, Hot Isostatic Pressed Waste Option, Direct Cement Waste Option, and Continued Current Operations Alternative.
DBE 15	Ammonia Tank Failure	This scenario is initiated by a catastrophic failure of the ammonia tank resulting in a spill of the entire contents. A fraction of the ammonia would flash to vapor as it escapes the tank. The remainder would settle and form a boiling pool.	The ammonia storage tank has a volume of 3,000 gallons. One hundred percent of the ammonia is spilled from the tank. The material that does not immediately flash to vapor would form a boiling pool; there is no absorption into the underlying surface and no groundwater impact.	Full Separations Option, Planning Basis Option, Transuranic Separations Option, Hot Isostatic Pressed Waste Option, Direct Cement Waste Option, Early Vitrification Option, and Minimum INEEL Processing Alternative.

Table C.4.16. Potentially bounding beyond design basis accident involving release of toxic chemicals.

Accident analysis	Title	Description	Assumptions	Applicable alternatives
BDB 02	Aircraft Crash	This scenario is initiated by an aircraft crash resulting in structural damage to both kerosene tanks and a subsequent fire.	The entire inventory in two storage tanks is released (approximately 30,000 gallons). No radiological inventories are impacted. Since the kerosene storage tanks are stored away from radiological inventories, a fire or explosion involving ignited kerosene would have limited consequences. The entire release enters the groundwater, no product is consumed in the resultant fire.	Planning Basis Option, Hot Isostatic Pressed Waste Option, Direct Cement Waste Option, and Continued Current Operations Alternative.
BDB 15	Aircraft Crash	This scenario is initiated by an aircraft crash that fails the ammonia tank. A fraction of the ammonia would flash to vapor as it escapes the tank. The remainder would settle and form a boiling pool.	The ammonia storage tank has a volume of 3,000 gallons. One hundred percent of the ammonia is spilled from the tank. The material that does not immediately flash to vapor would form a boiling pool; there would be no absorption into the underlying surface and no groundwater impact.	Full Separations Option, Planning Basis Option, Transuranic Separations Option, Hot Isostatic Pressed Waste Option, Direct Cement Waste Option, Early Vitrification Option, and Minimum INEEL Processing Alternative.

Table C.4-17. Summary of bounding radiological events for the various waste processing alternatives.

Bounding accident analysis	Process title	Event description	Maximally-exposed individual dose (millirem)	Noninvolved worker dose (millirem)	Offsite population (person-rem)	Latent cancer fatalities to offsite population
		No Action Alternative				
ABN20	Long-Term Onsite Storage of Calcine in bin sets	Bin set system degradation over time results in failure of the outer containment and a portion of the internal containment in a bin set and the possibility of opening a bin set to the environment. Likelihood of this event increases after 2095 when monitoring and maintenance requirements would no longer be met.	170	1.2×10^4	1.3×10^3	0.65
DBE20	Long-Term Onsite Storage of Calcine in bin sets	Seismic failure of a bin set structure and equipment such that a release occurs with a direct pathway to the environment (no interdiction for 30 days).	9,700	6.6×10^5	6.6×10^4	33
BDB20	Long-Term Onsite Storage of Calcine in bin sets	An aircraft crash into a bin set causes failure of the structure and the release of materials from a portion of the internal containment.	420	2.9×10^4	3.5×10^3	1.8
		Continued Current Operations Alternative				
ABN20	Long-Term Onsite Storage of Calcine in bin sets	Bin set system degradation over time results in failure of the outer containment and a portion of the internal containment in a bin set and the possibility of opening a bin set to the environment. Likelihood of this event increases after 2095 when monitoring and maintenance requirements would no longer be met.	170	1.2×10^4	1.3×10^3	0.65
DBE20	Long-Term Onsite Storage of Calcine in bin sets	Seismic failure of a bin set structure and equipment such that a release occurs with a direct pathway to the environment (no interdiction for 30 days).	9,700	6.6×10^5	6.6×10^4	33
BDB20	Long Term Onsite Storage of Calcine in bin sets	An aircraft crash into a bin set causes failure of the structure and the release of materials from a portion of the internal containment.	420	2.9×10^4	3.5×10^3	1.8

Table C.4-17. Summary of bounding radiological events for the various waste processing alternatives (continued).

Bounding accident analysis	Process title	Event description	Maximally-exposed individual dose (millirem)	Noninvolved worker dose (millirem)	Offsite population (person-rem)	Latent cancer fatalities to offsite population
		Full Separations Option				
ABN24	SBW Retrieval and Onsite Transport	Operational error or equipment failure results in structural failure of one of the two SBW receiving tanks in a constructed receiving facility.	5.3×10^{-3}	0.36	0.056	2.8×10^{-5}
DBE04	Full Separation	An organic-oxidant (red-oil) explosion during solvent treatment in the transuranic separation or strontium extraction separations processes, results in release of a significant quantity of radioactive and chemically hazardous material and simultaneous failure of operational confinement.	460	3.2×10^{4}	3.5×10^{3}	1.8
BDB08	Borosilicate Vitrification	An aircraft crash into the facility results in structural failure, process equipment damage, and subsequent fire.	6.8×10^{4}	4.6×10^{6}	6.0×10^{5}	300
		Planning Basis Option				
ABN24	SBW Retrieval and Onsite Transport	Operational error or equipment failure results in structural failure of one of the two SBW receiving tanks in a constructed receiving facility.	5.3×10^{-3}	0.36	0.056	2.8×10^{-5}
DBE01	New Waste Calcining Facility Continued Operations	A calciner vessel explosion due to loss of operational control results in subsequent failure of HEPA filtration and a direct pathway to the environment.	350	2.4×10^{4}	5.9×10^{3}	2.9
BDB08	Borosilicate Vitrification	An aircraft crash into the facility results in structural failure, process equipment damage, and subsequent fire.	6.8×10^{4}	4.6×10^{6}	6.0×10^{5}	300
		Transuranic Separations Option				
ABN16	Class C Grout Disposal	Failure of the above ground grout transport line to the Container Filling, Storage, and Shipping Area.	5.8	390	71	0.035
DBE05	Transuranic Separation	An organic-oxidant (red-oil) explosion, during solvent treatment results in release of a significant quantity of radioactive and chemically hazardous material and simultaneous failure of operational confinement.	1.3×10^{3}	8.6×10^{4}	7.9×10^{3}	4.0
BDB05	Transuranic Separation	An earthquake with subsequent fire causes failure of three high-activity waste surge tanks such that a release occurs with a direct pathway to the environment.	1.3×10^{3}	8.6×10^{4}	7.9×10^{3}	4.0

Table C.4-17. Summary of bounding radiological events for the various waste processing alternatives (continued).

Bounding accident analysis	Process title	Event description	Maximally-exposed individual dose (millirem)	Noninvolved worker dose (millirem)	Offsite population (person-rem)	Latent cancer fatalities to offsite population
		Hot Isostatic Pressed Waste Option				
ABN24	SBW Retrieval and Onsite Transport	Operational error or equipment failure results in structural failure of one of the two SBW receiving tanks in a constructed receiving facility.	5.3×10^{-3}	0.36	0.056	2.8×10^{-5}
DBE01	New Waste Calcining Facility Continued Operations	A calciner vessel explosion due to loss of operational control results in subsequent failure of HEPA filtration and a direct pathway to the environment.	350	2.4×10^{4}	5.9×10^{3}	2.9
BDB14	Liquid Waste Stream Evaporation	An aircraft crash impacts the evaporator process building and releases material in the high-activity waste surge tanks. The fire and crash are assumed to breach the building and provide a direct release path to the environment.	460	3.2×10^{4}	3.5×10^{3}	1.8
		Direct Cement Waste Option				
ABN24	SBW Retrieval and Onsite Transport	Operational error or equipment failure results in structural failure of one of the two SBW receiving tanks in a constructed receiving facility.	5.3×10^{-3}	0.36	0.056	2.8×10^{-5}
DBE01	New Waste Calcining Facility Continued Operations	A calciner vessel explosion due to loss of operational control results in subsequent failure of HEPA filtration and a direct pathway to the environment.	350	2.4×10^{4}	5.9×10^{3}	2.9
BDB12	Direct Cement Waste Immobilization	An aircraft crash into the Direct Cement Waste Facility causes failure of the static gravity mixer.	1.0×10^{3}	7.1×10^{4}	1.1×10^{4}	5.6
		Early Vitrification Option				
ABN24	SBW Retrieval and Onsite Transport	Operational error or equipment failure results in structural failure of one of the two SBW receiving tanks in a constructed receiving facility.	5.3×10^{-3}	0.36	0.056	2.8×10^{-5}
DBE09	Borosilicate Vitrification	A steam explosion occurs in the melter due to intrusion of water into the melt cell, which causes catastrophic failure of the melter and release of vitrified waste material.	1.6	110	14	7.0×10^{-3}
BDB09	Borosilicate Vitrification	An aircraft crash into the facility results in structured failure of the operating melter, seal pot, and the glass canister, and a subsequent fire.	730	50,000	6.6×10^{3}	3.3

Table C.4-17. Summary of bounding radiological events for the various waste processing alternatives (continued).

Bounding accident analysis	Process title	Event description	Maximally-exposed individual dose (millirem)	Noninvolved worker dose (millirem)	Offsite population (person-rem)	Latent cancer fatalities to offsite population
		Minimum INEEL Processing Alternative				
ABN17	High-Level Waste Interim Storage for Transport	A spill of material during canister filling operations with some of the spilled material would be entrained in the ventilation system and be exhausted into the environment.	0.25	17	2.6	1.3×10^{-3}
DBE21	Transuranic Waste Stabilization and Preparation for Transport to Waste Isolation Pilot Plant	Inadvertent criticality during transuranic waste shipping container loading operations as a result of vulnerability to loss of control over storage geometry.	3.0	210	120	0.06
BDB17	High-Level Waste Interim Storage for Transport	An aircraft crash breaches the facility housing and impacts a rail car containing four casks. A subsequent fire could result in the release of the inventory.	4.9×10^{3}	3.4×10^{5}	5.3×10^{4}	26
		Cross-Cutting Accidents				
ABN03	Calcine Retrieval and Onsite Transport	Failure of a transfer line or cyclone housing due to operation error or equipment failure causing direct impact of heavy object such as construction crane.	0.014	0.94	150	0.073
DBE03/20	Calcine Retrieval and Onsite Transport	A flood causes failure of bin set #1 structure and equipment such that a release occurs after 2000 with a direct pathway to the environment.	3.8	260	4.5×10^{4}	22

Table C.4-24. Accident evaluation vs. alternatives/options.

AA	Process Element	No Action Alternative	Continued Operations Alternative	Separations Alternative - Full Separation Option	Separations Alternative - Planning Basis Option	Separations Alternative - Transuranic Separations Option	Non-Separations Alternative - Hot Isostatic Pressed Waste Option	Non-Separations Alternative - Direct Cement Waste Option	Non-Separations Alternative - Early Vitrification Option	Minimum INEEL Processing Alternative
1	NWCF Continued Operation		X		A, B		A, B	A, B		
2	NWCF High Temp & MACT Modifications		E		E		E	E		
3	Calcine Retrieval and On-Site Transport	X	X	F	F	F	F	F	F	F
4	Full Separations			B	B					
5	TRU Separation (TRUEX)					B, C				
6	Cesium Separations (Cs Ion Exchange)		X							X
7	Class C Grout					X				B
8	Borosilicate Vitrification (Cs, TRU, Sr)			C	C					
9	Borosilicate Vitrification (Calcine & SBW)								B, C	
10	HLW/SBW Immobilization for Transport (Calcine & Cs IX)									X
11	HLW/SBW Immobilization for Transport (HIP)						X			
12	HLW/SBW Immobilization for Transport (FUETAP)							C		
13	HLW/SBW Immobilization for Transport (Calcine & SBW)									
14	Liquid Waste Stream Evaporation		C	B	B	X	B, C	B		
15	Additional Offgas Treatment			D	D	D	D	D	D	D
16	Class C Grout Disposal					A				
17	HLW Interim Storage for Transport									A, C
18	HLW/HAW Stabilization and Preparation for Transport									A, C
19	HLW/HAW Stabilization and Preparation for Transport									
20	Long Term On-Site Storage of Calcine in CSSFs	A, B, C	A, B, C							
21	TRU Stabilization and Preparation for Transport to WIPP		X		X	X	X	X		B
22	Long Term On-Site Storage of SBW	E								
23	SBW Stabilization and Preparation for Transport to WIPP								X	
24	SBW Retrieval and On-Site Transport		X	A	A	X	A	A	A, B	X

A Abnormal Events (Radiological)
B Design Basis Events (Radiological)
C Beyond Design Basis (Radiological)
D Bounding Chemical Release Scenario For All Frequency Classes (Note: Other scenarios also involved potential releases of chemicals which could be classified as toxic. However, these releases involved either localized hazards or releases into groundwater. Localized hazards are mitigated by wearing appropriate safety gear when working with potentially toxic materials. Groundwater releases pose a greater long term hazard rather than a short term hazard. In the short term, mitigative measures for groundwater releases can be implemented through evacuation of potentially impacted populations. For these reasons, localized hazards and groundwater releases are not specifically considered in the bounding accident determination
E Bounding Groundwater Releases for all frequency classes
F Bounding abnormal and design basis radiological accident that cross-cuts all active alternatives
X Applicable Scenario

Table C.4-25. Risks from bounding facility accidents for waste processing alternatives.

Frequency category	Bounding accident scenario	Related accident frequency [1/year]	Bounding accident frequency [1/year]	Related window of exposure [years]	Bounding window of exposure [years]	Probability of occurrence [events]	Offsite public dose [rem]	Offsite public LCFs [fat./event]	Additional risk to offsite public [fat.]	Offsite public incr cancer risk [%]	Compared to DOE std
	No Action										
ABN	Degradation and failure of bin set structure and equipment		1.0×10^{-3}[n]		1.0×10^{2}[h,i]	1.0×10^{-1}	1.3×10^{3}	6.5×10^{-1}	6.5×10^{-2}	3.87×10^{-4}[s,t]	3.87×10^{-6}[u]
DBE	Seismic failure of bin set structure and equipment	5.0×10^{-5}	5.0×10^{-4}[k]	1.0×10^{2}	1.0×10^{1}[h,I]	4.0×10^{-2}[r]	6.6×10^{4}	3.3×10^{1}	1.32	7.86×10^{-3}[s,t]	7.86×10^{-5}[u]
BDB	Aircraft crash failure of bin set structure and equipment		2.05×10^{-8}[g]		1.0×10^{2}[h,I]	2.05×10^{-6}	3.5×10^{3}	1.75	3.59×10^{-6}	2.14×10^{-8}[s,t]	2.14×10^{-10}[u]
	Continued Current Operations										
ABN	Degradation and failure of bin set structure and equipment		1.0×10^{-3}[n]		1.0×10^{2}[h,I]	1.0×10^{-1}	1.3×10^{3}	6.5×10^{-1}	6.5×10^{-2}	3.87×10^{-4}[s,t]	3.87×10^{-6}[u]
DBE	Seismic failure of bin set structure and equipment	5.0×10^{-5}	5.0×10^{-4}[k]	1.0×10^{2}	1.0×10^{1}[h,I]	4.0×10^{-2}[r]	6.6×10^{4}	3.3×10^{1}	1.32	7.86×10^{-3}[s,t]	7.86×10^{-5}[u]
BDB	Aircraft crash failure of bin set structure and equipment		2.05×10^{-8}[g]		1.0×102[h,I]	2.05×10^{-6}	3.5×10^{3}	1.75	3.59×10^{-6}	2.14×10^{-8}[s,t]	2.14×10^{-10}[u]
	Full Separations Option										
ABN	Operational failure of SBW retrieval and transport system		3.0×10^{-3}[m]		2.0×10^{1}[h]	6.0×10^{-2}	5.6×10^{-2}	2.8×10^{-5}	1.68×10^{-6}	1.0×10^{-8}[s,t]	1.0×10^{-10}[u]
DBE	Organic oxidant explosion failure of Separations Facility structure and equipment		3.0×10^{-4}[j]		2.0×10^{1}[h]	6.0×10^{-3}	3.5×10^{3}	1.75	1.05×10^{-2}	6.25×10^{-5}[s,t]	6.25×10^{-7}[u]
BDB	Aircraft crash failure of Boro Silicate Facility structure and equipment		2.05×10^{-8}[g]		2.0×10^{1}[h]	4.1×10^{-7}	6.0×10^{5}	3.0×10^{2}	1.23×10^{-4}	7.32×10^{-7}[s,t]	7.32×10^{-9}[u]
	Planning Basis Option										
ABN	Operational failure of SBW retrieval and transport system		3.0×10^{-3}[m]		2.0×10^{1}[h]	6.0×10^{-2}	5.6×10^{-2}	2.8×10^{-5}	1.68×10^{-6}	1.0×10^{-8}[s,t]	1.0×10^{-10}[u]
DBE	Calciner explosion failure of New Waste Calcining Facility structure and equipment		1.0×10^{-4}[o]		2.0×10^{1}[h]	2.0×10^{-3}	5.9×10^{3}	2.95	5.9×10^{-3}	3.51×10^{-5}[s,t]	3.51×10^{-7}[u]

Table C.4-25. Risks from bounding facility accidents for waste processing alternatives (continued).

Frequency category	Bounding accident scenario	Related accident frequency [1/year]	Bounding accident frequency [1/year]	Related window of exposure [years]	Bounding window of exposure [years]	Probability of occurrence [events]	Offsite public dose [rem]	Offsite public LCFs [fat./event]	Additional risk to offsite public [fat.]	Offsite public incr cancer risk [%]	Compared to DOE std
BDB	Aircraft crash fails Vitrification Facility structure and equipment		2.05×10^{-8}[g]		2.0×10^{1}[h]	4.1×10^{-7}	6.0×10^{5}	3.0×10^{2}	1.23×10^{-4}	7.32×10^{-7}[s,t]	7.32×10^{-9}[u]
	Transuranic Separations Option										
ABN	Operational failure of Class C grout transport system		3.0×10^{-3}[m]		2.0×10^{1}[h]	6.0×10^{-2}	7.1×10^{1}	3.55×10^{-2}	2.13×10^{-3}	1.27×10^{-5}[s,t]	1.27×10^{-7}[u]
DBE	Organic oxidant explosion failure of Separations Facility structure and equipment		3.0×10^{-4}[j]		2.0×10^{1}[h]	6.0×10^{-3}	7.9×10^{3}	3.95	2.37×10^{-2}	1.41×10^{-4}[s,t]	1.41×10^{-6}[u]
BDB	Seismic failure of high-activity waste surge equipment		$5.0\times1^{0-5}$l		2.0×10^{1}[h]	1.0×10^{-3}	7.9×10^{3}	3.95	3.95×10^{-3}	2.35×10^{-5}[s,t]	2.35×10^{-7}[u]
	Hot Isostatic Pressed Waste Option										
ABN	Operational failure of SBW retrieval and transport system		3.0×10^{-3}[m]		2.0×10^{1}[h]	6.0×10^{-2}	5.6×10^{-2}	2.8×10^{-5}	1.68×10^{-6}	1.0×10^{-8}[s,t]	1.0×10^{-10}[u]
DBE	Calciner explosion failure of New Waste Calcining Facility structure and equipment		1.0×10^{-4}[o]		2.0×10^{1}[h]	2.0×10^{-3}	5.9×10^{3}	2.95	5.9×10^{-3}	3.51×10^{-5}[s,t]	3.51×10^{-7}[u]
BDB	Aircraft crash fails evaporator structure and equipment		2.05×10^{-8}[g]		2.0×10^{1}[h]	4.1×10^{-7}	3.5×10^{3}	1.75	7.18×10^{-7}	4.27×10^{-9}[s,t]	4.27×10^{-11}[u]
	Direct Cement Waste Option										
ABN	Operational failure of SBW retrieval and transport system		3.0×10^{-3}[m]		2.0×10^{1}[h]	6.0×10^{-2}	5.6×10^{-2}	2.8×10^{-5}	1.68×10^{-6}	1.0×10^{-8}[s,t]	1.0×10^{-10}[u]
DBE	Calciner explosion failure of New Waste Calcining Facility structure and equipment		1.0×10^{-4}[o]		2.0×10^{1}[h]	2.0×10^{-3}	5.9×10^{3}	2.95	5.9×10^{-3}	3.51×10^{-5}[s,t]	3.51×10^{-7}[u]
BDB	Aircraft crash fails Cement Waste Facility structure and equipment		2.05×10^{-8}[g]		2.0×10^{1}[h]	4.1×10-7	1.1×10^{4}	5.5	2.26×10^{-6}	1.34×10^{-8}[s,t]	1.34×10^{-10}[u]

Table C.4-25. Risks from bounding facility accidents for waste processing alternatives (continued).

Frequency category	Bounding accident scenario	Related accident frequency [1/year]	Bounding accident frequency [1/year]	Related window of exposure [years]	Bounding window of exposure [years]	Probability of occurrence [events]	Offsite public dose [rem]	Offsite public LCFs [fat./event]	Additional risk to offsite public [fat.]	Offsite public incr cancer risk [%]	Compared to DOE std
	Early Vitrification Option										
ABN	Operational failure of SBW retrieval and transport system		3.0×10^{-3}		2.0×10^{1h}	6.0×10^{-2}	5.6×10^{-2}	2.8×10^{-5}	1.68×10^{-6}	$1.0\times10^{-8s,t}$	1.0×10^{-10u}
DBE	Steam explosion fails Vitrification Facility structure and equipment		1.0×10^{-4p}		2.0×10^{1h}	2.0×10^{-3}	1.4×10^{1}	7.0×10^{-3}	1.4×10^{-5}	$8.33\times10^{-8s,t}$	8.33×10^{-10u}
BDB	Aircraft crash fails Vitrification Facility structure and equipment		2.05×10^{-8g}		2.0×10^{1h}	4.1×10^{-7}	6.6×10^{3}	3.3	1.35×10^{-6}	$8.05\times10^{-9s,t}$	8.05×10^{-11u}
	Minimum INEEL Processing										
ABN	Operations failure in canister filling facility		3.0×10^{-3m}		2.0×10^{1h}	6.0×10^{-2}	2.6	1.3×10^{-3}	7.8×10^{-5}	$4.64\times10^{-7s,t}$	4.64×10^{-9u}
DBE	Criticality fails transuranic waste shipping facility structure and equipment		1.0×10^{-5q}		2.0×10^{1h}	2.0×10^{-4}	1.2×10^{2}	6.0×10^{-2}	1.2×10^{-5}	$7.14\times10^{-8s,t}$	7.14×10^{-10u}
BDB	Aircraft crash fails railcar storage facility		2.05×10^{-8g}		2.0×10^{1h}	4.1×10^{-7}	5.3×10^{4}	2.65×10^{1}	1.09×10^{-5}	$6.47\times10^{-8s,t}$	6.47×10^{-10u}
	Cross-Cut, All Alternatives										
ABN	Impact failure of transfer line, bin set 1 transfer equipment		3.0×10^{-3a}		6.0^{b}	1.8×10^{-2}	1.5×10^{2}	7.5×10^{-2}	1.35×10^{-3}	$8.04\times10^{-6s,t}$	8.04×10^{-8u}
DBE	Flood induced failure of bin set during calcine storage	1.0×10^{-6}	$1.0\times10^{-4c,d}$	3.8×10^{2}	$6.0^{e,f}$	4.58×10^{-3r}	4.5×10^{4}	2.25×10^{1}	1.03×10^{-1}	$6.13\times10^{-4s,t}$	6.13×10^{-6u}

a. During transfer of calcine from bin set, impact of transfer lines, equipment, temporary storage would produce a release calcine waste, calcine fines, etc. directly to the environment. Scenarios resulting in dropping of a heavy load on transfer equipment or temporary storage are assumed to be dominated by human failures. Catastrophic human failure during transfer operations is assessed as 0.001/activity with 30 activities per year.

b. Transfer of calcine from a single bin set is predicated on estimates of 30 years to remove all calcine waste (7 bin sets), 2 addition years required for the first transfer.

c. Several INEEL specific evaluations of flood frequency support an estimate of 10,000 years as a recurrence frequency for a flood that reaches elevation 4,912, the bottom of the berm surrounding bin set 1. Bin set 1 is known to be statically unstable. To assess the likelihood of bin set failure, it is assumed that a flood reaching the bottom of bin set 1 would liquify the earth surrounding bin set 1 and result in structural failure of the vault. Failure of the vault would result in the bin set lid falling on top of and failing the internal stainless steel bins. Calcine material would then be transported to the environment in flood waters.

d. Conditional failure of bin sets given the occurrence of a flood that reaches 4,912 feet is assumed to be 0.01 or less.

e. DOE intends to remove waste from bin set 1 at the earliest possible date. Therefore the period of vulnerability for bin set 1 flooding is assumed to be 10 years or less.

f. DOE does not intend to remove waste from bin sets 2 through 7 under no action and continued operations scenarios. Period of vulnerability for flooding failure of bin sets 2 through 7 is estimated based on 475 years of remaining useful design life minus 95 years (to 2095) after which mitigation efforts in a flood cannot be assured.

Table C.4-25. Risks from bounding facility accidents for waste processing alternatives (continued).

g. Data from NUREG 800 and military sources agree that the frequency of aircraft impacts decreases with distance from an existing runway, from 1.7×10^{-7}/movement-sq.mi. within a mile of the runway to 1.2×10^{-9}/movement-sq.mi. at 10 miles. After 5 miles the rate of decrease is dramatically less, and it is assumed that the rate beyond 10 miles is asymptotic to 1.0×10^{-9}/movement-sq.-mi. It is assumed that aircraft with sufficient mass to penetrate a bin set land and take off from Idaho Falls airport at a rate of 6 per day or 2,190 movements/year. It is also assumed that INTEC bin sets and other facilities with potentially hazardous inventories occupy approximately 6 acres of exposed land area. Therefore the area over which aircraft induced fires and releases can occur is less than 0.01 sq.-mi.

h. Period of vulnerability for operational or external events threatening INTEC facilities is estimated based on the estimated time the facility is in use, or the time at which the contents of the facility no longer pose a significant offsite hazard.

i. Half lives of strontium-90 and cesium-137 are 27.7 and 30.2 years respectively. Risk from air releases of stored calcine is assumed to be dominated by cesium and strontium release components. Significant risk exists up to the period of time in which Cs decays to < 10% of its existing inventory, a period of 100 years.

j. An oxidant explosion is modeled as a complex set of human errors and equipment failures. Without a systems model, it is difficult to predict a systems based event frequency. Several similar failures have occurred over approximately 1,000 years of reprocessing operations around the world. If the conditional likelihood of a catastrophic explosion is 0.01 the frequency of the event is estimated to be 3×10^{-5}/year.

k. Bin sets 2 through 7, designed to meet STD 1024 criteria, should withstand a 10,000 year earthquake. The frequency of seismic induced failure for bin sets 2 through 7 is estimated using a fragility factor of 2. Division of STD 1024 criteria by 2 provides a measure of the frequency of an earthquake that threatens the integrity of bin sets 2 through 7. Therefore, the frequency of seismic failure for bin sets 2 through 7 is 5×10^{-5}/year. Bin set 1 does not meet STD 1024. An estimate of 5×10^{-4}/year is used for frequency of earthquake induced failure.

l. Same assumptions used to evaluate bin set is used to estimate frequency of seismically induced failure for high-activity waste storage.

m. Frequency of failure is based on likelihood of human or equipment based failure being > 0.01/year and < 0.01/year. A geometric mean of 0.03/year is used.

n. Frequency estimated to be 1×10^{-6}/year for first year of performance period, varying upward to 1 in last year of performance period. Performance period estimated to be 380 years based on 2085 cessation of maintenance and surveillance. Geometric mean of failure frequency, 1×10^{-3} is used to estimate frequency of bin set failure during performance period.

o. Estimate of 1×10^{-4}/year of New Waste Calcining Facility operation for catastrophic failure of calciner cell is estimated using Safety Analysis Report for the facility.

p. Estimate based on vulnerability to catastrophic failure of operational control allowing aqueous material to enter melter cell. 1×10^{-3}/year used to estimate loss of operational control with factor of 10 reduction to catastrophic loss.

q. Estimate based on failure of double contingency criteria given two supposedly independent failures with a frequency of 1×10^{-3}. Factor of 10 increase used to address potential for common cause failure of contingency controls.

r. Where two bounding accident scenarios with the same consequences but different frequencies of occurrence and different windows of vulnerability are defined, risk from both scenarios is evaluated cumulatively.

s. Expected fatalities to the offsite public from a radiological release accident are estimated as the multiple of the total probability of accident occurrence, the resulting population dose, and the conversion 5×10^{-4} latent cancer fatalities per person-rem.

t. Increase in cancer risk from a radiological accident is the ratio of expected additional cancer deaths from the accident to the background cancer rate in a demographic area. Background risk of cancer is estimated based on 500,000 cancer deaths per year in US (population = 250,000,000), an average lifespan of 70 years, and a resident population of 120,000 in the affected area.

u. DOE facility safety assurance criteria as stated in DOE 5480.23 and DOE STD 1027 are designed to ensure that credible radiological and chemical release accidents do not occur more frequently than 1×10^{-6}/year, or contribute more than a 1 in 1,000,000 increase in latent cancers over background.

Table C.4-27. Facility disposition accidents summary.

Facility number	Facility title	Clean closure	Performance	Landfill Stds	Material at risk at closure	Contaminant mobility at closure	Energy for accident at closure	Maximum plausible accident	Bounding operations accident[a]
CPP-601	Fuel Processing Building		●		Low levels of radioactive and hazardous material residue after cease-use removal activities	Low mobility potential for contaminants affixed to surfaces or trapped in inaccessible locations	Low energy sources due to routine closure activities and removal of combustible materials	Accidental fire during demolition activities could release contaminants beyond the working area	Radiological: criticality event releasing significant radioactivity to the atmosphere
CPP-604	Waste Treatment Building			●	Low levels of radioactive and hazardous material residue after cease-use removal activities	Low mobility potential for contaminants affixed to surfaces or trapped in inaccessible locations	Low energy sources due to routine closure activities and removal of combustible materials	Accidental fire during demolition activities could release contaminants beyond the working area	Radiological: criticality event releasing significant radioactivity to the atmosphere
CPP-605	Blower Building			●	Low levels of radioactive and hazardous material residue after cease-use removal activities	Low mobility potential for contaminants affixed to surfaces or trapped in inaccessible locations	Low energy sources due to routine closure activities and removal of combustible materials	Accidental fire during demolition activities could release contaminants beyond the working area	Chemical release due to ammonia gas explosion in the former NO_x Pilot Plant during New Waste Calcining Facility testing
CPP-627	Remote Analytical Facility		●		Low levels of radioactive and hazardous material residue after cease-use removal activities	Low mobility potential for contaminants affixed to surfaces or trapped in inaccessible locations	Low energy sources due to routine closure activities and removal of combustible materials	Accidental fire during demolition activities could release contaminants beyond the working area	Radionuclide spill in the CPP-627 cave; classified as an abnormal event
CPP-640	Head End Process Plant		●		Low levels of radioactive and hazardous material residue after cease-use removal activities	Low mobility potential for contaminants affixed to surfaces or trapped in inaccessible locations	Low energy sources due to routine closure activities and removal of combustible materials	Accidental fire during demolition activities could release contaminants beyond the working area	Transfer cask criticality initiated by addition of water moderator to 24 Rover fuel tubes
CPP-659	New Waste Calcining Facility		●		Low levels of radioactive and hazardous material residue after cease-use removal activities	Low mobility potential for contaminants affixed to surfaces or trapped in inaccessible locations	Low energy sources due to routine closure activities and removal of combustible materials	Crane drops or equipment malfunctions during decontamination or demolition activities	Flood-induced failure of bin sets, the design basis event for calcine storage in No Action and Continued Current Operations Alternatives
CPP-666 and 767	Fluorinel Storage Facility and Stack	●	●		Low levels of radioactive and hazardous material residue after cease-use removal activities	Low mobility potential for contaminants affixed to surfaces or trapped in inaccessible locations	Low energy sources due to routine closure activities and removal of combustible materials	Accidental fire during demolition activities could release contaminants beyond the working area	Criticality event in Spent Nuclear Fuel Storage Area
CPP-684	Remote Analytical Laboratory		●		Low levels of radioactive and hazardous material residue after cease-use removal activities	Low mobility potential for contaminants affixed to surfaces or trapped in inaccessible locations	Low energy sources due to routine closure activities and removal of combustible materials	High winds disperse residual contaminants freed during routine demolition activities	Failure of CPP-684 containment releasing entire contents of Analytical Cell

Table C.4-27. Facility disposition accidents summary (continued).

Facility number	Facility title	Clean closure	Performance	Landfill Stds	Material at risk at closure	Contaminant mobility at closure	Energy for accident at closure	Maximum plausible accident	Bounding operations accident[a]
CPP-1618	Liquid Effluent Treatment & Disposal Building	●			Low levels of radioactive and hazardous material residue after cease-use removal activities	Low mobility potential for contaminants affixed to surfaces or trapped in inaccessible locations	Low energy sources due to routine closure activities and removal of combustible materials	Accidental fire during demolition activities could release contaminants beyond the working area	Explosion in fractionator releasing radioactivity to the atmosphere
CPP-708	Main Stack			●	Low levels of radioactive and hazardous material	Low mobility potential for contaminants affixed to surfaces or trapped in inaccessible locations	Low energy sources due to gradual disassembly of stack	Accidental drop of stack segment during disassembly	Main stack toppled westward by earthquake, crushing CPP-756 prefilters and CPP-604 offgas filter
CPP-713	Vault for Tanks VES-WM-187, 188, 189, and 190	●	●	●	Low levels of radioactive and hazardous material	Low mobility ensured by pipe capping and filling the tanks with Class C grout or clean fill material	Low energy sources during SBW retrieval, removal of combustible materials, and routine dispositioning	Rupture or break in the SBW transfer lines during SBW retrieval operations	Flood-induced failure of bin sets, the design basis event for calcine storage in No Action and Continued Current Operation Alternatives
CPP-729	Bin set #1	●	●	●	Low levels of radioactive and hazardous material	Low mobility ensured by pipe capping and filling the bin sets with Class C grout or clean fill material	Low energy sources during Calcine Retrieval and Transport Project, removal of combustible materials, and routine dispositioning	Rupture or break in the calcine transfer lines during Calcine Retrieval and Transport operations	Flood-induced failure of bin sets, the design basis event for calcine storage in No Action and Continued Current Operation Alternatives
CPP-742	Bin set #2	●	●	●	Low levels of radioactive and hazardous material	Low mobility ensured by pipe capping and filling the bin sets with Class C grout or clean fill material	Low energy sources during Calcine Retrieval and Transport Project, removal of combustible materials, and routine dispositioning	Rupture or break in the calcine transfer lines during Calcine Retrieval and Transport operations	Flood-induced failure of bin sets, the design basis event for calcine storage in No Action and Continued Current Operation Alternatives
CPP-746	Bin sets #3	●	●	●	Low levels of radioactive and hazardous material	Low mobility ensured by pipe capping and filling the bin sets with Class C grout or clean fill material	Low energy sources during Calcine Retrieval and Transport Project, removal of combustible materials, and routine dispositioning	Rupture or break in the calcine transfer lines during Calcine Retrieval and Transport operations	Flood-induced failure of bin sets, the design basis event for calcine storage in No Action and Continued Current Operation Alternatives

Table C.4-27. Facility disposition accidents summary (continued).

Facility number	Facility title	Clean closure	Performance	Landfill Stds	Material at risk at closure	Contaminant mobility at closure	Energy for accident at closure	Maximum plausible accident	Bounding operations accident[a]
CPP-756 and 649	Prefilter Vault and Atmospheric Protection System Building			●	Low levels of radioactive and hazardous material residue after cease-use removal activities	Low mobility ensured by pipe capping and installation of a site protective cover during closure activities	Low energy sources due to routine closure activities and removal of combustible materials	Accidental fire during demolition activities could release contaminants beyond the working area	Fire that begins in prefilters and spreads to all 104 final HEPA filters, releasing radioactivity to the atmosphere
CPP-760	Bin set #4	●	●	●	Low levels of radioactive and hazardous material	Low mobility ensured by pipe capping and filling the bin sets with Class C grout or clean fill material	Low energy sources during Calcine Retrieval and Transport Project, removal of combustible materials, and routine dispositioning	Rupture or break in the calcine transfer lines during Calcine Retrieval and Transport operations	Flood-induced failure of bin sets, the design basis event for calcine storage in No Action and Continued Current Operation Alternatives
CPP-765	Bin set #5	●	●	●	Low levels of radioactive and hazardous material	Low mobility ensured by pipe capping and filling the bin sets with Class C grout or clean fill material	Low energy sources during Calcine Retrieval and Transport Project, removal of combustible materials, and routine dispositioning	Rupture or break in the calcine transfer lines during Calcine Retrieval and Transport operations	Flood-induced failure of bin sets, the design basis event for calcine storage in No Action and Continued Current Operation Alternatives
CPP-780 through CPP-786	Vaults for Tanks VES-WM-180-186	●	●	●	Low levels of radioactive and hazardous material	Low mobility ensured by pipe capping and filling the tanks with Class C grout or clean fill material	Low energy sources during SBW retrieval, removal of combustible materials, and routine dispositioning	Rupture or break in the SBW transfer lines during SBW retrieval operations	Flood-induced failure of bin sets, the design basis event for calcine storage in No Action and Continued Current Operation Alternatives
CPP-791	Bin set #6	●	●	●	Low levels of radioactive and hazardous material	Low mobility ensured by pipe capping and filling the bin sets with Class C grout or clean fill material	Low energy sources during Calcine Retrieval and Transport Project, removal of combustible materials, and routine dispositioning	Rupture or break in the calcine transfer lines during Calcine Retrieval and Transport operations	Flood-induced failure of bin sets, the design basis event for calcine storage in No Action and Continued Current Operation Alternatives
CPP-795	Bin set #7	●	●	●	Very low levels of radioactive and hazardous material; bin sets did not contain calcine	Low mobility ensured by pipe capping and filling the bin sets with Class C grout or clean fill material	Low energy sources during Calcine Retrieval and Transport Project, removal of combustible materials, and routine dispositioning	Rupture or break in the calcine transfer lines during Calcine Retrieval and Transport operations	Flood-induced failure of bin sets, the design basis event for calcine storage in No Action and Continued Current Operation Alternatives

a. In addition to the "bounding operational scenario" for *radiological and hazardous material releases* shown in the last column of this table for all the facilities, the following bounding accident scenario for *hazardous chemical releases* should be included for all facilities, except CPP-605. As described in the introduction of this facility analysis, the bounding accident scenario for *hazardous chemical releases* is a catastrophic failure of a 3,000-gallon ammonia tank and formation of cloud of toxic vapor. This chemical accident postulated during INTEC-wide operations has the greatest potential consequences to workers and the off-site population.

APPENDIX C.5

TRANSPORTATION

TABLE OF CONTENTS

List of Tables

C.5 Traffic and Transportation

C.5.1 INTRODUCTION

This appendix supports the results of the transportation analyses presented in Section 5.2.9 of this document. The types of waste being considered are identified in Table C.5-1.

For this EIS, DOE evaluates five alternatives under which nine treatment options occur. The No Action Alternative does not involve shipping and therefore is not analyzed in this appendix. Many options have multiple waste shipments. Within some options different possibilities of shipping and storing waste exist.

C.5.2 ROUTE SELECTION

In order to evaluate transportation impacts, DOE chose reasonable surrogate shipment routes to each destination. These routes do not necessarily reflect DOE's ultimate choice, which has yet to be determined.

In addition, the destination for some waste types is not finalized. Class A grout is assumed to be shipped to the Envirocare Facility in Utah, but DOE has not identified an offsite low-level waste disposal facility. Also, the President has not selected a national geologic repository. The proposed site at Yucca Mountain in Nevada is the only site currently under consideration. Therefore, for purposes of analysis, DOE assumed that Yucca Mountain is the destination of any HLW that would be sent to deep geologic disposal. Transuranic waste is assumed to be sent to the Waste Isolation Pilot Plant.

The impacts of transporting Class C grout for offsite disposal were analyzed although the preferred choice DOE is considering for disposing of this waste is at a new INEEL landfill. Disposing of the waste at an offsite location is another possibility to this choice and thus is examined here. As with the previously mentioned waste types, the location of a disposal facility for Class C grout has not been selected, but for the purpose of this analysis a surrogate route to Barnwell, South Carolina is assumed.

C.5.2.1 <u>Truck Route Selection</u>

Route selection for waste shipments by truck was determined by the HIGHWAY 3.3 computer code (Johnson et al. 1993a). HIGHWAY is a computerized road atlas that details more than 240,000 miles of interstate and other highways. The user can specify the routing criteria to constrain the route selection.

Table C.5-1. Transportation analyses required by alternative.

Waste type		Origin	Destination	Truck shipments	Rail shipments
Continued Current Operations Alternative					
RH-TRU	110 cubic meters of RH-TRU grout from tank heels packaged in 280 WIPP half-containers at 0.4 cubic meter per half-container	INTEC	WIPP	140	70
Full Separations Option					
Vitrified HAW	470 cubic meters of vitrified HAW packaged in 780 HLW canisters.	INTEC	NGR	780	160
Class A grout	27,000 cubic meters of Class A grout packaged in 25,100 concrete cylinders of approximately 1 cubic meter each.	INTEC	Envirocare	4,200	1,300
Solidified HAW	250 cubic meters packaged in 1,200 55-gallon drums which are placed into casks.	INTEC	Hanford	80	40
Vitrified HAW	730 cubic meters of vitrified HAW packaged in 625 Hanford HLW canisters.	Hanford	INTEC	620	160
Planning Basis Option					
Vitrified HAW	470 cubic meters of vitrified HAW packaged in 780 HLW canisters.	INTEC	NGR	780	160
Class A grout	30,000 cubic meters of Class A grout packaged in 27,900 concrete cylinders of approximately 1 cubic meter each.	INTEC	Envirocare	4,700	1,400
RH-TRU	110 cubic meters of RH-TRU grout from tank heels packaged in 280 WIPP half-containers at 0.4 cubic meter per half-container.	INTEC	WIPP	140	70
Transuranic Separations Option					
RH-TRU	220 cubic meters of granular solids packaged in 550 RH-TRU containers	INTEC	WIPP	280	140
Class C grout	22,700 cubic meters of Class C grout packaged in 21,100 concrete cylinders of approximately 1 cubic meter each.	INTEC	Barnwell	7,000	2,100

Table C.5-1. (Continued).

Waste type		Origin	Destination	Truck shipments	Rail shipments
Hot Isostatic Pressed Waste Option					
HIP HLW	3,400 cubic meters of HIPed HLW packaged in 5,700 Type B canisters.	INTEC	NGR	5,700	1,100
RH-TRU	110 cubic meters of RH-TRU grout from tank heels packaged in 280 WIPP half-containers at 0.4 cubic meter per half-container.	INTEC	WIPP	140	70
Direct Cement Waste Option					
Cementitious HLW	13,000 cubic meters of cemented HLW packaged in 18,000 Type B canisters.	INTEC	NGR	18,000	3,600
RH-TRU	110 cubic meters of RH-TRU grout from tank heels packaged in 280 WIPP half-containers at 0.4 cubic meter per half-container.	INTEC	WIPP	140	70
Early Vitrification Option					
Vitrified HLW	8,500 cubic meters of vitrified calcine packaged in 11,800 Type B canisters.	INTEC	NGR	12,000	2,400
Vitrified RH-TRU	360 cubic meters of vitrified SBW/NGLW packaged in 900 RH-TRU containers.	INTEC	WIPP	450	230
Minimum INEEL Processing Alternative					
Calcine and Cs IX resin	4,300 cubic meters of calcine and Cs-IX resin (included with calcine) packaged in 3,700 Hanford HLW canisters.	INTEC	Hanford	3,700	920
CH-TRU	7,500 cubic meters of grouted CH-TRU from SBW packaged in 36,000 55-gallon drums.	INTEC	WIPP	1,300	670
Vitrified HAW	730 cubic meters of vitrified HAW packaged in 625 Hanford HLW canisters.	Hanford	INTEC	620	160
Vitrified LAW	14,400 cubic meters of vitrified LAW packaged in 5,550 LAW containers.	Hanford	INTEC	620	310
Vitrified HAW	730 cubic meters of vitrified HAW packaged in 625 Hanford HLW canisters.	INTEC	NGR	620	160
Vitrified LAW	14,400 cubic meters of vitrified LAW packaged in 5,550 LAW containers.	INEEL	Envirocare	620	310

Cs = cesium; HAW = high-activity waste; HIP = Hot Isostatic Press; LAW = low-activity waste; NGLW = newly-generated liquid waste; NGR = national geologic repository; RH = remote-handled; TRU = transuranic waste; SBW = sodium-bearing waste; WIPP = Waste Isolation Pilot Plant.

HIGHWAY calculates the total route length and the distances traveled through rural, suburban, and urban population zones. The HIGHWAY code determines population densities (people per square mile) for each of three population zones (urban, suburban, and rural) along the route using 1990 census data.

The HIGHWAY model contains an HM-164 and a Waste Isolation Pilot Plant default routing option. The HM-164 option, when activated, specifies a route that would comply with the U.S. Department of Transportation regulations for highway route-controlled quantities of radioactive material. The Waste Isolation Pilot Plant default routing option provides the New Mexico-specified routes to the Waste Isolation Pilot Plant. For purposes of this EIS, HIGHWAY was run using the following conditions:

- 70 percent emphasis on time and 30 percent emphasis on mileage
- HM-164 routing for all destinations except New Mexico
- The Waste Isolation Pilot Plant default routing for all shipments to New Mexico

The total distances between all required origins and destinations is presented in Table C.5-2.

Table C.5-2. Truck route distances (miles).

	Barnwell	Envirocare	Hanford	INTEC	NGR	WIPP
Barnwell	0	NR	NR	2,400	NR	NR
Envirocare	NR	0	NR	300	NR	NR
Hanford	NR	NR	0	630	NR	NR
INTEC	2,400	300	630	0	750	1,400
NGR	NR	NR	NR	750	0	NR
WIPP	NR	NR	NR	1,400	NR	0

NR = Not required; NGR = national geologic repository; WIPP = Waste Isolation Pilot Plant.

C.5.2.2 Rail Route Selection

Rail routes were determined by the INTERLINE 5.0 computer model (Johnson et al. 1993b). The INTERLINE computer model is designed to simulate routing on the U.S. rail system. The INTERLINE database was originally based on data from the Federal Railroad Administration and reflected the U.S. railroad system in 1974. The database has been expanded and modified over the past two decades. The code is updated periodically to reflect current track conditions and has been compared with reported mileages and observations of commercial rail firms.

The INTERLINE model uses the shortest route algorithm that finds the path of minimum impedance within an individual subnetwork. A separate method is used to find paths along the subnetworks. The routes chosen for this study used the standard assumptions in the INTERLINE model to simulate the process of selection that railroads would use to direct shipments of radioactive waste. For sites that do not have direct rail access, the rail site nearest the waste shipment endpoint was used for routing. Population densities along the route are determined using 1990 census data. Table C.5-3 presents the total mileage between INTEC and all waste shipment endpoints.

Table C.5-3. Rail route distances (miles).

	Barnwell	Envirocare	Hanford	INTEC	NGR	WIPP
Barnwell	0	NR	NR	2,300	NR	NR
Envirocare	NR	0	NR	300	NR	NR
Hanford	NR	NR	0	690	NR	NR
INTEC	2,300	300	690	0	660	1,500
NGR	NR	NR	NR	660	0	NR
WIPP	NR	NR	NR	1,500	NR	0

NR = Not required; NGR = national geologic repository; WIPP = Waste Isolation Pilot Plant.

C.5.3 VEHICLE-RELATED IMPACTS

This section addresses the impacts of traffic accidents and vehicle emissions associated with transporting each waste type to its destination. These impacts are not related to the radioactive material or hazardous chemicals being transported and would be the same as the impacts from the transportation of nonhazardous material. DOE calculated accident impacts as the number of fatalities that would be expected due to additional vehicle traffic along the proposed routes. Fatalities were calculated on a per shipment basis and were then totaled for all shipments over the transportation period. Calculations were based on the accident statistics and data presented in *State-Level Accident Rates of Surface Freight Transportation: A Reexamination* (Saricks and Tompkins 1999). Impacts from vehicle emissions were calculated as the expected number of excess latent fatalities.

Accident rates used in this assessment were computed for all shipments regardless of cargo. Saricks and Tompkins (1999) point out that shippers and carriers of radioactive material have a higher-than-average awareness of transportation impacts and prepare for such shipments accordingly. These effects were not considered, and accident rates were assumed to be identical to those for normal cargo transport. The accident impacts depend on the total distance traveled in each state and do not rely on national average accident statistics.

In addition to risks from accidents, DOE estimated health risks from vehicle emissions. The distance traveled in an urban population zone and the impact factor for particulate and sulfur dioxide truck exhaust emissions (Rao et al. 1982) were used to estimate urban-area pollution effects due to waste shipments.

The impact factor, 1.0×10^{-7}, estimates the number of latent fatalities per kilometer traveled. This impact factor is only valid for urban population zones; therefore, latent fatalities expected from exhaust emissions are only estimated for the total distance that is traveled through urban zones. It should be noted that impacts due to exhaust gases are small relative to impacts from accident fatalities.

C.5.3.1 Truck Impacts

Table C.5-4 presents vehicle-related impacts such as number of accidents for a single round trip between selected points. These values were multiplied by the appropriate number of route shipments (Table C.5-1) to obtain the total impacts reported in Section 5.2.9. All shipments were assumed to be round trip to account for the return of the empty shipping casks. Therefore, the data in Table C.5-4 were created assuming twice the one way mileage shown in Table C.5-2. The expected vehicle pollution latent fatalities were calculated only for distance traveled in urban population zones.

Table C.5-4. Vehicle-related impacts per round-trip shipment for trucks.

Originating site	Destination	Impact category	Total
INEEL	Barnwell	Accidents	3.5×10^{-3}
		Fatalities	1.4×10^{-4}
		Vehicle pollution LFs	1.3×10^{-5}
	Envirocare	Accidents	3.5×10^{-4}
		Fatalities	1.8×10^{-5}
		Vehicle pollution LFs	1.8×10^{-6}
	Hanford	Accidents	6.3×10^{-4}
		Fatalities	4.3×10^{-5}
		Vehicle pollution LFs	1.1×10^{-6}
	NGR	Accidents	7.7×10^{-4}
		Fatalities	3.5×10^{-5}
		Vehicle pollution LFs	5.5×10^{-6}
	WIPP	Accidents	1.7×10^{-3}
		Fatalities	6.5×10^{-5}
		Vehicle pollution LFs	5.0×10^{-6}

LF = latent fatality; NGR = national geologic repository; WIPP = Waste Isolation Pilot Plant.

C.5.3.2 Rail Impacts

Table C.5-5 presents vehicle-related impacts for selected rail routes. These values were multiplied by the appropriate number of route shipments (Table C.5.1) to obtain the total impacts reported in Table 5.2-13. The expected number of accidents and fatalities per shipment are based on route-specific data and state-specific rail statistics presented in Saricks and Tompkins (1999). Impact factors for latent fatalities

Table C.5-5. Vehicle-related impacts per round-trip shipment for rail.

Originating site	Destination	Impact category	Total per shipment
INEEL	Barnwell	Accidents	3.2×10^{-4}
		Fatalities	6.1×10^{-5}
	Envirocare	Accidents	5.9×10^{-5}
		Fatalities	1.7×10^{-5}
	Hanford	Accidents	1.7×10^{-4}
		Fatalities	2.3×10^{-5}
	NGR	Accidents	1.0×10^{-4}
		Fatalities	3.1×10^{-5}
	WIPP	Accidents	1.6×10^{-4}
		Fatalities	3.1×10^{-5}

NGR = national geologic repository; WIPP = Waste Isolation Pilot Plant.

due to exhaust emissions from rail transport are not available. For this reason vehicle pollution latent fatalities are omitted from Table C.5-5. All shipments were assumed to be round trip to account for the return of the empty shipping casks. Therefore, the data in Table C.5-5 was calculated assuming twice the one-way mileage shown in Table C.5-3.

C.5.4 CARGO-RELATED INCIDENT-FREE IMPACTS

This section estimates the radiological impacts of incident-free transportation (i.e., no occurrence of accidents) to occupational and public receptors. DOE used the RADTRAN 4 model (Neuhauser and Kanipe 1992) to estimate these impacts. Required route-specific inputs such the number of miles traveled, population densities adjacent to shipping routes, and the number of miles traveled in each of the population zones (urban, suburban, and rural) are determined using the HIGHWAY and INTERLINE models described in Section C.5.2.

Four radiation exposure scenarios were analyzed using the RADTRAN 4 code as follows:

- **Along Route:** Exposure to members of the public who reside adjacent to routes of travel
- **Sharing Route:** Exposure to members of the public sharing the right of way
- **Stops:** Exposure to members of the public while shipments are at rest stops
- **Occupational:** Exposure to vehicle crews

Among the more sensitive RADTRAN input parameters is the Transport Index. The Transport Index represents the radiation dose at one meter away from the surface of the shipping package. The maximum radiation dose permissible is 10 millirems per hour at 2 meters for exclusive-use shipments. For this analysis, the 2-meter regulatory limit was used to calculate the maximum allowable dose at 1 meter (Transport Index). Since the Transport Index is dependent on the number of packages per shipment and the package dimension, a value for Transport Index was calculated for each of the various packages associated with the different waste forms that would be shipped. The Transport Index ranged from a high of 16.9 for truck transport of solidified high-activity waste to a low of 0.31 for rail transport of contact-handled transuranic waste. Many of the other inputs are dependent on the mode of transportation and are discussed in the following sections.

The incident-free impacts estimated from RADTRAN are in units of person-rem. These can be converted into latent cancer fatalities using conversion factors. For nonoccupational doses, 1 person-rem is expected to cause 5×10^{-4} latent cancer fatalities, and for occupational doses 1 person-rem is expected to cause 4×10^{-4} latent cancer fatalities (ICRP 1991).

C.5.4.1 <u>Truck Impacts</u>

In addition to the RADTRAN inputs described in Section C.5.4, other unique parameters can affect truck shipments. The vehicle speed was assumed to be 15, 25, and 55 miles per hour in urban, suburban, and rural zones, respectively. DOE believes that these speeds actually underestimate the probable speed of the truck through each of the population zones. This assumption results in a conservative overestimation of exposure and also accounts for the possibility of speed reductions due to traffic.

With the exception of shipments between INEEL and Envirocare, all truck shipments were assumed to have 0.011 hours of stopping time for every kilometer traveled. This accounts for overnight stopping; the trip from INEEL to Envirocare is not long enough to require an overnight stop. The total stopping time assumed for shipments from INEEL to Envirocare is 0.167 hours (10 minutes).

During transport the distance between the waste and the crew is assumed to be 10 meters. During stops, there are an assumed 50 members of the public present located 20 meters from the waste.

C.5.4.2 <u>Rail Impacts</u>

In addition to the RADTRAN inputs described in Section C.5.4, there are other parameters which are unique to rail shipments. The train speed was assumed to be 15, 25, and 40 miles per hour in urban, suburban, and rural zones, respectively.

With the exception of shipments between INEEL and Envirocare, all rail shipments were assumed to have 0.033 hours of stopping time for every kilometer traveled. This accounts for overnight stopping; the trip from INEEL to Envirocare is not long enough to require an overnight stop. The total stopping time for shipments from INEEL to Envirocare is 0.167 hours (10 minutes).

During transport, the distance between the waste and the crew is assumed to be 152 meters. An assumed 100 members of the public are present at the stops at 20 meters from the waste.

C.5.5 CARGO-RELATED ACCIDENT IMPACTS

This section presents the impacts due to transportation accidents in which an environmental release of radioactive material occurs. Radiological impacts were evaluated considering the probability of a given accident occurring and the consequences of that accident. The RADTRAN 4 model estimates the collective accident risk to populations by considering the spectrum of possible accidents and summing the results for each type of accident. The estimates in Section 5.2.9 do not show the risk from a given accident occurring but present the total expected impacts considering the probability and consequences of all accidents. For the maximally-exposed individual, DOE used the RISKIND code to calculate the radiation dose from accidents (see Section C.5.5.5).

C.5.5.1 Accident Types

All accidents can be represented by a spectrum of severity classes ranging from those considered least severe to most severe. The severity class of an accident is dependent on the crush force or impact speed and the duration of a 1,300-degree Kelvin fire (NRC 1977). Two sets of accident severity categories and associated conditional probabilities were used in assessing cargo-related accident impacts for this analysis. All vitrified waste and waste forms similar to vitrified wastes (e.g., hot isostatic pressed waste) were analyzed using a methodology based on studies performed in support of NUREG/CR-4829 (Fisher et al. 1988) (i.e., the Modal Study) (Ross 1999). This study represents the most recently developed methodology for assessing cargo-related accident impacts and is used for the transportation analysis performed for the *Yucca Mountain Repository EIS*. Since the study only considers the transport of spent nuclear fuel and vitrified HLW wastes, a second methodology, that found in NUREG-0170 (NRC 1977), was used for the remaining radioactive waste forms being considered in this EIS. For both of these methods, each accident severity category has an associated conditional probability. The conditional probabilities represent the likelihood that an accident will involve the mechanical forces and the heat energy associated with each of the categories.

Table C.5-6 shows what fraction of the total accidents would be expected to be from each severity category, as based on NUREG-0170. For example, of all possible truck accidents that may occur, 55 percent would be classified as a level one severity accident. According to these fractional occurrences, a level one accident occurs more often but is the least severe while a level eight is highly unlikely but is the most severe. The table also represents the fraction of all accidents of that type that could occur in each of the population density zones. Of all expected level one severity accidents, 10 percent would occur in the rural population density zone, another 10 percent would occur in the suburban zone, and 80 percent would occur in the urban population density zone.

Table C.5-6. Accident conditional probability of occurrences (NUREG-0170 methodology).[a]

Accident severity category	Fractional occurrences	Rural	Suburban	Urban
Truck				
1	0.55	0.1	0.1	0.8
2	0.36	0.1	0.1	0.8
3	0.07	0.3	0.4	0.3
4	0.02	0.3	0.4	0.3
5	2.8×10^{-3}	0.5	0.3	0.2
6	1.1×10^{-3}	0.7	0.2	0.1
7	8.5×10^{-5}	0.8	0.1	0.1
8	1.5×10^{-5}	0.9	0.05	0.05
Rail				
1	0.50	0.1	0.1	0.8
2	0.30	0.1	0.1	0.8
3	0.18	0.3	0.4	0.3
4	0.02	0.3	0.4	0.3
5	1.8×10^{-3}	0.5	0.3	0.2
6	1.3×10^{-4}	0.7	0.2	0.1
7	6.0×10^{-5}	0.8	0.1	0.1
8	1.0×10^{-5}	0.9	0.05	0.05

a. Source: NRC (1977).

Table C.5-7 presents the accident conditional occurrence probabilities for truck and rail transport of vitrified HLW wastes. There are only six accident severity categories used in this methodology. Table C.5-7 shows that 99 percent of all truck and rail accidents would be a Category 1 severity event; in comparison, accidents of a Category 2 through 6 severity are very unlikely to occur. The distribution of each accident severity category by population density zones is not considered in the Modal-support study.

Table C.5-7. Accident conditional probability of occurrences (Modal-related methodology).[a]

Accident severity category	Conditional probability	
	Truck	Rail
1	0.99	0.99
2	4.1×10^{-5}	2.0×10^{-3}
3	3.8×10^{-3}	1.3×10^{-6}
4	1.8×10^{-3}	5.6×10^{-4}
5	1.6×10^{-5}	6.1×10^{-4}
6	9.8×10^{-6}	1.3×10^{-4}

a. Source: Ross (1999).

C.5.5.2 Accident Release

As with the accident severity categories and conditional probabilities discussed in the previous section, accident releases were calculated using two methodologies: the method derived from NUREG/CR-4829 (Fisher et al. 1988) and the method presented in NUREG-0170 (NRC 1977). For both of these approaches, three factors were used to determine the amount the material that is released into the environment and available for inhalation. These factors include the release fraction, the aerosolized fraction, and the respirable fraction.

The release fraction is the fraction of material that would be released from the shipping container in an accident of a given severity category. For this analysis, all waste containers containing non-vitrified waste forms are assumed to be a Type B shipping container with material release fractions assumed to be the same as those defined in NUREG-0170. Estimated release fractions for Type B containers are reported in Table C.5-8. For CH-TRU and RH-TRU, release fractions developed to assess impacts of transporting transuranic wastes in the *Waste Isolation Pilot Plant Disposal Phase Final Supplemental Impact Statement* (DOE 1997) were used; these are also listed in Table C.5-8. Release fractions for vitrified wastes and wastes with physical characteristics similar to vitrified waste are represented by release fractions developed in the studies performed in support of NUREG/CR-4829 (Modal Study). This model assumes that the stainless steel cladding on the vitrified HLW canister would limit the quantity of waste material that would be released even in the most severe accidents. Those release fractions are shown in Table C.5-9.

Table C.5-8. Estimated release fractions.

Accident severity category	Type B container[a]	RH-TRU[b]	CH-TRU[b]
1	0	0	0
2	0	0	0
3	0.01	6×10^{-9}	8×10^{-9}
4	0.1	2×10^{-7}	2×10^{-7}
5	1	1×10^{-4}	8×10^{-5}
6	1	1×10^{-4}	2×10^{-4}
7	1	2×10^{-4}	2×10^{-4}
8	1	2×10^{-4}	2×10^{-4}

a. Source: NRC (1977). Used for solidified HAW, Class C Grout, Class A Grout, resin, calcine, and cementitious HLW.
b. Source: DOE (1997).
RH = remote handled; CH = contact handled; TRU = transuranic waste.

Table C.5-9. Estimated release fractions (Modal-related methodology).[a]

Accident severity category	Release fraction
1	0
2	0
3	7.0×10^{-9}
4	4.0×10^{-6}
5	4.0×10^{-6}
6	4.0×10^{-6}

a. Source: Ross (1999).

The aerosolized fraction represents the fraction of the material released in an accident of a given severity that becomes aerosolized. The respirable fraction represents the fraction of aerosolized material that could be inhaled. Both of these factors are dependent on the physical and chemical characteristics of the waste form. Table C.5-10 shows the aerosolized and respirable fractions for each of the radioactive waste forms considered in this transportation analysis. The vitrified waste forms all have aerosolized and respirable fractions equal to 1.0 since these factors have already been taken into account in the release fractions developed for the Modal Study support model.

Table C.5-10. Aerosolized and respirable fractions.

Physical waste form	Aerosolized fractions	Respirable fractions
Vitrified HAW[a]	1.0	1.0
Class A grout[b]	0.05	0.05
Solidified HAW[b]	0.05	0.05
HIP HLW[a]	1.0	1.0
Cementitious HLW[b]	0.05	0.05
Calcine and Cs ion exchange resin[b]	0.1	0.05
Vitrified LAW[a]	1.0	1.0
CH-TRU[c]	1.0	1.0
RH-TRU[c]	1.0	1.0
Vitrified RH-TRU[a]	1.0	1.0

a. Source: Ross (1999).
b. Source: NRC (1977).
c. Source: DOE (1997).
HAW = high-activity waste; LAW = low-activity waste; HIP = hot isostatic pressed; Cs = cesium; RH = remote handled; CH = contact handed TRU = transuranic waste.

C.5.5.3 Radiological Waste Characterization

In order to determine the potential cargo-related impacts from accidents, DOE estimated the radiological content of each waste type (Table C.5-11). The total amount of material available to receptors was determined by multiplying the total radiological content of a shipment by the release factor that corresponds to each type of accident.

C.5.5.4 Exposure Pathways for Released Material

RADTRAN 4 assumes that the material available to the receptor in any given accident is dispersed into the environment according to standard Gaussian diffusion models. Default data for atmospheric dispersion were used, representing an instantaneous ground-level release and a small diameter source cloud. The calculation of the collective population dose after the release and dispersal of radioactive material includes the following pathways:

- External exposure to a passing radioactive cloud
- External exposure to contaminated soil
- Internal exposure from inhaling airborne contaminants

C.5.5.5 Radiological Consequence Assessment Using RISKIND

The RISKIND version 1.11 (Yuan et al. 1995) assessment was configured to provide consequences under the two most frequent atmospheric surface layer conditions[1] existing in the contiguous United States: neutral and stable. Neutral (Pasquill stability class 'D') conditions exist nearly half the time with prevalent wind speeds ranging between 4 and 7 meters per second; stable conditions (Pasquill stability classes 'F' and 'G') about one-fifth of the time with a wind speed below 1 meter per second (TRW 1998). These joint atmospheric stability and wind speed conditions dictate how much of the radioactive material released from an assumed failed waste package ultimately reaches an affected individual. The neutral and stable atmospheric transport conditions were emulated in RISKIND by selecting the D and F Pasquill stability classes with respective wind speeds of 5.7 and 0.9 meters per second.

The receptor defined for purposes of this analysis was an adult member of the public located outdoors at the location of maximum exposure to the wind-borne plume of radioactive material (the "critical receptor" location). Using RISKIND, the distance from the truck or rail accident site to the unshielded critical receptor was calculated to be <0.1 and 0.6 kilometers under neutral and stable atmospheric stability conditions, respectively. This critical receptor or maximally-exposed individual was assumed to be exposed to the plume's radioactive contents for two hours before being evacuated or otherwise leaving the affected area. Thus, the individual's consequence (total effective dose equivalent—TEDE) was derived solely from a short-term (2-hour) scenario of direct radiation exposure from the shipment, breathing contaminated air, being submerged by contaminated air ("cloudshine"), and standing on contaminated ground ("groundshine"). Long-term exposure conditions such as eating food or water contaminated by the plume or receiving medical care to reduce the amount of radioactive material present in the body were not considered by DOE to be reasonably foreseeable and thus were not included in this analysis.

The type and amount of radioactive material released from each of the 14 waste package categories assumed to fail in an accident was taken or adapted from the complementary RADTRAN 4 input files. All radioactivity data used was based on the unit source terms listed in Table C.5-11. The RADTRAN 4 waste package failure data used included the smallest "moderate severity" and highest "extreme severity" non-zero release fractions and the respective respirable aerosol estimators. The range of values from which the release estimators were selected is shown in Tables C.5-8 through C.5-10, which are based on

1 Meteorologists distinguish three states of the atmospheric surface layer: unstable, neutral, and stable. These adjectives refer to the reaction of an insulated parcel of air displaced vertically which can be predicted using measurements of the vertical temperature profile of the atmosphere below 100 meters.

NUREG-0170 and Modal-related (NUREG/CR-4829) methodologies. These two accident severity categories were chosen to portray the complete range of consequences for accidents involving release of radioactive material. To restrict the influence of waste package design and preparation on close-in direct radiation exposures, the RISKIND assessment reflected exclusive-use shipments with a 2-meter dose rate set at the Department of Transportation limit of 10 mrem per hour. Waste package dimensions for this direct radiation exposure portion of the assessment were assumed to be the same as those used for the RADTRAN analysis.

For multiple waste package shipments, it was simply assumed that one-quarter of the waste packages would fail during an accident (in all cases, at least one package was assumed to leak some or all of it's contents). Lacking verifiable information on the failure behavior of multiple INEEL waste package shipments, DOE believes that this assumption is a reasonable compensating measure. This assumption alone accounts for the differences observed in the truck and rail consequence results for each waste form shipped. RISKIND was also configured to include the effects of a moderate fire (corresponding to diesel fuel burning at a rate of about one gallon per minute) on the transport and diffusion of radioactive material from the accident site to the critical receptor. All other RISKIND parameter values were left at their default settings.

The results of the consequence analyses are shown in Tables C.5-12 and C.5-13 for moderate and extreme severity truck and rail accidents, respectively. Under moderate accident severity conditions, the critical receptor dose ranges from 2.6×10^{-8} (CH-TRU by truck, stable atmosphere) to 0.4 rem (solidified HAW by rail, neutral atmosphere). For these same shipments under extreme severity accident conditions, the critical receptor dose ranges from 1.2×10^{-5} (Vitrified RH-TRU by truck, stable atmosphere) to 36 rem (Solidified HAW by rail, neutral atmosphere). Differences in release estimators account for the observed shift from CH-TRU under moderate severity accident conditions to Vitrified RH-TRU under extreme conditions at the low end of the consequence range. Consequences are highest for Solidified HAW shipments because the combination of source term and release characteristics for this waste form results in the greatest amount of radioactive material being released under both moderate and extreme severity accident conditions.

Table C.5-12. Moderate severity truck and rail accident critical receptor consequences for all waste forms under neutral and stable atmospheric conditions.

Table C.5-13. Extreme severity truck and rail accident critical receptor consequences for all waste forms under neutral and stable atmospheric conditions.

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Table C.5-11. Radioactivity of each waste type (curies per container).

	Class A grout[a]	HAW vitrified at INEEL[b]	Solidified HAW[c]	HAW vitrified at Hanford[d]	HIP HLW[e]	Direct cementitious waste[f]	Early Vitrified HAW[g]	Calcine and Cs IX resin[h]	LAW vitrified at Hanford[d]	Class C grout[a]	Vitrified RH-TRU[i]	CH-TRU[j]	RH-TRU[k]
Am-241	0.0052	12	2.6	13	1.6	0.51	0.77	2.5	0.14	5.4×10^{-3}	0.22	0.060	18
Am-243	8.1×10^{-9}	1.8×10^{-5}	3.9×10^{-6}	3.8×10^{-5}	4.6×10^{-6}	1.5×10^{-6}	2.2×10^{-6}	7.2×10^{-6}	4.1×10^{-7}	8.3×10^{-9}	8.7×10^{-5}	2.7×10^{-5}	2.4×10^{-5}
Ba-137m	0.29	1.8×10^{-4}	4.0×10^{-5}	-	1.6×10^{3}	510	770	2.5×10^{3}	-	440	150	3.6×10^{-3}	5.2×10^{-5}
Cd-113m	-	-	-	-	0.067	0.021	0.032	0.1	-	-	7.4×10^{-3}	-	-
Ce-144	3.7×10^{-4}	16	3.4	-	2.3	0.72	5.3×10^{-18}	1.7×10^{-17}	-	4.0×10^{-4}	2.5×10^{-8}	2.0×10^{-4}	21
Cm-242	1.3×10^{-8}	2.9×10^{-5}	6.3×10^{-6}	-	3.9×10^{-6}	1.2×10^{-6}	1.9×10^{-6}	6.1×10^{-6}	-	1.3×10^{-8}	5.0×10^{-5}	1.5×10^{-4}	3.9×10^{-5}
Cm-244	2.4×10^{-8}	5.4×10^{-5}	1.2×10^{-5}	6.5×10^{-5}	7.3×10^{-6}	2.3×10^{-6}	3.5×10^{-6}	1.1×10^{-5}	1.4×10^{-7}	2.5×10^{-8}	4.4×10^{-3}	2.7×10^{-3}	7.1×10^{-5}
Co-60	0.07	2.4×10^{-5}	5.3×10^{-6}	-	0.16	0.050	0.024	0.076	-	0.072	0.027	0.021	3.5×10^{-9}
Cs-134	0.0029	1.3×10^{-6}	2.8×10^{-7}	-	1.9	0.61	1.2×10^{-3}	3.9×10^{-3}	-	0.16	1.1×10^{-3}	5.6×10^{-5}	1.1×10^{-9}
Cs-135	4.1×10^{-6}	4.6×10^{-9}	9.9×10^{-10}	0.25	0.027	8.6×10^{-3}	0.013	0.043	2.1×10^{-4}	7.6×10^{-3}	3.7×10^{-3}	5.8×10^{-8}	1.1×10^{-9}
Cs-137	0.34	13,000	2,800	1.6×10^{4}	1.8×10^{3}	570	820	2.6×10^{3}	13	470	150	3.8×10^{-3}	5.5×10^{-5}
Eu-152	1.3×10^{-4}	0.35	0.077	-	0.048	0.015	0.023	0.075	-	1.7×10^{-4}	5.4×10^{-3}	2.7×10^{-4}	0.50
Eu-154	0.010	28	6.2	-	3.8	1.2	1.8	5.8	-	0.013	0.24	0.020	43
Eu-155	9.4×10^{-5}	0.82	0.18	-	0.17	0.054	0.014	0.044	-	9.6×10^{-5}	0.11	0.019	1.1
I-129	8.9×10^{-5}	0.020	0.0036	-	1.9×10^{-3}	5.9×10^{-4}	5.6×10^{-4}	1.8×10^{-3}	-	4.7×10^{-4}	0.034	2.3×10^{-4}	8.3×10^{-3}
Nb-93m	-	-	-	-	0.093	0.029	0.045	0.14	-	-	7.7×10^{-3}	-	-
Ni-63	0.0093	1.0×10^{-4}	2.2×10^{-5}	-	-	-	-	-	-	9.8×10^{-3}	0.12	5.7×10^{-3}	5.9×10^{-11}
Np-237	3.1×10^{-14}	0.030	0.054	0.01	2.5×10^{-3}	7.8×10^{-4}	7.4×10^{-4}	2.4×10^{-3}	1.6×10^{-4}	3.8×10^{-14}	0.012	6.9×10^{-5}	0.034
Pa-233	3.8×10^{-15}	0.010	0.0025	-	1.5×10^{-3}	4.8×10^{-4}	7.4×10^{-4}	2.4×10^{-3}	-	3.8×10^{-14}	0.012	-	0.034
Pd-107	-	-	-	-	7.6×10^{-4}	2.4×10^{-4}	3.7×10^{-4}	1.2×10^{-3}	-	-	6.7×10^{-5}	-	-
Pm-147	0.0017	3.7	-	-	0.51	0.16	0.25	0.79	-	1.7×10^{-3}	0.023	0.11	5.5
Pr-144	-	-	-	-	0.51	0.16	0.25	0.8	-	-	2.5×10^{-8}	9.8×10^{-3}	-
Pu-238	5.1×10^{-10}	100	22	110	14	4.3	6.5	0.21	0.85	5.7×10^{-10}	1.4	0.092	150
Pu-239	1.0×10^{-11}	2.4	0.52	2.3	0.31	0.097	0.13	0.41	0.017	1.1×10^{-11}	0.23	9.6×10^{-3}	3.5
Pu-240	7.9×10^{-12}	1.6	0.36	1.8	0.22	0.070	0.10	0.33	0.014	9.1×10^{-12}	0.044	3.2×10^{-3}	2.4
Pu-241	2.4×10^{-10}	50	10.7	56	6.6	2.1	3.0	9.7	0.13	2.7×10^{-10}	0.57	0.060	69
Pu-242	1.6×10^{-14}	0.0032	7.0×10^{-4}	-	4.3×10^{-4}	1.4×10^{-4}	2.1×10^{-4}	6.7×10^{-4}	-	1.8×10^{-14}	3.3×10^{-5}	1.8×10^{-6}	4.8×10^{-3}
Ru-106	0.22	0.14	0.031	4.3×10^{-13}	0.92	0.29	3.0×10^{-14}	9.8×10^{-14}	2.5×10^{-15}	0.23	5.0×10^{-7}	5.3×10^{-4}	0.19
Sb-125	0.050	1.9×10^{-5}	4.2×10^{-6}	-	0.20	0.062	7.5×10^{-3}	0.024	-	0.051	2.1×10^{-3}	8.2×10^{-3}	1.3×10^{-9}
Sb-126	-	-	-	-	2.5×10^{-3}	8.0×10^{-4}	1.2×10^{-3}	3.9×10^{-3}	-	-	2.4×10^{-4}	-	-
Se-79	-	-	-	-	0.021	6.5×10^{-3}	0.010	0.032	-	-	1.8×10^{-3}	-	-
Sm-151	0.52	250	55	320	36	11	17	0.56	0.40	0.53	1.3	0.059	350
Sn-121m	-	-	-	-	1.0×10^{-3}	3.3×10^{-4}	5.0×10^{-4}	1.6×10^{-3}	-	-	2.3×10^{-4}	-	-
Sn-126	-	-	-	-	0.018	5.8×10^{-3}	8.8×10^{-3}	0.028	-	-	1.7×10^{-3}	-	-
Sr-90	5.4×10^{-5}	1.4×10^{4}	3.1×10^{3}	1.7×10^{4}	1.9×10^{3}	600	920	2.9×10^{3}	34	520	160	3.3	1.2×10^{-4}
Tc-99	0.090	2.8	0.60	1.2	0.70	0.22	0.34	1.1	0.59	0.19	0.040	1.7×10^{-3}	0.41
Th-230	3.0×10^{-5}	3.4×10^{-5}	7.4×10^{-6}	1.1×10^{-3}	1.2×10^{-4}	3.8×10^{-5}	5.8×10^{-5}	1.9×10^{-4}	1.6×10^{-6}	3.2×10^{-5}	3.7×10^{-6}	1.8×10^{-8}	4.6×10^{-5}
Th-231	2.2×10^{-5}	2.5×10^{-5}	5.4×10^{-6}	-	8.9×10^{-5}	2.8×10^{-5}	4.3×10^{-5}	1.4×10^{-4}	-	2.3×10^{-5}	8.7×10^{-5}	3.1×10^{-3}	3.6×10^{-5}

Table C.5-11. (Continued).

	Class A grout[a]	HAW vitrified at INEEL[b]	Solidified HAW[c]	HAW vitrified at Hanford[d]	HIP HLW[e]	Direct cementitious waste[f]	Early Vitrified HAW[g]	Calcine and Cs IX resin[h]	LAW vitrified at Hanford[d]	Class C grout[a]	Vitrified RH-TRU[i]	CH-TRU[j]	RH-TRU[k]
U-232	6.3×10^{-20}	5.9×10^{-6}	1.3×10^{-6}	-	-	-	-	-	-	1.2×10^{-19}	7.7×10^{-6}	3.6×10^{-7}	8.5×10^{-6}
U-233	1.2×10^{-17}	9.4×10^{-4}	2.0×10^{-4}	1.8×10^{-6}	9.3×10^{-5}	2.9×10^{-5}	1.0×10^{-7}	3.3×10^{-7}	1.1×10^{-8}	1.3×10^{-17}	1.0×10^{-6}	2.8×10^{-10}	1.3×10^{-3}
U-234	1.4×10^{-15}	0.10	0.022	0.12	0.014	4.4×10^{-3}	6.7×10^{-3}	0.022	7.4×10^{-4}	2.1×10^{-15}	3.4×10^{-3}	1.6×10^{-4}	0.15
U-235	1.0×10^{-17}	7.6×10^{-4}	1.6×10^{-4}	7.7×10^{-4}	9.9×10^{-5}	3.1×10^{-5}	4.3×10^{-5}	1.4×10^{-4}	4.7×10^{-6}	1.5×10^{-17}	8.7×10^{-5}	4.1×10^{-6}	1.1×10^{-3}
U-236	2.4×10^{-17}	0.0017	3.7×10^{-4}	-	2.3×10^{-4}	7.3×10^{-5}	1.1×10^{-4}	3.6×10^{-4}	-	3.4×10^{-17}	1.4×10^{-4}	7.9×10^{-6}	2.5×10^{-3}
U-237	2.0×10^{-17}	1.1×10^{-3}	2.4×10^{-4}	-	1.5×10^{-4}	4.8×10^{-5}	7.3×10^{-5}	2.4×10^{-4}	-	2.3×10^{-17}	1.4×10^{-5}	-	1.6×10^{-3}
U-238	2.4×10^{-18}	1.8×10^{-4}	3.9×10^{-5}	4.0×10^{-5}	1.9×10^{-5}	6.1×10^{-6}	2.2×10^{-6}	7.1×0^{-6}	2.4×10^{-7}	2.8×10^{-18}	8.7×10^{-5}	2.9×10^{-6}	2.6×10^{-4}
Y-90	5.1×10^{-7}	1.4×10^{4}	3.0×10^{3}	1.7×10^{4}	1.9×10^{3}	600	920	2.9×10^{-3}	34	510	0.016	2.1	1.2×10^{-4}
Zr-93	-	-	-	-	0.11	0.034	0.051	0.17	-	-	9.1×10^{-3}	-	-

a. Source: Landman and Barnes (1998).
b. Source: Landman (1998), Fluor Daniel (1997).
c. Source: Quigley and Keller (1998), Landman (1998).
d. Source: Jacobs (1998).
e. Source: Barnes (1998a), Dafoe and Losinski (1998), Fluor Daniel (1997), Russell et al. (1998a,b).
f. Source: Barnes (1998a), Fluor Daniel (1997), Russell et al. (1998a,b)
g. Source: Barnes (1998a,b), Fewell (1999), Lee (1999).
h. Source: Barnes (1998a,b), Lopez (1998).
i. Source: Wenzel (1997).
j. Source: Barnes (1998c).
k. Source: Russell et al. (1998a).

Cs IX = cesium ion exchange; HAW = high-activity waste; HIP = Hot Isostatic Press; LAW = low-activity waste; TRU = transuranic waste; CH = contact-handled; RH = remote-handled.

Table C.5-12. Moderate severity truck and rail accident critical receptor consequences for all waste forms under neutral and stable atmospheric conditions.

	Truck					Rail				
Waste form shipped	Source[a] (curies)	TEDE[b] (rem) Neutral	LCF probability	TEDE[b] (rem) Stable	LCF probability	Source[a] (curies)	TEDE[b] (rem) Neutral	LCF probability	TEDE[b] (rem) Stable	LCF probability
Calcine	0.55	0.085	4.3×10^{-5}	2.1×10^{-3}	1.1×10^{-6}	1.1	0.17	8.5×10^{-5}	4.1×10^{-3}	2.1×10^{-6}
Cementitious HLW	0.058	8.8×10^{-3}	4.4×10^{-6}	2.1×10^{-4}	1.1×10^{-7}	0.11	0.018	9.0×10^{-6}	4.3×10^{-4}	2.2×10^{-7}
CH-TRU	3.3×10^{-7}	7.7×10^{-6}	3.9×10^{-9}	2.6×10^{-8}	1.3×10^{-11}	6.7×10^{-7}	8.2×10^{-6}	4.1×10^{-9}	3.8×10^{-8}	1.9×10^{-11}
Class A Grout	7.9×10^{-5}	2.4×10^{-5}	1.2×10^{-8}	3.8×10^{-7}	1.9×10^{-10}	2.0×10^{-4}	4.6×10^{-5}	2.3×10^{-8}	9.1×10^{-7}	4.6×10^{-10}
Class C Grout	0.048	2.3×10^{-3}	1.2×10^{-6}	5.4×10^{-5}	2.7×10^{-8}	0.15	6.7×10^{-3}	3.4×10^{-6}	1.6×10^{-4}	8.0×10^{-8}
CsIX Resin	1.9	9.8×10^{-3}	4.9×10^{-6}	2.4×10^{-4}	1.2×10^{-7}	1.9	9.7×10^{-3}	4.9×10^{-6}	2.3×10^{-4}	1.2×10^{-7}
HIP HLW	5.1×10^{-5}	1.6×10^{-5}	8.0×10^{-9}	2.1×10^{-7}	1.1×10^{-10}	1.0×10^{-4}	2.4×10^{-5}	1.2×10^{-8}	4.0×10^{-7}	2.0×10^{-10}
RH-TRU	4.0×10^{-6}	6.1×10^{-5}	3.1×10^{-8}	1.3×10^{-6}	6.5×10^{-10}	8.0×10^{-6}	1.2×10^{-4}	6.0×10^{-8}	2.6×10^{-6}	1.3×10^{-9}
Solidified HAW	0.89	0.18	9.0×10^{-5}	4.3×10^{-3}	2.2×10^{-6}	1.8	0.36	1.8×10^{-4}	8.7×10^{-3}	4.4×10^{-6}
Vitrified HAW	3.5×10^{-4}	7.4×10^{-5}	3.7×10^{-8}	1.6×10^{-6}	8.0×10^{-10}	7.0×10^{-4}	1.4×10^{-4}	7.0×10^{-8}	3.2×10^{-6}	1.6×10^{-9}
Vitrified HAW Hanford	2.4×10^{-5}	1.3×10^{-5}	6.5×10^{-9}	1.1×10^{-7}	5.5×10^{-11}	6.1×10^{-5}	1.8×10^{-5}	9.0×10^{-9}	2.4×10^{-7}	1.2×10^{-10}
Vitrified HAW INEEL	2.9×10^{-4}	5.8×10^{-5}	2.9×10^{-8}	1.4×10^{-6}	7.0×10^{-10}	5.8×10^{-4}	1.2×10^{-4}	6.0×10^{-8}	2.8×10^{-6}	1.4×10^{-9}
Vitrified LAW	1.8×10^{-6}	1.1×10^{-5}	5.5×10^{-9}	4.8×10^{-8}	2.4×10^{-11}	3.0×10^{-6}	1.2×10^{-5}	6.0×10^{-9}	6.7×10^{-8}	3.4×10^{-11}
Vitrified RH-TRU	4.4×10^{-6}	8.3×10^{-6}	4.2×10^{-9}	3.5×10^{-8}	1.8×10^{-11}	8.7×10^{-6}	9.1×10^{-6}	4.6×10^{-9}	5.6×10^{-8}	2.8×10^{-11}

a. Amount of radioactive material dispersed during the accident.
b. Total effective dose equivalent committed to an adult located 0.1 (neutral) and 0.6 (stable) kilometers downwind from the accident site for a two-hour exposure period.
LCF = Latent cancer fatality.

Table C.5-13. Extreme severity truck and rail accident critical receptor consequences for all waste forms under neutral and stable atmospheric conditions.

	Truck					Rail				
Waste form shipped	Source[a] (curies)	TEDE[b] (rem) neutral	LCF probability	TEDE[b] (rem) stable	LCF probability	Source[a] (curies)	TEDE[b] (rem) neutral	LCF probability	TEDE[b] (rem) stable	LCF probability
Calcine	55	8.5	4.3×10^{-3}	0.21	1.1×10^{-4}	110	17	8.5×10^{-3}	0.41	2.1×10^{-4}
Cementitious HLW	5.8	0.88	4.4×10^{-4}	0.021	1.1×10^{-5}	11	1.8	9.0×10^{-4}	0.043	2.2×10^{-5}
CH-TRU	8.3×10^{-3}	0.013	6.5×10^{-6}	3.1×10^{-4}	1.6×10^{-7}	0.017	0.026	1.3×10^{-5}	6.2×10^{-4}	3.1×10^{-7}
Class A Grout	7.9×10^{-3}	1.5×10^{-3}	7.5×10^{-7}	3.7×10^{-5}	1.9×10^{-8}	0.020	3.8×10^{-3}	1.9×10^{-6}	9.0×10^{-5}	4.5×10^{-8}
Class C Grout	4.8	0.23	1.2×10^{-4}	5.4×10^{-3}	2.7×10^{-6}	15	0.67	3.4×10^{-4}	0.016	8.0×10^{-6}
CsIX Resin	190	0.98	4.9×10^{-4}	0.024	1.2×10^{-5}	380	1.9	9.5×10^{-4}	0.047	2.4×10^{-5}
HIP HLW	0.029	4.5×10^{-3}	2.3×10^{-6}	1.1×10^{-4}	5.5×10^{-8}	0.058	9.0×10^{-3}	4.5×10^{-6}	2.2×10^{-4}	1.1×10^{-7}
RH-TRU	0.13	1.8	9.0×10^{-4}	0.043	2.2×10^{-5}	0.27	3.6	1.8×10^{-3}	0.086	4.3×10^{-5}
Solidified HAW	89	1.8	9.0×10^{-3}	0.43	2.2×10^{-4}	180	3.6	1.8×10^{-2}	0.87	4.4×10^{-4}
Vitrified HAW	0.20	0.037	1.9×10^{-5}	8.9×10^{-4}	4.5×10^{-7}	0.40	0.075	3.8×10^{-5}	1.8×10^{-3}	9.0×10^{-7}
Vitrified HAW Hanford	0.014	2.1×10^{-3}	1.1×10^{-6}	5.1×10^{-5}	2.6×10^{-8}	0.035	5.2×10^{-3}	2.6×10^{-6}	1.3×10^{-4}	6.5×10^{-8}
Vitrified HAW INEEL	0.17	0.033	1.7×10^{-5}	7.9×10^{-4}	4.0×10^{-7}	0.33	0.066	3.3×10^{-5}	1.6×10^{-3}	8.0×10^{-7}
Vitrified LAW	1.0×10^{-3}	7.0×10^{-4}	3.5×10^{-7}	1.6×10^{-5}	8.0×10^{-9}	1.7×10^{-3}	1.2×10^{-3}	6.0×10^{-7}	2.7×10^{-5}	1.4×10^{-8}
Vitrified RH-TRU	2.5×10^{-3}	5.1×10^{-4}	2.6×10^{-7}	1.2×10^{-5}	6.0×10^{-9}	5.0×10^{-3}	1.0×10^{-3}	5.0×10^{-7}	2.4×10^{-5}	1.2×10^{-8}

a. Amount of radioactive material dispersed during the accident.

b. Total effective dose equivalent committed to an adult located 0.1 (neutral) and 0.6 (stable) kilometers downwind from the accident site for a two-hour exposure period.

LCF = Latent cancer fatality.

Idaho High-Level Waste & Facilities Disposition

DRAFT ENVIRONMENTAL IMPACT STATEMENT

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Volume 4

APPENDICES C.6 THROUGH E

APPENDIX C.6

PROJECT INFORMATION

TABLE OF CONTENTS

TABLE OF CONTENTS (Continued)

Section | Page

TABLE OF CONTENTS (Continued)

TABLE OF CONTENTS (Continued)

List of Tables

TABLE OF CONTENTS (Continued)

List of Tables (Continued)

TABLE OF CONTENTS (Continued)

List of Tables (Continued)

TABLE OF CONTENTS (Continued)

List of Tables (Continued)

TABLE OF CONTENTS (Continued)

List of Tables (Continued)

TABLE OF CONTENTS (Continued)

List of Tables (Continued)

TABLE OF CONTENTS (Continued)

List of Tables (Continued)

C.6 Project Information

Appendix C.6 provides detailed information on the projects that comprise the alternatives described in Chapter 3. Section C.6.1 provides tables that identify the projects needed to implement each alternative and option. It also identifies proposed and existing facilities for each alternative and option. Section C.6.2 provides tables that give quantitative details on the construction, operations, and decontamination and decommissioning activities associated with each project.

C.6.1 PROJECTS AND FACILITIES ASSOCIATED WITH THE ALTERNATIVES

DOE's five waste processing alternatives are:

1. No Action
2. Continued Current Operations
3. Separations
4. Non-Separations
5. Minimum INEEL Processing

For purposes of analysis, DOE has broken the actions to implement each alternative and option into discrete projects. The proposed projects associated with the waste processing alternatives are presented in Table C.6.1-1. There are multiple projects comprising an alternative or option. Some projects are used repeatedly for the various alternatives and options. Projects that are very similar between alternatives and options are generally represented by a single bounding project. Detailed information on the individual projects is provided in Section C.6.2.

C.6.1.1 No Action Alternative

Existing INTEC facilities required for the No Action Alternative would include the bin sets, Tank Farm, High-Level Liquid Waste Evaporator, Process Equipment Waste Evaporator, and Liquid Effluent Treatment and Disposal Facility. The existing and proposed facilities associated with this alternative are listed in Table C.6.1-2. Table C.6.1-3 lists the projects associated with the No Action Alternative.

Table C.6.1-1. Projects at the INEEL associated with the waste processing alternatives.[a]

Project number	Project	Alternative/option
P1A	Calcine SBW Including New Waste Calcining Facility Upgrades	CCO, PB, HIP, DC
P1B	Newly Generated Liquid Waste and Tank Farm Heel Waste Management	CCO, PB, HIP, DC
P1C	Process Equipment Waste Evaporator and Liquid Effluent Treatment and Disposal Facility	EV, MIN
P1D	No Action Alternative	NAA
P1E	Bin Set 1 Calcine Transfer	NAA, CCO
P4	Long-Term Storage of Calcine in Bin Sets	NAA, CCO
P9A	Full Separations	FS
P9B	Vitrification Plant	FS
P9C	Class A Grout Plant	FS
P9J	HAW Denitration, Packaging and Cask Loading Facility	(b)
P18	New Analytical Laboratory	FS, PB, TS, HIP, DC, EV, MIN
P18MC	Remote Analytical Laboratory Operations	NAA, CCO
P23A	Full Separations	PB
P23B	Vitrification Plant	PB
P23C	Class A Grout Plant	PB
P24	Vitrified Product Interim Storage	FS, PB, MIN
P25A[c]	Packaging and Loading Vitrified HLW at INTEC for Shipment to a Geologic Repository	FS, PB, MIN
P25B[c]	Shipping HLW from INTEC to a Geologic Repository	FS, PB, MIN
P26	Class A Grout Disposal in Tank Farm and Bin Sets	FS
P27	Class A Grout Disposal in a New Low-Activity Waste Disposal Facility	FS, TS, MIN
P28A[c]	Class A Grout Shipment to Offsite Disposal Site	FS, PB
P35D	Class A Grout Packaging and Shipping to a New Low-Activity Waste Disposal Facility	FS
P35E	Class A Grout Packaging and Loading for Offsite Disposal	FS, PB, MIN
P39A	Packaging and Loading Transuranic Waste at INTEC for Shipment to the Waste Isolation Pilot Plant	TS
P39B[c]	Shipping Transuranic Waste from INTEC to the Waste Isolation Pilot Plant	TS
P49A	Transuranic/Class C Separations	TS
P49C	Class C Grout Plant	TS
P49D	Class C Grout Packaging and Shipping to a New Low-Activity Waste Disposal Facility	TS
P49E	Class C Grout Packaging and Loading for Offsite Disposal	TS
P51	Class C Grout Disposal in Tank Farm and Bin Sets	TS
P59A	Calcine Retrieval and Transport	FS, PB, TS, HIP, DC, EV, MIN
P59B[c]	Calcine Retrieval and Transport Just-in-Time	MIN
P61	Vitrified HLW Interim Storage	EV
P62A	Packaging and Loading Vitrified HLW at INTEC for Shipment to a Geologic Repository	EV
P63A[c]	Shipping Vitrified HLW from INTEC to a Geologic Repository	EV
P64D[c]	Transport of Vitrified Waste to INEEL	MIN
P64E	Vitrified Low-Activity Waste Shipment to Offsite Disposal Site	MIN
P71	Mixing and Hot Isostatic Pressing	HIP
P72	Interim Storage of Hot Isostatic Pressed Waste	HIP
P73A	Packaging and Loading Hot Isostatic Pressed Waste at INTEC for Shipment to a Geologic Repository	HIP

Table C.6.1-1. (Continued).

Project Number	Project	Alternative/option
P73B[c]	Shipping Hot Isostatic Pressed Waste from INTEC to a Geologic Repository	HIP
P80	Direct Cement Process	DC
P81	Unseparated Cementitious HLW Interim Storage	DC
P83A	Packaging and Loading Cementitious Waste at INTEC for Shipment to a Geologic Repository	DC
P83B[c]	Shipping Cementitious Waste from INTEC to a Geologic Repository	DC
P88	Early Vitrification Facility with Maximum Achievable Control Technology	EV
P90A	Packaging and Loading Vitrified SBW at INTEC for Shipment to the Waste Isolation Pilot Plant	EV
P90B[c]	Shipping of Vitrified SBW from INTEC to the Waste Isolation Pilot Plant	EV
P111	SBW and Newly Generated Liquid Waste Treatment with Cesium Ion Exchange to Contact-Handled Transuranic Grout and Low-Level Waste Grout	MIN
P112A	Packaging and Loading Contact-Handled Transuranic Waste for Shipment to the Waste Isolation Pilot Plant	MIN
P112B[c]	Shipping Contact-Handled Transuranic Waste to the Waste Isolation Pilot Plant	MIN
P112E	Shipping Transuranic Waste from INTEC to the Waste Isolation Pilot Plant	CCO, HIP, DC
P117A	Calcine Packaging and Loading to Hanford	MIN
P117B[d]	Calcine Packaging and Loading Just-in-Time	MIN
P118	Separations Organic Incinerator	FS, PB, TS
P121A[c]	Calcine Transport to Hanford	MIN
P121B[c,d]	Calcine Transport to Hanford Just-in-Time	MIN
P133	Waste Treatment Pilot Plant	FS, PB, TS, HIP, DC, EV, MIN

a. NAA = No Action Alternative; CCO = Continued Current Operations Alternative; FS = Separations Alternative/Full Separations Option; PB = Separations Alternative/Planning Basis Option; TS = Separations Alternative/Transuranic Separations Option; HIP = Non-Separations Alternative/Hot Isostatic Pressed Waste Option; DC = Non-Separations Alternative/Direct Cement Waste Option; EV = Non-Separations Alternative/Early Vitrification Option; MIN = Minimum INEEL Processing Alternative.
b. Stand-alone project; not associated with a specific waste processing alternative or option.
c. Transportation project. No project data presented in C.6.2.
d. P59A, P117A, and P121A relate to the Interim Storage Shipping scenario; P59B, P117B, and P121B relate to the Just-in-Time Shipping scenario. Section 3.1.5 explains the relationship of these two scenarios under the Minimum INEEL Processing Alternative.

Table C.6.1-2. Facilities associated with the No Action Alternative.

Facility name	Purpose
Existing Facilities	
Calcined Solids Storage Facilities (bin sets)	Stores calcined HLW.
Tank Farm	Stores liquid SBW and newly generated liquid waste.
High-Level Liquid Waste Evaporator	Concentrates SBW.
Process Equipment Waste Evaporator	Concentrates the newly generated liquid waste.
Liquid Effluent Treatment and Disposal Facility	Concentrates the acids from Process Equipment Waste Evaporator overheads.
Coal-Fired Steam Generating Facility	Provides steam for processes.
Substation	Provides electrical power for INTEC facilities.
Remote Analytical Laboratory	Performs analytical services for the process streams.
Proposed Facilities	
Calcine Retrieval and Transport System (bin set 1 only)[a]	Retrieves calcine from bin set 1 and transports it to bin set 6 or 7.

a. As decided in the SNF & INEL EIS Record of Decision (60 FR 28680; June 1, 1995).

Table C.6.1-3. Projects associated with the No Action Alternative.

Project number	Project name
P1D	No Action Alternative
P1E	Bin Set 1 Calcine Transfer
P4	Long-term Storage of Calcine in Bin Sets
P18MC	Remote Analytical Laboratory Operation

C.6.1.2 Continued Current Operations Alternative

Existing INTEC facilities required for the Continued Current Operations Alternative would include the bin sets, Tank Farm, New Waste Calcining Facility, High-Level Liquid Waste Evaporator, Process Equipment Waste Evaporator, and Liquid Effluent Treatment and Disposal Facility. The existing and proposed facilities associated with this alternative are listed in Table C.6.1-4. Table C.6.1-5 lists the projects associated with the Continued Current Operations Alternative.

C.6.1.3 Separations Alternative

DOE has selected three options for implementation of the Separations Alternative: Full Separations, Planning Basis, and Transuranic Separations. These options have similar requirements for new INTEC facilities, such as the need for a separations facility and low activity waste grouting facility. However, the specific processes that occur in each of the proposed facilities and the waste forms that would be produced differ between the options.

Full Separations Option

Existing INTEC facilities required for the Full Separations Option would include the bin sets, Tank Farm, High-Level Liquid Waste Evaporator, Process Equipment Waste Evaporator, and Liquid Effluent Treatment and Disposal Facility. Proposed facilities would include a Calcine Retrieval and Transport System, Waste Separations Facility, Vitrification Plant, Class A Grout Plant, Low-Activity Waste Disposal Facility, and Interim Storage Facility. The existing and proposed facilities associated with this alternative are listed in Table C.6.1-6. Table C.6.1-7 lists the projects associated with the Full Separations Option.

Planning Basis Option

Existing INTEC facilities required for the Planning Basis Option would include the bin sets, Tank Farm, New Waste Calcining Facility, High-Level Liquid Waste Evaporator, Process Equipment Waste Evaporator, and Liquid Effluent Treatment and Disposal Facility. Proposed facilities would include a Calcine Retrieval and Transport System, Waste Separations Facility, Vitrification Plant, Class A Grout Plant, Interim Storage Facility, and Newly Generated Liquid Waste Treatment Facility. The existing and proposed facilities associated with this alternative are listed in Table C.6.1-8. Table C.6.1-9 lists the projects associated with the Planning Basis Option.

Table C.6.1-4. Facilities associated with the Continued Current Operations Alternative.

Facility name	Purpose
Existing Facilities	
Calcined Solids Storage Facilities (bin sets)	Stores calcined HLW.
Tank Farm	Stores liquid SBW and newly generated liquid waste.
New Waste Calcining Facility	Calcines liquid SBW and newly generated liquid waste.
High-Level Liquid Waste Evaporator	Concentrates SBW and newly generated liquid waste.
Liquid Effluent Treatment and Disposal Facility	Concentrates the acids from Process Equipment Waste Evaporator overheads.
Process Equipment Waste Evaporator	Concentrates the high acid and high radioactivity newly generated liquid waste.
Remote Analytical Laboratory	Performs analytical services for the process streams.
Coal-Fired Steam Generating Facility	Provides steam for processes.
Substation	Provides electrical power for INTEC facilities.
Proposed Facilities	
Calcine Retrieval and Transport System (bin set 1 only)	Retrieves calcine from bin set 1 and transports it to bin set 6 or 7.
Newly Generated Liquid Waste Treatment Facility	Concentrates and grouts the newly generated liquid waste prior to disposal at a low-level waste disposal facility.

Table C.6.1-5. Projects associated with the Continued Current Operations Alternative.

Project number	Project name
P1A	Calcine SBW Including New Waste Calcining Facility Upgrades
P1B	Newly Generated Liquid Waste and Tank Farm Heel Waste Management
P1E	Bin Set 1 Calcine Transfer
P4	Long-Term Storage of Calcine in Bin Sets
P18MC	Remote Analytical Laboratory Operation
P112E	Shipping Transuranic Waste from INTEC to the Waste Isolation Pilot Plant

Table C.6.1-6. Facilities associated with the Full Separations Option.

Facility name	Purpose
<u>Existing Facilities</u>	
Calcined Solids Storage Facilities (bin sets)	Stores calcined HLW until removed for chemical separation and potentially serves as a destination for Class A grout.
Tank Farm	Stores liquid SBW until removed for chemical separation and potentially serves as a destination for Class A grout.
High-Level Liquid Waste Evaporator	Concentrates SBW and newly generated liquid waste.
Liquid Effluent Treatment and Disposal Facility	Concentrates the acids from Process Equipment Waste Evaporator overheads.
Process Equipment Waste Evaporator	Concentrates the high acid and high radioactivity newly generated liquid waste.
Remote Analytical Laboratory	Performs analytical services for the process streams.
Coal-Fired Steam Generating Facility	Provides steam for processes.
Substation	Provides electrical power for INTEC facilities.
<u>Proposed Facilities</u>	
Calcine Retrieval and Transport System	Retrieves calcine from the bin sets and transports it to the Waste Separations Facility.
Waste Separations Facility	Performs chemical separations producing the high-activity waste and low-activity waste streams.
Vitrification Plant	Converts the high-activity waste to a vitrified (glass) form.
Class A Grout Plant	Evaporates and denitrates the low-activity waste and produces a Class A grout.
Low-Activity Waste Disposal Facility	Receives containerized Class A grout for disposal.
Vitrified Product Interim Storage Facility	Provides interim storage for vitrified high-activity waste until shipped to a geologic repository.
New Analytical Laboratory	Replaces the Remote Analytical Laboratory.
Waste Treatment Pilot Plant	Develops and tests new processes

Table C.6.1-7. Projects associated with the Full Separations Option.

Project number	Project name
P59A	Calcine Retrieval and Transport
P9A	Full Separations
P9B	Vitrification Plant
P9C	Class A Grout Plant
P24	Vitrified Product Interim Storage
P25A	Packaging and Loading Vitrified HLW at INTEC for Shipment to a Geologic Repository
P25B	Shipping HLW from INTEC to a Geologic Repository
P18	New Analytical Laboratory
P118	Separations Organic Incinerator
P133	Waste Treatment Pilot Plant
	and
P35D *and*	Class A Grout Packaging and Shipping to a New Low-Activity Waste Disposal Facility *and*
P27	Class A Grout Disposal in a New Low-Activity Waste Disposal Facility
	or
P35E *and*	Class A Grout Packaging and Loading for Offsite Disposal *and*
P28A	Class A Grout Shipment to Offsite Disposal Site
	or
P26	Class A Grout Disposal in Tank Farm and Bin Sets

Table C.6.1-8. Facilities associated with the Planning Basis Option.

Facility name	Purpose
Existing Facilities	
Calcined Solids Storage Facilities (bin sets)	Stores calcined HLW until removed for chemical separation and potentially serves as a destination for Class A grout.
Tank Farm	Stores liquid SBW until removed for chemical separation and potentially serves as a destination for Class A grout.
New Waste Calcining Facility	Calcines liquid SBW and newly generated liquid waste.
High-Level Liquid Waste Evaporator	Concentrates SBW and newly generated liquid waste.
Liquid Effluent Treatment and Disposal Facility	Concentrates the acids from Process Equipment Waste Evaporator overheads.
Process Equipment Waste Evaporator	Concentrates the high acid and high radioactivity newly generated liquid waste.
Remote Analytical Laboratory	Performs analytical services for the process streams.
Coal-Fired Steam Generating Facility	Provides steam for processes.
Substation	Provides electrical power for INTEC facilities.
Proposed Facilities	
Calcine Retrieval and Transport System	Retrieves calcine from the bin sets and transports it to the Waste Separations Facility.
Waste Separations Facility	Performs chemical separations producing the high-activity waste and low-activity waste streams.
Vitrification Plant	Converts the high-activity waste to a vitrified (glass) form.
Class A Grout Plant	Evaporates and denitrates the low-activity waste and produces a Class A grout.
Vitrified Product Interim Storage Facility	Stores vitrified high-activity waste in stainless steel canisters which are either stored in a modified, existing facility or placed into new concrete and steel vaults.
New Analytical Laboratory	Replaces the Remote Analytical Laboratory.
Newly Generated Liquid Waste Treatment Facility	Concentrates and grouts the newly generated liquid waste prior to disposal at a low-level waste disposal facility.
Waste Treatment Pilot Plant	Develops and tests new processes.

Table C.6.1-9. Projects associated with the Planning Basis Option.

Project number	Project name
P1A	Calcine SBW Including New Waste Calcining Facility Upgrades
P1B	Newly Generated Liquid Waste and Tank Farm Heel Waste Management
P59A	Calcine Retrieval and Transport
P23A	Full Separations
P23B	Vitrification Plant
P23C	Class A Grout Plant
P24	Vitrified Product Interim Storage
P25A	Packaging and Loading Vitrified HLW at INTEC for Shipment to a Geologic Repository
P25B	Shipping HLW from INTEC to a Geologic Repository
P18	New Analytical Laboratory
P118	Separations Organic Incinerator
P133	Waste Treatment Pilot Plant
P35E	Class A Grout Packaging and Loading for Offsite Disposal
P28A	Class A Grout Shipment to Offsite Disposal Site

Transuranic Separations Option

Existing INTEC facilities required for the Transuranic Separations Option would include the bin sets, Tank Farm, High-Level Liquid Waste Evaporator, Process Equipment Waste Evaporator, and Liquid Effluent Treatment and Disposal Facility. Proposed facilities would include a Calcine Retrieval and Transport System, Transuranic Separations Facility, Class C Grout Plant, and Low-Activity Waste Disposal Facility. The existing and proposed facilities associated with this alternative are listed in Table C.6.1-10. Table C.6.1-11 lists the projects associated with the Transuranic Separations Option.

C.6.1.4 Non-Separations Alternative

Hot Isostatic Pressed Waste Option

Existing INTEC facilities required for the Hot Isostatic Pressed Waste Option would include the bin sets, Tank Farm, New Waste Calcining Facility, High-Level Liquid Waste Evaporator, Process Equipment Waste Evaporator, and Liquid Effluent Treatment and Disposal Facility. Proposed facilities would include a Calcine Retrieval and Transport System, Hot Isostatic Press Facility, Interim Storage Facility, and Newly Generated Liquid Waste Treatment Facility. The existing and proposed facilities associated with this alternative are listed in Table C.6.1-12. Table C.6.1-13 lists the projects associated with the Hot Isostatic Pressed Waste Option.

Direct Cement Waste Option

Existing INTEC facilities required for the Direct Cement Waste Option would include the bin sets, Tank Farm, New Waste Calcining Facility, High-Level Liquid Waste Evaporator, Process Equipment Waste Evaporator, and Liquid Effluent Treatment and Disposal Facility. Proposed facilities would include a Calcine Retrieval and Transport System, Cement Facility, Interim Storage Facility, and Newly Generated Liquid Waste Treatment Facility. The existing and proposed facilities associated with this alternative are listed in Table C.6.1-14. Table C.6.1-15 lists the projects associated with the Direct Cement Waste Option.

Table C.6.1-10. Facilities associated with the Transuranic Separations Option.

Facility name	Purpose
Existing Facilities	
Calcined Solids Storage Facilities (bin sets)	Stores calcined HLW until removed for chemical separation and potentially serves as a destination for Class C grout.
Tank Farm	Stores liquid SBW until removed for chemical separation and potentially serves as a destination for Class C grout.
High-Level Liquid Waste Evaporator	Concentrates SBW and newly generated liquid waste.
Liquid Effluent Treatment and Disposal Facility	Concentrates the acids from Process Equipment Waste Evaporator overheads.
Process Equipment Waste Evaporator	Concentrates the high acid and high radioactivity newly generated liquid waste.
Remote Analytical Laboratory	Performs analytical services for the process streams.
Coal-Fired Steam Generating Facility	Provides steam for processes.
Substation	Provides electrical power for INTEC facilities.
Proposed Facilities	
Calcine Retrieval and Transport System	Retrieves calcine from the bin sets and transports in the Transuranic Separations Facility.
Transuranic Separations Facility	Performs transuranic extraction producing the transuranic and low-activity waste streams. Dries and solidifies the transuranic waste stream.
Class C Grout Plant	Evaporates and denitrates the low-activity waste and produces a Class C grout.
Low-Activity Waste Disposal Facility	Receives containerized Class C grout for disposal.
New Analytical Laboratory	Replaces the Remote Analytical Laboratory.
Waste Treatment Pilot Plant	Develops and tests new processes.

Table C.6.1-11. Projects associated with the Transuranic Separations Option.

Project number	Project name
P59A	Calcine Retrieval and Transport
P49A	Transuranic/Class C Separations
P49C	Class C Grout Plant
P39A	Packaging and Loading Transuranic Waste at INTEC for Shipment to the Waste Isolation Pilot Plant
P39B	Shipping Transuranic Waste from INTEC to the Waste Isolation Pilot Plant
P18	New Analytical Laboratory
P118	Separations Organic Incinerator
P133	Waste Treatment Pilot Plant
	and
P49D *and*	Class C Grout Packaging and Shipping to a New Low-Activity Waste Disposal Facility *and*
P27	Class C Grout Disposal in a New Low-Activity Waste Disposal Facility
	or
P49E *and*	Class C Grout Packaging and Loading for Offsite Disposal *and*
P28A	Class C Grout Shipment to Offsite Disposal Site
	or
P51	Class C grout Disposal in Tank Farm and Bin Sets

Table C.6.1-12. Facilities associated with the Hot Isostatic Pressed Waste Option.

Facility name	Purpose
Existing Facilities	
New Waste Calcining Facility	Calcines liquid SBW and newly generated liquid waste.
High-Level Liquid Waste Evaporator	Concentrates SBW and newly generated liquid waste.
Calcined Solids Storage Facilities (bin sets)	Stores calcine from the New Waste Calcining Facility until removed by the Calcine Retrieval and Transport system and sent to the Hot Isostatic Press Facility.
Process Equipment Waste Evaporator	Concentrates the newly generated liquid waste before storing, calcining, or grouting.
Liquid Effluent Treatment and Disposal Facility	Processes the newly generated liquid waste overheads from the Process Equipment Waste Evaporator.
Remote Analytical Laboratory	Performs analytical services for the process streams.
Tank Farm	Stores liquid SBW until removed for calcination in the New Waste Calcining Facility.
Coal-Fired Steam Generating Facility	Provides steam energy for the process.
Substation	Provides electrical power for the INTEC facilities.
Proposed Facilities	
Calcine Retrieval and Transport System	Retrieves calcine from the bin sets and transports it to the Hot Isostatic Press Facility.
Hot Isostatic Press Facility	Processes the calcine to produce an impervious, non-leachable glass-ceramic form.
HLW Interim Storage Facility	Provides interim storage for Hot Isostatic Pressed Waste canisters until shipped to a geologic repository.
Newly Generated Liquid Waste Treatment Facility	Concentrates and grouts the newly generated liquid waste prior to disposal at a low-level waste disposal facility.
New Analytical Laboratory	Replaces the Remote Analytical Laboratory.
Waste Treatment Pilot Plant	Develops and tests new processes.

Table C.6.1-13. Projects associated with the Hot Isostatic Pressed Waste Option.

Project number	Project name
P1A	Calcine SBW Including New Waste Calcining Facility Maximum Achievable Control Technology Upgrades
P1B	Newly Generated Liquid Waste and Tank Farm Heel Waste Management
P18	New Analytical Laboratory
P59A	Calcine Retrieval & Transport
P71	Mixing and Hot Isostatic Pressing
P72	Interim Storage of Hot Isostatic Pressed Waste
P73A	Packaging and Loading Hot Isostatic Pressed Waste at INTEC for Shipment to a Geologic Repository
P73B	Shipping Hot Isostatic Pressed Waste from INTEC to a Geologic Repository
P112E	Shipping Transuranic Waste from INTEC to the Waste Isolation Pilot Plant
P133	Waste Treatment Pilot Plant

Table C.6.1-14. Facilities associated with the Direct Cement Waste Option.

Facility name	Purpose
Existing Facilities	
New Waste Calcining Facility	Calcines liquid SBW and newly generated liquid waste.
High-Level Liquid Waste Evaporator	Concentrates SBW and newly generated liquid waste.
Calcined Solids Storage Facilities (bin sets)	Stores the HLW calcine until transported by the Calcine Retrieval and Transport system to the Direct Grouting Facility.
Process Equipment Waste Evaporator	Concentrates the newly generated liquid waste.
Liquid Effluent Treatment and Disposal Facility	Processes the newly generated liquid waste overheads from the Process Equipment Waste Evaporator.
Remote Analytical Laboratory	Perform analytical services for the process streams.
Tank Farm	Stores liquid SBW until removed for calcination in the New Waste Calcining Facility.
Coal-Fired Steam Generating Facility	Provides steam energy for the process.
Substation	Provides electrical power for the INTEC facilities.
Proposed Facilities	
Calcine Retrieval and Transport System	Retrieves calcine from the bin sets and transports it to the Direct Grouting Facility.
Cement Facility	Processes the calcined SBW and HLW to produce a hydroceramic form.
HLW Interim Storage Facility	Provides interim storage for cemented HLW canisters until shipped to a geologic repository.
Newly Generated Liquid Waste Treatment Facility	Concentrates and grouts the newly generated liquid waste prior to disposal at a low-level waste disposal facility.
New Analytical Laboratory	Replaces the Remote Analytical Laboratory.
Waste Treatment Pilot Plant	Develops and tests new processes.

Table C.6.1-15. Projects associated with the Direct Cement Waste Option.

Project number	Project name
P1A	Calcine SBW including New Waste Calcining Facility Upgrades
P1B	Newly Generated Liquid Waste and Tank Farm Heel Waste Management
P18	New Analytical Laboratory
P59A	Calcine Retrieval and Transport
P80	Direct Cement Process
P81	Unseparated Cementitious HLW Interim Storage
P83A	Packaging and Loading Cementitious Waste at INTEC for Shipment to a Geologic Repository
P83B	Shipping Cementitious Waste from INTEC to a Geologic Repository
P112E	Shipping Transuranic Waste from INTEC to the Waste Isolation Pilot Plant
P133	Waste Treatment Pilot Plant

Early Vitrification Option

Existing INTEC facilities required for the Early Vitrification Option would include the bin sets, Tank Farm, High-Level Liquid Waste Evaporator, Process Equipment Waste Evaporator, and Liquid Effluent Treatment and Disposal Facility. Proposed facilities would include a Calcine Retrieval and Transport System, Early Vitrification Facility, and Interim Storage Facility. The existing and proposed facilities associated with this alternative are listed in Table C.6.1-16. Table C.6.1-17 lists the projects associated with the Early Vitrification Option.

C.6.1.5 Minimum INEEL Processing Alternative

Existing INTEC facilities required for the Minimum INEEL Processing Alternative would include the bin sets, Tank Farm, High-Level Liquid Waste Evaporator, Process Equipment Waste Evaporator, and Liquid Effluent Treatment and Disposal Facility. Proposed facilities would include a Calcine Retrieval and Transport System, Calcine Packaging Facility, Interim Storage Facility, Sodium-Bearing Waste and Newly Generated Liquid Waste Treatment Facility, and Low-Activity Waste Disposal Facility. The existing and proposed facilities associated with this alternative are listed in Table C.6.1-18.

This alternative includes two scenarios for shipping calcine from INEEL to the Hanford Site. The first scenario is to ship the calcine during the years 2012 through 2035, which would require the Hanford Site to build canister storage buildings for interim storage of the INEEL calcine prior to treatment. Table C.6.1-19 lists the projects associated with this shipping scenario for the Minimum INEEL Processing Alternative. A second scenario is to ship calcine to the Hanford Site on a just-in-time basis, over the years 2028 through 2030. The calcine would be shipped to the Hanford Site at the rate it can be introduced directly to the treatment process, so that construction of canister storage buildings would not be necessary. Table C.6.1-19 lists the projects associated with this shipping scenario for the Minimum INEEL Processing Alternative.

In addition, this alternative would require existing and new facilities at the Hanford Site to treat the INEEL waste. The facilities and projects that would be associated with management of the calcined HLW at the Hanford Site are described in Appendix C.8.

Table C.6.1-16. Facilities associated with the Early Vitrification Option.

Facility name	Purpose
Existing Facilities	
Calcined Solids Storage Facilities (bin sets)	Stores calcine, until removed by the Calcine Retrieval and Transport system and sent to the Vitrification Facility.
High-Level Liquid Waste Evaporator	Concentrates SBW and Newly Generated Liquid Waste.
Process Equipment Waste Evaporator	Concentrates the effluents resulting from vitrification the Vitrification Facility.
Liquid Effluent Treatment and Disposal Facility	Processes the overheads from the Process Equipment Waste Evaporator.
Remote Analytical Laboratory	Performs analytical services for the process streams.
Tank Farm	Stores liquid SBW until removed for vitrification.
Coal-Fired Steam Generating Facility	Provides steam energy for the process.
Substation	Provides electrical power for INTEC facilities.
Proposed Facilities	
Calcine Retrieval and Transport System	Retrieves calcine from the bin sets and transports it to the Vitrification Facility.
Early Vitrification Facility	Vitrifies SBW, newly generated liquid waste, and calcine.
HLW Interim Storage Facility	Provides interim storage for the vitrified HLW canisters until shipped to a geologic repository.
New Analytical Laboratory	Replaces the Remote Analytical Laboratory.
Waste Treatment Pilot Plant	Develops and tests new processes.

Table C.6.1-17. Projects associated with the Early Vitrification Option.

Project number	Project name
P1C	Process Equipment Waste Evaporator and Liquid Effluent Treatment and Disposal Facility
P18	New Analytical Laboratory
P59A	Calcine Retrieval and Transport
P61	Vitrified HLW Interim Storage
P62A	Packaging and Loading Vitrified HLW at INTEC for Shipment to a Geologic Repository
P63A	Shipping of Vitrified HLW from INTEC to a Geologic Repository
P88	Early Vitrification with Maximum Achievable Control Technology
P90A	Packaging and Loading Vitrified SBW at INTEC for Shipment to the Waste Isolation Pilot Plant
P90B	Shipping of Vitrified SBW from INTEC to the Waste Isolation Pilot Plant
P133	Waste Treatment Pilot Plant

Table C.6.1-18. Facilities associated with the Minimum INEEL Processing Alternative.[a]

Facility name	Purpose
<u>Existing Facilities</u>	
Calcined Solids Storage Facilities (bin sets)	Stores calcined HLW until removed for packaging and loading for shipment to the Hanford Site.
Tank Farm	Stores liquid SBW until removed for processing through the treatment facility.
Process Equipment Waste Evaporator	Concentrates the newly generated liquid waste.
High-Level Liquid Waste Evaporator	Concentrates SBW and newly generated liquid waste.
Liquid Effluent Treatment and Disposal Facility	Processes overheads from the Process Equipment Waste Evaporator.
Remote Analytical Laboratory	Performs analytical services for the process streams.
Coal-Fired Steam Generating Facility	Provides steam for processes.
Substation	Provides electrical power for INTEC facilities.
<u>Proposed Facilities</u>	
Calcine Retrieval and Transport System	Retrieves calcine from the bin sets and transports it to the Calcine Packaging Facility.
Calcine Packaging Facility	Prepares the calcine for shipment.
SBW and NGLW Treatment Facility	Processes the liquid wastes for shipment.
New Analytical Laboratory	Replaces the Remote Analytical Laboratory.
Vitrified Product Interim Storage Facility	Provides interim storage for vitrified high-activity waste until shipped to a geologic repository.
Low-Activity Waste Disposal Facility	Receives vitrified low-activity waste for disposal.
Waste Treatment Pilot Plant	Develops and tests new processes.

a. Facilities at the Hanford Site are described in Appendix C.8.

Table C.6.1-19. Projects associated with the Minimum INEEL Processing Alternative.[a]

Project number	Project name
P1C	Process Equipment Waste Evaporator and Liquid Effluent Treatment and Disposal
P18	New Analytical Laboratory
P24	Vitrified Product Interim Storage
P25A	Packaging and Loading Vitrified HLW at INTEC for Shipment to a Geologic Repository
P25B	Transport of Vitrified Waste from INEEL to a Geologic Repository
P27	Class A Grout Disposal in a New Low-Activity Waste Disposal Facility
P64D	Transport of the Vitrified Waste to INEEL
P111	SBW and Newly Generated Liquid Waste Treatment with Cesium Ion Exchange to Contact-Handled Transuranic Grout and Low-Level Waste Grout
P112A	Packaging and Loading Contact-Handled Transuranic Waste for Transport to the Waste Isolation Pilot Plant
P112B	Shipping Contact-Handled Transuranic Waste to the Waste Isolation Pilot Plant
P133	Waste Treatment Pilot Plant
	and
P59A	Calcine Retrieval and Transport
P117A	Calcine Packaging and Loading to Hanford
P121A	Calcine Transport to Hanford
	or
P59B	Calcine Retrieval and Transport Just-in-Time
P117B	Calcine Packaging and Loading Just-in-Time
P121B	Calcine Transport to Hanford Just-in-Time
P35E	Class A Grout Packaging and Loading for Offsite Disposal
P64E	Vitrified Low-Activity Waste Shipment to Offsite Disposal Site

a. Projects at the Hanford Site are described in Appendix C.8.

DOE used a systematic process to identify which existing INTEC facilities would be analyzed in detail under the facility disposition alternatives in this EIS. Detailed information regarding this process and facility disposition alternatives is provided in Section 3.2, Facility Disposition Alternatives. Existing HLW facilities would be dispositioned under all waste processing alternatives. The facility disposition alternatives are modular in nature and can be integrated with any waste processing alternative or option. Table C.6.1-20 identifies the facility disposition alternatives and the specific project associated with the dispositioning of each facility. Detailed information for the proposed projects associated with each facility closure are presented in C.6.2.

For the Tank Farm and bin sets, which together constitute the majority of the total inventory of residual radioactivity, DOE analyzed all five facility disposition alternatives. Since the residual amount of radioactive and/or chemical contaminants associated with other INTEC facilities is much less than that of the Tank Farm and bin sets, the overall residual risk at INTEC would not change significantly due to the contribution from these other facilities. For purposes of analysis, DOE assumed a single facility disposition alternative for the other INTEC HLW facilities, except for the New Waste Calcining Facility and the Fuel Processing Building and related facilities for which two facility disposition alternatives were evaluated.

Table C.6.1-20. Facility disposition alternatives.

Facility Description	Facility Disposition Alternative: Clean Closure	Performance-Based Closure	Closure to Landfill Standards	Performance-Based Closure with Class A Grout Disposal	Performance-Based Closure with Class C Grout Disposal
Tank Farm and Related Facilities					
Tank Farm[a]	P59G	P3B	P3C	P26	P51
CPP-619 – Tank Farm Area – CPP (Waste Storage Control House)			P156B		
CPP-628 - Tank Farm Area – CPP (Waste Storage Control House)			P156C		
CPP-638 – Waste Station (WM-180) Tank Transfer Building			P156E		
CPP-712 – Instrument House (VES-WM-180, 181)			P156F		
CPP-717 – STR/SIR[e] Waste Storage Tank Pads (A, B, C, and D) and Vessels			P156G		
Bin Sets and Related Facilities					
Bin sets[b]	P59F	P59C	P59D	P26	P51
CPP-639 – Blower Building/Bin Sets 1, 2, 3			P157A		
CPP-646 – Instrument Building for 2nd Set Calcined Solids			P157B		
CPP-647 – Instrument Building for 3rd Set Calcined Solids			P157C		
CPP-658 – Instrument Building for 4th Set Calcined Solids			P157D		
CPP-671 – Instrument Building for 5th Set Calcined Solids			P157E		
CPP-673 – Instrument Building for 6th Set Calcined Solids			P157F		
Process Equipment Waste Evaporator and Related Facilities					
CPP-604 – Process Equipment Waste Evaporator			P158H		
CPP-605 – Blower Building			P158A		
CPP-641 – West Side Waste Holdup	P156L				
CPP-649 – Atmospheric Protection Building			P158B		
CPP-708 – Exhaust Stack/Main Stack[c]			P158C		
CPP-756 – Pre-Filter Vault			P158D		
CPP-1618 – Liquid Effluent Treatment and Disposal Facility	P158E				
NA – PEWE[f] Condensate Lines			P154B		
NA – PEWE[f] Condensate Lines and Cell Floor Drain Lines			P154A		
Fuel Processing Building and Related Facilities					
CPP-601 – Fuel Processing Building		P160E	P160A		
CPP-627 – Remote Analytical Facility Building		P160F	P160C		
CPP-640 – Head End Process Plant		P160G	P160D		
FAST and Related Facilities					
CPP-666 – Fluorinel Dissolution Process and Fuel Storage Facility		P161A			
CPP-767 – Fluorinel Dissolution Process and Fuel Storage Facility Stack	P161B				

Table C.6.1-20. (Continued).

Facility Description	Facility Disposition Alternative: Clean Closure	Performance-Based Closure	Closure to Landfill Standards	Performance-Based Closure with Class A Grout Disposal	Performance-Based Closure with Class C Grout Disposal
Transport Lines Group					
NA – Process Offgas Lines		P162C			
NA – High-Level Liquid Waste (Raffinate) Lines			P162A		
NA – Process (Dissolver) Transport Lines		P162D			
NA – Calcine Solids Transport Lines			P162B		
Other HLW Facilities					
CPP-659 – New Waste Calcining Facility[d]		165A	165B		
CPP-684 – Remote Analytical Laboratory		P159			

a. The INTEC Tank Farm consists of underground storage tanks, concrete tank vaults, waste transfer lines, valve boxes, valves, airlift pits, cooling equipment, and several small buildings containing instrumentation and valves for the waste tanks. Includes waste storage tanks (VES-WM-180 through 190), Tank Vaults for Tanks VES-WM-180 through 186 (CPP-780 through 786), Tank Enclosure for Tanks VES-WM-187 through 190 (CPP-713), and facilities CPP-721 through 723, CPP-737 through 743, and CPP-634 through 636, and CPP-622, 623, and 632.
b. The bin sets consist of ancillary structures, instrument rooms, filter rooms, cyclone vaults, and stacks, including CSSF-1 through 7, CPP-729, CPP-732, CPP-741 through 742, CPP-744, CPP-746 through 747, CPP-760 through 761, CPP-765, CPP-791, CPP-795, and CPP-1615.
c. Includes the instrument building for Main Stack CPP-692 and waste transfer line valve boxes.
d. Includes Organic Solvent Disposal Building CPP-694.
e. STR = Submarine Thermal Reactor, SIR = Submarine Intermediate Reactor
f. PEWE = Process Equipment Waste Evaporator.

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C.6.2 PROJECT SUMMARIES

Waste Processing Projects

C.6.2.1 Calcine SBW Including New Waste Calcining Facility Upgrades (P1A)

PROJECT DESCRIPTION: Four waste processing alternatives/options (Continued Current Operations Alternative, Planning Basis Option, Hot Isostatic Pressed Waste Option, and Direct Cement Waste Option) require that liquid sodium-bearing waste (SBW) be calcined prior to further processing, storage, or disposal. To accomplish that objective, modifications and additions to the New Waste Calcining Facility (NWCF) and a new storage tank would be required. The modified calcining facility would process all SBW by the end of 2014, but would remain operational through 2016 in preparation for closure.

PROJECT DETAILS

NWCF Upgrades

In order to obtain an operating permit from the State of Idaho, the NWCF would have to undergo certain modifications to comply with the expected maximally achievable control technology (MACT) requirements for air emissions. Also, to calcine the liquid waste more efficiently the calciner must operate at a higher temperature than used in previous campaigns. The project data sheet reflects construction and decontamination and decommissioning, but not NWCF operations.

Baseline Information

- The calciner would operate at 600°C and would convert SBW to calcine. Startup and operational testing of the upgraded calciner would occur in 2009-2010.

- Nearly all SBW would be calcined by the end of 2014; however, the calciner may continue operations until 2016, at which time the calciner may have completed calcination of its own Type-I beds, for decontamination purposes.

- The MACT and high-temperature upgrades would be operational by 2009, when the calciner would undergo startup and operational testing.

Table C.6.2-1. Construction project data for the new liquid waste storage tank for the Calcine SBW Including New Waste Calcining Facility Upgrades (P1A)

Table C.6.2-2. Construction project data for the New Waste Calcining Facility MACT Compliance Facility for the Calcine SBW Including New Waste Calcining Facility Upgrades (P1A)

Table C.6.2-3. Operations project data for combined operations of facilities for the Calcine SBW Including New Waste Calcining Facility Upgrades (P1A)

Table C.6.2-4. Decontamination and decommissioning project data for the new liquid waste storage tank for the Calcine SBW Including New Waste Calcining Facility with Upgrades (P1A)

Table C.6.2-5. Decontamination and decommissioning project data for the New Waste Calcining Facility MACT Compliance Facility for the Calcine SBW Including New Waste Calcining Facility with Upgrades (P1A)

C.6.2.2 Newly Generated Liquid Waste and Tank Farm Heel Waste Management (P1B)

GENERAL PROJECT OBJECTIVE: The general objective of this project is to provide design, construction, startup, operation, and decommissioning of a new facility to treat and stabilize newly generated liquid waste and Tank Farm heel waste. The project would be conducted in support of the four waste processing alternatives/options: Continued Current Operations Alternative, Planning Basis Option, Hot Isostatic Pressed Waste Option, and Direct Cement Waste Option.

PROJECT DESCRIPTION: The treatment facility would begin processing liquid waste in 2015. Until that time, newly generated liquid waste would be stored in the existing Tank Farm tank WM-190. The project addresses three treatment processes:

- Treatment and stabilization of the newly generated liquid waste would occur over the time period of 2015 through 2035. The proposed project would result in the design, construction, and operation of a new facility to treat and stabilize newly generated liquid waste that has been concentrated by evaporation in the Process Equipment Waste Evaporator and Liquid Effluent Treatment and Disposal Facilities. After cesium and undissolved solids are removed from the waste, the remaining waste would be concentrated further in an evaporator, neutralized, stabilized in a grout mixture, and placed in 55-gallon drums for disposal at INEEL as Class-A, low-level waste.

- In-situ removal of cesium from the tank heels would occur over the time period of 2015 through 2016. The proposed project, which relies on the solubility of cesium in water, would utilize equipment within the new Newly Generated Liquid Waste Facility. Process water would be pumped into the tanks from CPP-603, the waste heel would be agitated via a jet pump, and undissolved solids would be allowed to settle. Subsequently, clarified water containing cesium would be decanted from the tanks and processed in an ion-exchange column. The processed water would be piped into a second tank for further cesium removal. After the small amount of cesium-saturated resin has been dried, it would be stored in the bin sets with calcine.

- The remaining tank heel waste would be stabilized over the time period of 2016 through 2020. Processing would occur within the new Newly Generated Liquid Waste Facility. Process water would be pumped into the tanks from CPP-603; the waste heel would be agitated via a jet pump, and drained from the tank into the evaporator. After concentration, the waste would be dried, packaged, and readied for shipment to WIPP.

Additional evaluation would be required during design to establish the requirements and design of the filtration device for the removal of undissolved solids. Different filtration systems may be required for the three processes.

NEW FACILITY DESCRIPTION: The new facility would be located in the northwest corner of the INTEC. The 2-story building is above grade with the exception of below grade canyon areas for process lines. The areas of the building requiring the most radiological shielding (5-feet thick concrete walls) are the ion exchange rooms and the packaging and loading high bay. These areas are centrally located in the facility. Except for the raw grouting and neutralization material rooms, the processing rooms are considered radiation areas with remote operations. The newly generated liquid waste is brought to the facility through a new underground pumping/piping system. No previously undisturbed land would be affected by the project.

The packaging and loading area is a shielded high bay which accommodates the remote handling of the undissolved solids and spent sorbant containers. The dried, RH-transuranic waste would be packaged in WIPP half-canisters (0.4 m^3 capacity) for disposal at WIPP, the cesium resin would be placed in the bin sets with calcine, and the remaining grouted low-level waste would be disposed of at INEEL.

Table C.6.2-6. Construction and operations project data for Newly Generated Liquid Waste and Tank Farm Heel Waste Management (P1B).

Table C.6.2-7. Decontamination and decommissioning project data for Newly Generated Liquid Waste and Tank Farm Heel Waste Management (P1B)

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C.6.2.3 Process Equipment Waste Evaporator and Liquid Effluent Treatment and Disposal Facility (P1C)

GENERAL DESCRIPTION: Two of the high-level-waste-treatment options require a separate project to concentrate the dilute, newly generated-liquid wastes prior to their treatment for disposal or transport. This project runs from 2000 through 2035, except for the Tank Farm portion, which only runs through 2014. The waste treatment would utilize existing facilities: the Process Equipment Waste Evaporator and the Liquid Effluent Treatment and Disposal Facility; thus, no construction activities are necessary for this project.

The Process Equipment Waste Evaporator (PEWE) uses steam from the steam plant to concentrate liquid wastes to a particular specific gravity. Vapors from the evaporator are condensed and sent to the Liquid Effluent Treatment and Disposal Facility, a fractionator for recycling acids. The feed rate into the Process Equipment Waste Evaporator limits the emissions from the Liquid Effluent Treatment and Disposal (LET&D) Facility to comply with the RCRA limits. For Type-II liquid waste (see P111 for definitions of Type-I and Type-II Newly Generated Liquid Wastes), the feed rate is 400 gal/hr. The concentrated liquid from the evaporator is returned to storage while awaiting further processing. The PEW evaporator would concentrate an average of 105,000 gallons per year of Type-II liquid waste to 5,000 gallons at a rate of 400 gal/hr.

Since the calciner is not used in the treatment options requiring this project, no new Type-I waste would be generated, except for incidental amounts from the Filter Leach Facility. Therefore, the evaporator would concentrate only small amounts of Type-I waste that could be diluted with Type-II waste.

Table C.6.2-8. Construction and operations project data for the PEW Evaporator and LET&D Facility (P1C)

C.6.2.4 No Action Alternative (P1D)

GENERAL DESCRIPTION: This No Action Alternative starts in the year 2000 and continues through 2035, which is the end for the 1995 Settlement Agreement. Because there is no construction needed in this option, there would be no decontamination, decommissioning, and demolition; only operations are included.

The calciner at the New Waste Calcining Facility (NWCF) would not operate after June 2000, and would not be upgraded during the period of interest. Rather, it would not be operating, requiring minimum maintenance by a small crew, and its buildings would be heated during the winters.

The bin sets at the Calcined Solids Storage Facility would be prepared for long-term monitoring by isolating their vaults from the atmosphere and adding a pair of small HEPA filters to accommodate bin sets 1-3. Personnel would be shared from NWCF's small crew to monitor the bin sets through 2035. The filter leach facility, also located at NWCF, would continue to operate until 2009, when tanks WM-100-102 (54,000-gal total capacity) would be full of Type I liquid wastes (see C.6.2.36 - P111 for definitions of Type I and Type II newly generated liquid wastes).

Certain INEEL facilities would continue to generate or process liquid waste that would be stored in "permitable" tanks, such as WM-190 (300,000-gal capacity for Type II liquid wastes), and WM-100-102 (54,000-gal total capacity for Type I liquid wastes). When those tanks are full (2009 for WM-100-102 and 2017 for WM-190), all liquid waste generation must cease, or other processing and disposal arrangements would be necessary.

The Process Equipment Waste Evaporator and Liquid Effluent Treatment and Disposal Facility would be used to concentrate liquid wastes prior to storage. Additionally, the High-Level Liquid Waste Evaporator would also operate until June 2001. The pH of the wastes to be stored in WM-190 after evaporation must be neutral so that WM-190's vault may be approved as secondary containment. The Process Equipment Waste Evaporator, Liquid Effluent Treatment and Disposal Facility, service waste system, offgassystems, and Tank Farm operations would continue to operate through 2017; thereafter, only a small crew would be needed to monitor and maintain them. The Remote Analytical Laboratory would operate through 2017 to characterize the liquid wastes pertaining to the HLW program.

It is assumed that the State of Idaho would issue a RCRA, Part-B permit every five years to cover all waste treatment facilities.

Table C.6.2-9. Construction and operations project data for the No Action Alternative (P1D)

C.6.2.5 Bin Set 1 Calcine Transfer (P1E)

PROJECT DESCRIPTION: The No Action Alternative and the Continued Current Operations Alternative require that the calcine contained in bin set 1 be moved to a seismically-compliant bin set with sufficient available space, because bin set 1 does not meet the seismic requirements. Bin sets 6 and 7 meet these requirements and, since they are virtually identical, the cost to transfer calcine from bin set 1 to either bin set 6 or 7 would be the same.

A potential problem with this project is that the soil around the bin sets may be contaminated. Soil samples would be needed to determine if the soil is contaminated and to what degree. Should the soil be heavily contaminated, it becomes much more costly to remove, treat, and dispose of. Determining such increased treatment and disposal costs are beyond the scope of this project.

Schedule: This project would start in the year 2000, after the Record of Decision. Activities such as design, environmental permitting, mock-up, and safety documentation would run from 2000 through 2004. Construction, SO tests, and the operational readiness review would occur between 2005 and 2012, with the actual calcine transfer requiring one year, during 2012.

Specifics: To access the top of the concrete vault surrounding bin set 1, several feet of soil would be excavated and the original superstructure removed. A new concrete slab would then be installed on top of the vault's roof for stability. Retaining walls would also be installed between bin sets 1-2 and 1-3, to support the shielding earth berms flanking bin set 1. At least two risers (pipes) would be welded remotely to the top of each annular bin within bin set 1 by drilling and removing the cores from the thick concrete-vault's roof and then piercing the tops of the bins. Similarly, at least one riser would be installed in each of the center cylindrical bins. Flexible suction and blower tubes would be installed along with the transport piping between the annular bins in bin set 1 and a new cyclone that would be installed above bin set 7 to ensure that the transferred calcine is separated from the transport air. A new blower/HEPA filter system having a capacity of 500 lbs/hr would be installed.

It would take approximately 1,100 hours to transfer the bulk calcine from bin set 1 to bin set 7 and another 1,500 to 3,000 hours to transfer the fines, not including the time it would take to move equipment from bin to bin within bin set 1. This schedule requires two, 10-hour shifts, 4-days per week, with an additional shift working 12-hours per day for the other three days. Each shift would consist of four people: one supervisor-operator, two additional operators, and a radiation-control technician. Six additional support people (engineer, technician, administrator, and three maintenance workers) would be required, bringing the total to 18.

Baseline information

The following information may include certain assumptions that pertain to this project:

- As part of the INEEL's infrastructure, a low-level waste landfill would be available to dispose of contaminated soil and concrete removed from the bin set 1 superstructure and for other miscellaneous low-level and incidental wastes generated during this project.

- One year is sufficient for three full-time crews to transfer the calcine from bin set 1 to bin set 7, and to remove enough of the fines so bin set 1 would be prepared for closure.

- Low-level and incidental radioactive wastes that include small amounts of calcine (the HEPA filters, for example) are listed under mixed hazardous wastes. The filters would be leached and the remnants disposed of at INEEL. This project assumes that an INEEL facility would be available (through the INEEL's infrastructure) for such purpose.

Table C.6.2-10. Construction and operations project data for the Bin Set 1 Calcine Transfer (P1E)

C.6.2.6 <u>Long-Term Storage of Calcine in Bin Sets (P4)</u>

PROJECT DESCRIPTION: This project consists of long-term storage of calcine, and monitoring and performing occasional maintenance on the calcined-solids storage facility (CSSF, commonly called bin sets) from 1999 indefinitely. There are seven bin sets and each bin set contains several individual storage units that contain a radioactive, granular-solid waste form called calcine. Each bin set is surrounded by a concrete vault. All of the sodium-bearing waste would have been converted to calcine by 2014, and all of the calcine would have been stored in the bin sets by the end of 2014; no new waste would be added to the bin sets after that.

Prior to long-term storage, a few modifications must be made to the bin sets. A pair (in series) of small (6-inch) HEPA filters must be added to the bin set groups 1, 2, and 3. Furthermore, each bin set's vault must be isolated from the atmosphere, except for bin set 1, which is already isolated.

Long-term storage would consist of the following items:

- Having a health-physicist monitor each of the continuous air monitors daily to check for potential leaks, which may take 1-2 hours to do,

- Every six months, a technician would monitor the temperatures in the bin sets via thermocouple readings,

- Once a year, a technician would calibrate the thermocouple instrumentation, and

- Approximately every 20 years, the 10 HEPA filters may need to be replaced. It is not known how frequently these filters would have to be replaced; they are not expected to be heavily contaminated, but their integrity may degrade in the radiation field over a long time.

Table C.6.2-11. Construction and operations project data for the Long-Term Storage of Calcine in Bin Sets (P4)

C.6.2.7 Full Separations (P9A & P23A)

GENERAL PROJECT OBJECTIVE: The general objective of this project is to provide for a Full Separations Waste Separations Facility (WSF) and smaller, related facilities, including the Bulk Chemical Storage Facility, the Condensate Collection Facility, the Calcine Dissolution Facility, and the Low Activity Waste Collection Facility.

PROCESS DESCRIPTION: The Waste Separations Facility receives liquid sodium-bearing waste (SBW) from the Tank Farm Facility and solid calcine from the Calcined Solids Storage Facility (CSSF or bin sets). After some initial treatment of these feed streams, the radionuclides are chemically separated into two streams: a high-activity waste stream containing the transuranic nuclides, cesium and strontium, and a low activity waste stream containing the rest of the waste constituents. After the separation process, the high-activity waste and low-activity waste streams are routed to other facilities (addressed as separate projects) for further treatment.

SBW would be transferred from Tank Farm tanks to a storage tank in WSF. The SBW would then be filtered to remove undissolved solid particles before further processing. Calcine retrieval from the CSSF is addressed as a separate project. After the calcine is received at the Calcine Dissolution Facility (an addition to the Waste Separations Facility), it is dissolved in nitric acid, filtered, and then fed to the Waste Separations Facility for further processing.

After filtration of either SBW or dissolved calcine, the waste is sent through ion exchange columns to remove cesium. After cesium removal, actinides are removed from the waste by the transuranic extraction process.

Transuranic Extraction is a solvent extraction process that removes dissolved actinides from a liquid. The organic solvent extracts a high percentage of actinides from the aqueous feed and also extracts a portion of other radioactive and nonradioactive ions. To minimize the partitioning of these non-actinide species into the solvent, the solvent is “scrubbed” with a weak nitric acid solution that back-extracts most of the non-actinide species into the scrub effluent, which is combined with the feed. The solvent is then “stripped” of actinides by contacting it with a weak nitric acid solution containing 1-hydroxyethane 1,1 diphosphonic acid. The strip solution removes the actinides and a few other metal ions such as molybdenum and zirconium. The solvent is then contacted with an aqueous sodium carbonate solution to remove additional ions, primarily mercury. Contact with the carbonate solution also neutralizes acid present in the solvent and removes organic degradation products. Finally the solvent is contacted with weak nitric acid to re-acidify the solution, which is then recycled back to the front end of the transuranic extraction process.

Mixing and separation of the various solutions in the transuranic extraction process takes place in a series of centrifugal contactors. The centrifugal contactors provide high aqueous organic interface to promote mixing and then accomplish quick separation between the organic and aqueous phases to minimize degradation of the organic solvent.

A portion of the carbonate wash solution is sent to a mercury removal system, in which dissolved mercury in the waste is reduced to elemental mercury using formic acid. The metallic mercury is then amalgamated and packaged for storage and disposal.

Strontium is removed in a strontium extraction process, which like the transuranic extraction process uses a series of centrifugal contactors to mix and separate an organic solvent and an aqueous stream. Following extraction of strontium into the solvent, the solvent is scrubbed with 2 molar nitric acid, the strontium removed (or “stripped”) using 0.01 molar ammonium citrate, washed with sodium carbonate and rinsed with nitric acid to reacidify the solvent. The carbonate wash effluent is sent to a mercury removal system, similar to that described for the transuranic extraction wash. The strontium extraction strip effluent is concentrated by evaporation and sent to the High Activity Waste Treatment Facility. The strontium extraction rinse effluent and raffinate are sent to the Low Activity Waste Treatment Facility.

FACILITY DESCRIPTIONS: The smaller, related facilities associated with the Waste Separations Facility are the:

- Bulk Chemical Storage Facility, a steel-framed structure that is used for storage of non-radioactive bulk chemicals needed for processing.

- Low Activity Waste Collection Facility, a concrete shielded structure containing tanks that collect low activity waste from various locations at the INTEC. This facility houses three collection tanks. Each LAW collection tank has a 303 m^3 capacity (80,000 gal). The three tanks are located on one side of the facility behind a shield wall. The pumps used to transfer the low-activity waste liquids to the Waste Separations Facility are located on the other side of the wall.

- Condensate Collection Facility, a steel-framed structure housing tanks that collect condensed steam (non-radioactive) from various process and building users before transfer back to the steam plant.

- Calcine Dissolution Facility, an addition to the Waste Separations Facility in which the retrieved calcine is dissolved in nitric acid before passing it on, as a liquid, to the separations processes.

The Waste Separations Facility is designed to house the equipment and systems for separating the SBW and calcine into high-activity waste and low-activity waste streams. It is based on a concept of centrally located, below grade, process cells with thick concrete walls surrounded by areas that contain progressively less radioactive hazards. Equipment that is in highly radioactive service and not expected to require maintenance (e.g., tanks) is located in the ten central cells. Equipment in radioactive service that would require maintenance is located in corridors (pump and valve corridors) that are adjacent to the process cells. Finally, personnel access corridors are located outside the pump and valve corridors and allow visual access to the pump and valve corridors via shielded windows. Stainless steel liners are provided in areas in where equipment and valves create a need for spill protection and decontamination.

In addition to the cells housing the process equipment, there would be three additional cells located at the north end of the facility. These cells are the manipulator repair cell, for repair of manipulators and other equipment, a decontamination cell, for decontamination of equipment prior to maintenance activities, and a filter leach cell, in which process filters are treated (by leaching in nitric acid) to remove much of the contamination before they are disposed of.

Table C.6.2-12. Construction and operations project data for Full Separations (P9A)

Table C.6.2-13. Decontamination and decommissioning project data for Full Separations (P9A)

Table C.6.2-14. Construction and operations project data for Full Separations (P23A)

Table C.6.2-15. Decontamination and decommissioning project data for Full Separations (P23A)

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C.6.2.8 <u>Vitrification Plant (P9B & P23B)</u>

GENERAL PROJECT OBJECTIVE: The proposed project provides for the design, construction, startup, operation, and decommissioning of the Vitrification Plant, designated the High Activity Waste Treatment Facility, for the Early Separations option. The Vitrification Plant receives liquid high-activity waste from a chemical separation process and converts it to a glassy solid form by mixing the waste with glass frit and processing it through a crucible melter. The finished product would meet the requirements for disposal at a national geologic repository.

PROJECT DESCRIPTION: The Vitrification Plant receives concentrated high-activity waste from the Waste Separations Facility. This high-activity waste is the product of a process that chemically separates various radionuclides from the liquid sodium-bearing waste (SBW) and granular solid calcined material that is currently stored at INTEC. After the transuranic nuclides, cesium and strontium, would be removed from the SBW and dissolved calcine, they would be concentrated in an evaporator and transferred to the Vitrification Plant. The concentrated liquid stream would be combined with spent resin from the cesium ion exchange columns, undissolved solids from the SBW and calcine treatment, and glass frit. The resulting slurry would then be introduced into a melter, where it is melted into a homogeneous, molten glass. The glass would then be poured into canisters. After allowing the canisters to cool for about 24 hours, the canister lid is welded to the canister body and the assembly would be decontaminated before being transferred to another facility for interim storage.

FACILITY DESCRIPTIONS: The Vitrification Plant would be divided into four main processing cells, the feed preparation cell, the pouring, vitrification, and breakdown cell, the offgas treatment cell, and the transfer welding cell. The feed preparation cell would contain the feed staging tank, solids storage tank, undissolved SBW solids tank, and the melter feed tanks. These tanks would be used to sample and blend the feed for glass formulation and waste form qualification purposes. The pouring vitrification and breakdown cell would contain the melter, canister pouring equipment, and dust scrubber. It also would contain the mechanical dismantling (breakdown equipment) used to reduce the size of equipment that is to be disposed of. The offgas cell would contain the equipment to treat the offgas from the melter. The transfer welding cell would contain equipment for welding of the canister lids, decontamination of the canisters, and radiological survey of the cleaned canisters. Rooms housing support equipment, clean chemical storage and supply, etc. would be located around and above these process cells.

Table C.6.2-16. Construction and operations project data for the Vitrification Plant (P9B)

Table C.6.2-17. Decontamination and decommissioning project data for the Vitrification Plant (P9B)

Table C.6.2-18. Construction and operations project data for the Vitrification Plant (P23B)

Table C.6.2-19. Decontamination and decommissioning project data for the Vitrification Plant (P23B)

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C.6.2.9 Class A Grout Plant (P9C & P23C)

GENERAL PROJECT OBJECTIVES: This project describes the costs and impacts of one of the facilities supporting that alternative, the Class A Grout Plant, designated the Low Activity Waste Treatment Facility.

PROCESS DESCRIPTION: The Class A Grout Plant receives concentrated low-activity waste from another facility, the Waste Separations Facility. This low-activity waste is the product of a process that chemically separates various radionuclides from the liquid sodium-bearing waste and granular solid calcined material that is currently stored at INTEC. After the transuranic nuclides, cesium, and strontium are removed from the SBW and dissolved calcine, the solution containing the remaining radionuclides would be concentrated in an evaporator and transferred to the Class A Grout Plant. The concentrated stream would be subjected to a high temperature denitration process. The denitration would be accomplished in a fluidized bed that uses air as the fluidization gas and burns kerosene with oxygen to provide the reaction temperature. The nitrates in the concentrated liquid stream are evolved as nitrogen oxides. Offgas from the denitrator would be treated to reduce emissions of unburned hydrocarbons and nitrogen oxides to acceptable levels. Solids from the denitrator are pneumatically conveyed to a storage bin. At intervals (currently assumed to be about once per month) the solids would be combined with Portland cement, blast furnace slag and flyash to form a LLW grout. Based on the concentrations of nuclides in this mixture, the grout is expected to meet the definition of Class A LLW, as given in 10 CFR 61. This project ends with the grout ready to be pumped (pump included with this project) to disposal facilities or LLW containers. The packaging for disposal and disposal facilities are addressed in other projects.

FACILITY DESCRIPTIONS: The Class A Grout Plant is about 57-m (187-ft) long (north-south) and about 43-m (144-ft) wide (east-west). It would extend about 22-m (72-ft) above grade and about 12-m (40-ft) below grade. The areas that contain radioactive material are generally located below grade, in a central concrete core. Hatches in the tops of the cells would be provided for initial installation of this equipment and non-routine access later. The cell floors and walls would be lined with stainless steel to allow easy decontamination. The process areas would be located on the lower level, and consist of a number of cells that contain the waste feed storage tanks, the denitrator, offgas treatment equipment, solids separation and storage equipment, and grout mixing and pumping equipment. A decontamination cell would also be located on the lower level and provides an area where equipment can be decontaminated before hands-on maintenance is performed.

As in any nuclear facility, the Class A Grout Plant would be divided into ventilation zones depending on the potential for contamination. Pressure differentials would be maintained so that air flows from areas of lowest contamination potential to areas of highest contamination potential. The areas of highest potential for contamination would be maintained at the lowest pressure (typically -0.75 in. of water). Administrative areas with no contamination potential (designated clean areas) would be ventilated using separate systems designed to commercial standards.

Table C.6.2-20. Construction and operations project data for the Class A Grout Plant (P9C)

Table C.6.2-21. Decontamination and decommissioning project data for the Class A Grout Plant (P9C)

Table C.6.2-22. Construction and operations project data for the Class A Grout Plant (P23C)

Table C.6.2-23. Decontamination and decommissioning project data for the Class A Grout Plant (P23C)

C.6.2.10 HAW Denitration, Packaging and Cask Loading Facility (P9J)

GENERAL PROJECT OBJECTIVES: The project included activities that would be associated with the construction and operation of a facility that would use evaporation and denitration technology to process the high-activity waste (HAW), load the waste into drums, and load the drums into a shipping cask. This facility would be called the HAW Denitration, Packaging and Cask Loading Facility.

PROCESS DESCRIPTION: The process would solidify the transuranic, strontium, and cesium ion exchange effluent streams for packaging and shipment to another facility for further treatment (vitrification). The objective would be to produce a dry material meeting shipping requirements that would minimize handling costs and impacts to the vitrification facility.

The waste solutions from the TRUEX and strontium extraction processes and the effluent from the cesium ion exchange would be mixed in a tank. The waste solution would be sent to an evaporator to concentrate the waste. The volume of the waste solution would be reduced by a factor of 66. The water vapor from the evaporation would be condensed and processes as low-level waste. The evaporator bottoms would be sent to the denitration process to be transformed into a solid waste suitable for shipping.

The denitrator would be a fluidized bed reactor. The evaporator bottoms, mixed with a 2.2M aluminum nitrate solution would be fed into the bed. Kerosene and oxygen would also be fed into the reactor to maintain the reactor temperature of about 600° C. The aluminum nitrate reacts with the waste to form solid pellets (calcine).

The solid pellets would be separated from the fluidizing air by cyclones. The solids would be stored for packaging and shipment. The offgaswould be cleaned by the MACT facility to remove environmental hazards such as organic vapors and mercury. The dried waste would be loaded into a shipping canister and sent to the vitrification facility.

FACILITY DESCRIPTION: The HAW Denitration, Packaging and Cask Loading Facility would consist of two buildings, one containing the process equipment and the other would be used to receive the drums from the process building and load them into a shipping cask. The process building would be 210 feet long and 142 feet wide. The drum handling building would be 160 feet long and 42 feet wide.

The process building would be designed to house the equipment and systems for evaporation, denitration, and packaging of the high-activity waste into drums. The process cells would be centrally located with thick concrete walls surrounded by areas that contain progressively less radioactive hazards. The equipment in radioactive service that would require maintenance would be located in corridors (pump and valve corridors) that are adjacent to the process cells. Finally, an operating corridor would be located outside of the radioactive process cells. Stainless steel liners would be provided in areas where equipment and valves create a need for spill protection and decontamination.

The drum handling building would receive a high-activity waste filled drum from the process building on a transfer cart. A transfer tunnel would connect the process building to the drum handling building. The drum would be pulled from the cart up into a drum-handling machine. The drum would be then lowered from the drum handling machine into the cask.

Table C.6.2-24. Construction and operations project data for the HAW Denitration, Packaging and Cask Loading Facility (P9J).

Table C.6.2-25. Decontamination and decommissioning project data for the HAW Denitration, Packaging and Cask Loading Facility (P9J).

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C.6.2.11 New Analytical Laboratory (P18)

GENERAL PROJECT OBJECTIVES: The analytical laboratory project provides environmental and regulatory required sample analysis for the waste processing alternatives. The laboratory work would include analyses of samples required for process and criticality control, start-up tests, environmental permits, and for other project specific, environmental and regulatory required purposes. The typical types of analysis would be for metals and other inorganic species, organic chemicals, radiological samples, pH, CI, F, SO_4 NO_3 TOC, gross α, β, and γ, % solids, etc.

PROCESS DESCRIPTION: The information contained in this project summary is based on the laboratory needs for the Full Separations Option which would represent the bounding case for impacts. The analytical work would be handled by the existing Remote Analytical Laboratory and a new Environmental Analytical Laboratory. The existing Remote Analytical Laboratory would be used for analyses of samples required for process and criticality control studies and for environmental and regulatory required tests. The normal daily load for the Remote Analytical Laboratory is anticipated to be in the range of 48 samples requiring 153 analyses. The Environmental Analytical Laboratory is needed to handle the samples required for the environmental and regulatory compliance purposes because of the large number of samples and sample volumes required for such studies. The Environmental Analytical Laboratory is designed to accommodate the larger size samples taken for the environmental permits.

The Environmental Analytical Laboratory would be in operations from 2015 through 2040. The existing Remote Analytical Laboratory is reportedly scheduled for shutdown in 2020. There would be a heavy sampling and analytical workload during the initial trial-burn testing and the initial operations. However, the environmental and regulatory required sampling and analyses would be substantially reduced by the year 2020. This would allow the new laboratory to accommodate all the analytical work required without further need for the existing Remote Analytical Laboratory after 2020.

The Remote Analytical Laboratory receives samples via a pneumatic transfer system for analysis. It contains a large hot cell where analyses can be performed on radiological samples. The new Environmental Analytical Laboratory would have capability similar to the Remote Analytical Laboratory for remote analyses of the samples. Process analytical samples from the facilities would be delivered to the laboratories in new pneumatic transfer system lines similar to the one used to transfer samples from the New Waste Calcining Facility to the Remote Analytical Laboratory.

The existing pneumatic transfer system is capable of transporting up to 50-milliliter sample bottles between the New Waste Calcining Facility and the Remote Analytical Laboratory. The sample size may need to be increased to as much as 1-liter to perform more analytical work for compliance verification. Currently, studies are underway at the INTEC to evaluate the conditions that allow transportation of large sample volumes (approximately 500-milliliters) via the existing pneumatic transfer system.

The pneumatic transfer system consists of two runs of metallic tubing that connect the New Waste Calcining Facility hot cell to the Remote Analytical Laboratory hot cell. Between the two buildings, the tubing is held above ground level (approximately 20-30 feet) by a series of metal supports. Small plastic transfer canisters containing sample bottles are pneumatically propelled through the tubes. The plastic canister, commonly called a rabbit, is shaped like a dumbbell and contains padding to protect the sample bottle while in transit. The rabbits are routinely used to transport 15-milliliter bottles. The padding can be removed to allow the transport of up to 50-milliliter sample bottles.

FACILITY DESCRIPTION: The existing Remote Analytical Laboratory is located in CPP-684, about 200 yards from the New Waste Calcining Facility. The Remote Analytical Laboratory is a prefabricated/modular building with the total area of approximately 1,115 meters^2 (12,000 feet^2). The new Environmental Analytical Laboratory would be located in the north corner of the INTEC (inside the INTEC fence). The building floor plan of the Environmental Analytical Laboratory would occupy an area of 25 meters (82 feet) by 34.1 meters (112 feet), consisting of two levels with the total area of 1,705 meters^2 (18,343 feet^2). Its design and features are based on the Remote Analytical Laboratory. The lower level would consist of three analytical cells and two gloveboxes, both warm and cold laboratory facilities, a shift office, a health physics office, personnel decontamination area, maintenance and other support facilities. The upper level would provide separate heating and air conditioning supply and exhaust area and electrical rooms.

The Environmental Analytical Laboratory would be a structural steel building with metal walls and roof panels. The building would have a rigid frame structure with horizontal bracing in the plane of the roof and vertical bracing in the side and end walls. The foundation would primarily consist of grade beams with spread footings at column locations. The analytical cells would have 1-meter (3.3-feet) thick concrete walls for shielding and they would be supported on an equally thick mat foundation. Other floor slabs would have a top elevation of 200 millimeters (8-inch) above grade elevation with footings down to the frostline. Reinforced concrete floor slabs would be sized to withstand the maximum loading, based on the design conditions.

The heating, ventilation, and air conditioning system would consist of multiple air-handling units that supply conditioned air to independent ventilation zones. The system would provide air for the clean areas, including cold laboratory, offices, and restrooms. Each ventilation zone in the clean area would be supplied by a single package heat pump unit. The areas of the facility having the potential for airborne contamination would be supplied by a once-through ventilation system. Those areas with high airborne contamination potential may receive ventilation air supply from other confinement zones, if this arrangement is beneficial. Airflow from these zones would be filtered and discharged through the stack with no recirculation.

Table C.6.2-26. Construction and operations project data for the New Analytical Laboratory (P18)

Table C.6.2-27. Decontamination and decommissioning project data for the New Analytical Laboratory (P18)

C.6.2.12 Remote Analytical Laboratory Operations (P18MC)

GENERAL PROJECT OBJECTIVES: This project is needed in conjunction with the other projects for the treatment and storage of high-level waste at INEEL. The project differs from another analytical laboratory project, P18, in that a new facility is not required. The existing analytical laboratory used in this project would continue to operation from 2007 through 2035, followed by decontamination, decommissioning, and demolition (covered in P159). No construction data is included, since the facility already exists.

PROJECT DESCRIPTION: Liquid waste samples from the Tank Farm and calcine samples from the NWCF processing facility would be taken and analyzed to determine the calcining process parameters, and to characterize the waste form for further treatment and disposal. The existing Remote Analytical Laboratory would continue to operate from 2007 through 2035.

Table C.6.2-28. Construction and operations project data for the Remote Analytical Laboratory Operations (P18MC)

C.6.2.13 Vitrified Product Interim Storage (P24)

GENERAL PROJECT OBJECTIVE: The general objective of this project is to provide design, construction, startup, operation, and decommissioning of a facility to receive and store the waste filled glass canisters produced in the Full Separations and Planning Basis Options. The storage would be for an interim period of time until a repository is ready to receive the waste.

PROJECT DESCRIPTION: The scope of included work for this project is the effort to construct, operate, and decommission a facility to receive and store the waste-filled canisters produced in the Full Separations and Planning Basis Options. The vitrified waste would be placed in glass storage canisters that are qualified and approved for shipment to a repository. The canisters would be the same as those used at the Defense Waste Processing Facility at the Savannah River Site. The canisters would be loaded at the Vitrification Plant and sent directly to the Interim Storage Facility on a transfer cart through an underground transfer cart tunnel.

Three Interim Storage Facility concepts have been evaluated for the storage of the vitrified waste; the concepts include a new facility, a modified existing facility, or storage in NUHOMS™ storage casks.

NEW FACILITY DESCRIPTION: If a new Interim Storage Facility is built, it would be newly designed and constructed and sited adjacent to the Vitrified Product Process building. The Interim Storage Facility would consist of two equally sized, below-grade concrete vaults covered by a concrete operating deck. Each vault would contain 220 vertically oriented storage tubes with each tube holding two glass canisters. The storage tubes are closed and sealed by means of a shielding plug installed at the operating deck level. The storage vaults would have natural convective cooling with intake and exhaust plenums to maintain glass canister and structural materials within the allowable temperature limits. The glass canister handling machine would be used to handle the glass canisters. The handling machine would be designed to receive the glass canisters through the canister transfer tunnel and transport and place them in the storage tubes in the vaults.

MODIFIED EXISTING FACILITY: If it is decided to modify an existing building rather than build a new one, the modified Interim Storage Facility would be located in the building originally built to contain the Fuel Processing Restoration process. The Fuel Processing Restoration project was cancelled with the building mostly finished, but before most of the process equipment was installed. Internal specific areas of the building would have to be modified and/or finished to provide the modified Interim Storage Facility. These specific areas include electrical, heating, ventilation, and air conditioning, life safety systems, and the areas specific to the modified Interim Storage Facility. The major reason that the Fuel

Processing Restoration building was evaluated for the modified Interim Storage Facility are the existing concrete vaults that would have held the radioactive process equipment. If the modified Interim Storage Facility is selected, its current location would be an additional factor in the decision process to locate the process facility.

The modified Interim Storage Facility is designed to hold waste canisters in vertical sealed storage tubes. The storage tubes would be located in a concrete storage vault just as described for a new facility but would hold four canisters.

The concrete walls between the existing process vaults would be removed to form one storage vault. A steel grid arrangement would be installed on the existing concrete floor of the vault to level and position the storage tubes, and a steel lining would be installed on the east vault wall to provide the additional necessary personnel shielding. The bottoms of the storage tubes would be sealed with steel plate and the tops would be closed with steel shield plugs. Spacers would be used at the top of the pipes to position them and provide radiation shielding. The spacers and the pipes would be welded together to provide adequate air sealing so the fans can force the flow of cooling air from east to west. The combinations of spacers and pipe plugs would form a relatively flat floor.

A large open area called the charge hall is located above the top of the storage tube/shield plug/shield spacer surface and is formed by the walls and roof of the upper portion of the building. Two canister-handling machines used to move and handle the canisters are located in the charge hall.

NUHOMS™: If the NUHOMS™ system is used, the canisters would be placed into Dual Purpose Canisters and stored in NUHOMS™ storage casks on the existing ISFSI/NUHOMS™ pad. Additional pad space would have to be constructed adjacent to the existing pad.

Table C.6.2-29. Construction and operations project data for Vitrified Product Interim Storage (P24)

Table C.6.2-30. Decontamination and decommissioning project data for the Vitrified Product Interim Storage (P24)

C.6.2.14 Packaging and Loading Vitrified HLW at INTEC for Shipment to a Geologic Repository (P25A)

GENERAL PROJECT OBJECTIVE: The proposed project provides the support for the packaging and loading of vitrified high-activity waste that is stored in the Interim Storage Facility making it ready for shipment to a National Geological Repository. The sealed glass canisters would be loaded into a certified transport cask for shipment to the repository.

PROJECT DESCRIPTION: The packaging and loading project would remove all vitrified glass canisters produced in the Full Separations and Planning Basis options over 20 years beginning in year 2045. The canisters would be the same as those used at the Defense Waste Processing Facility at the Savannah River Site. With the radiation levels estimated to be 2500 R/hr at contact, all movements of the canisters from the storage tubes to the transport cask would be performed remotely by the same glass canister handling machine (GCHM) used for originally placing the canisters in the storage tubes. The transport would be a multi-purpose cask design modified and certified for this specific payload. The cask would accept four canisters in a specially designed basket with spacers. Once loaded the cask is prepared for transport (sealed with its bolted cover, inspected, and leak tested). The assembly would be moved out of the loading area into a staging area and made ready for shipment to the repository on its dedicated railcar.

FACILITY DESCRIPTION: The canister load out and railcar/transport cask assembly staging area is an integral part of the Interim Storage Facility located at the east side of the facility. It includes all the equipment, utilities and controls necessary to load canisters into a transport cask and make the cask ready for shipment.

An overhead bridge crane capable of handling the transport cask would run the length of the cells. A rail spur line, branching off from a line that services the steam plant, would slope down to the south end of the staging area where it enters the building through an overhead door. In the staging area the assembly would be cleaned and inspected and the impact limiters and the cask lid removed.

The railcar loaded with the transport cask would be moved into the load out area and positioned directly below an access port in the operating vault floor. The transport cask would be raised to an upright position for loading and back to the horizontal position while on the railcar. A platform capable of lifting the shipping cask and railcar assembly to receive the canisters from the handling machine would be provided. It would be equipped with restraints to prevent movement in the event of a seismic disturbance. The shielded cover of the access port would be opened directly over the transport cask basket allowing a canister to be loaded. Only one canister at a time can be loaded.

Table C.6.2-31. Construction and operations project data for the Packaging and Loading Vitrified HLW at INTEC for Shipment to a Geologic Repository (P25A)

Table C.6.2-32. Decontamination and decommissioning project data for the Packaging and Loading Vitrified HLW at INTEC for Shipment to a Geologic Repository (P25A).

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C.6.2.15 Class A Grout Disposal in Tank Farm and Bin Sets (P26)

GENERAL PROJECT OBJECTIVE: The general objective of this project is to provide for the Resource Conservation Recovery Act (RCRA) performance-based clean closure of the Tank Farm Facility and the Calcined Solids Storage Facility (bin sets) and subsequent disposal of Class A grout in these facilities. The Tank Farm currently stores sodium-bearing liquid waste. The bin sets store calcined solids resulting from the calcination of liquid waste. Other projects would remove the liquid waste or calcine (except for the heel) from these facilities.

PROCESS DESCRIPTIONS: During the closure phase, the facilities would be decontaminated to the maximum extent that is technically and economically practical. For the Tank Farm, the tanks and vaults would be washed and the resulting liquid pumped out to remove the majority of the heel waste residues. The remaining liquid heel would be solidified using clean grout. The ancillary piping, such as waste transfer lines, would be flushed and grouted with clean grout. Afterwards, the vaults would be completely filled with clean grout to prevent the intrusion of liquid and to act as a temporary cover or cap over the tank. When pouring is complete, the 11 tanks and the sand under nine of the 11 tanks, would be encapsulated between the newly poured grout and the vault floor.

A similar closure approach would be used for the bin sets. The interior surfaces of the bins, piping, and ancillary equipment would be decontaminated, again to the maximum extent that is technically and economically practical. It is assumed, for this project, that the bins would be sufficiently decontaminated such that performance criteria would be met. The vault void (the space between the bins and the surrounding concrete structure) would be filled with clean grout to provide added structural rigidity to the bins and minimize the chance of subsidence within the bin sets over time.

After the Tank Farm and the bin sets have been closed, they would be used as low-activity waste disposal facilities. The tank and bin voids would be filled with Class A grout that would be produced at the Class A Grout Plant and delivered to the Tank Farm and bin sets in shielded piping.

FACILITY DESCRIPTIONS: The Tank Farm consists of underground storage tanks, tank vaults, interconnecting waste transfer lines, valve boxes, valves, airlift pits, cooling equipment, and several small buildings that contain instrumentation and valving for the waste tanks. The eleven 300,000 to 318,000-gallon stainless steel tanks are contained in underground, unlined concrete vaults and are used to store mixed liquid wastes. The tanks have a 50-foot diameter and an overall height of approximately 30 feet (including the dome height). A thin sand layer was placed between the vault floor and tank on nine of the eleven tanks.

Liquid waste is transferred throughout the Tank Farm in underground stainless steel lines. The liquid waste that remains after the tanks have been emptied as low as possible with the steam jets and airlifts is referred to as a "heel." The heels are expected to range in volume from 5,000 to 15,000 gallons when cease use occurs. During high-level waste processing, grout would be pumped, at intervals, from the Class A Grout Plant to the Tank Farm in shielded lines.

The Calcined Solids Storage Facility contains seven bin sets, with each bin set containing multiple bins used for calcine storage. Each set of bins is arranged inside a concrete structure called a vault. The bins themselves are large vertical cylinders constructed of stainless steel. The Class A grout would be pumped to the bin sets using the same systems as in the Tank Farm.

Table C.6.2-33. Decontamination and decommissioning project data for Performance-Based Clean Closure of Bin Sets for the Class A Grout Disposal in Tank Farm and Bin Sets (P26 & P51)

Table C.6.2-34. Decontamination and decommissioning project data for Performance-Based Clean Closure of Tank Farm for the Class A Grout Disposal in Tank Farm and Bin Sets (P26 & P51)

Table C.6.2-35. Construction and operations project data for Bin Set Closure for the Class A Grout Disposal in Tank Farm and Bin Sets (P26)

Table C.6.2-36. Construction and operations project data for Tank Farm Closure for the Class A Grout Disposal in Tank Farm and Bin Sets (P26)

Table C.6.2-37. Decontamination and decommissioning project data for Tank Farm Closure with Class A Fill for the Class A Grout Disposal in Tank Farm and Bin Sets (P26)

Table C.6.2-38. Decontamination and decommissioning project data for Bin Sets Closure with Class A Fill for the Class A Grout Disposal in Tank Farm and Bin Sets (P26)

C.6.2.16 Class A/C Grout Disposal in a New Low-Activity Waste Disposal Facility (P27)

GENERAL PROJECT OBJECTIVE: This project presents a proposed design for the Idaho National Engineering and Environmental Laboratory (INEEL) Low-activity Waste Class A/C Near Surface Land Disposal Facility. The INEEL low-activity waste disposal facility project provides an "assured storage management system" for the near surface disposal of Class A or C waste.

PROJECT DESCRIPTION: The primary design criterion is to prevent leaching of contaminants from the waste into the surrounding soil or into the Snake River Aquifer. The project provides a modular design in which reasonably sized durable containers can be stored. The containers in which the grouted waste would be placed are of a size that could be retrieved and moved or repaired in the event of an unforeseen problem. The containers were also designed such that they would neither corrode nor decompose in a manner that structural integrity is lost. This provides a design that is termed "Assured Storage." The INEEL Disposal Facility would be an engineered watertight structure with a load bearing cap and internal structure.

FACILITY DESCRIPTION: This structure is designed for the long-term disposal of a maximum of 34,830 m^3 (45,556 yd^3) of Class A/C radioactive grouted LLW. The disposal unit would be constructed of reinforced concrete with liquid-tight coated interior walls and floors providing primary containment. The unit would be partitioned into nine separate cells by 45.72-cm (18-in.) reinforced concrete load-bearing walls. The drainage system design is provided by sloping the floors in the disposal unit to trench drains in the center of each cell. A secondary containment is included in the design consisting of a reinforced, heat-welded thermoplastic geo-liner set on a compacted sub-base. The geo-liner would extend under the foundation and around the walls of the disposal facility.

The most cost-effective site for the low-activity waste disposal facility and support facilities would be generally located outside the southeast corner of and as near as possible to the INTEC security perimeter fence. This location is desirable since it has already been disturbed by activities at the INTEC and many personnel facilities are already in place at the INTEC. Additionally, the roads leading from the INTEC to the disposal site are private INEEL roads

The facility design has both an internal and an external monitoring capability for the duration of institutional control of the facility. The facility is also designed so that if radioactive material is discovered to have leached from within the facility, then the site can be remediated and repaired quickly and in a cost-effective manner.

A soil cap would be placed over the disposal unit roof after a concrete protective wear surface has been cast. The cap would include both backfilled soil and topsoil and would be at least 2.13 m (7 feet) deep to support growth of selected indigenous plant materials. The cap would be seeded with indigenous plant materials that would best transpire moisture from the soil to the atmosphere in the semi-arid alpine desert area of the INEEL.

The effective life of the disposal facility disposal unit as an intruder barrier and hazard protection would not be less than 500 years or until the maximum remaining radioactivity from all wastes would not pose an unacceptable hazard to an intruder or public health and safety. Institutional control of the site would be maintained at least through the year 2095.

Table C.6.2-39. Construction and operations project data for the Class A/C Grout Disposal in a New Low-Activity Waste Disposal Facility (P27)

Table C.6.2-40. Decontamination and decommissioning project data for the Class A/C Grout Disposal in a New Low-Activity Waste Disposal Facility (P27)

C.6.2.17 Class A Grout Packaging and Shipping to a New Low-Activity Waste Disposal Facility (P35D)

GENERAL PROJECT OBJECTIVE: The project objective is to provide for the design, construction, operation, and decommissioning of a facility to fill and seal landfill-disposable hollow concrete cylinders with Class A low-level waste (LLW) grout, load the containers onto a lowboy trailer and ship to an INEEL disposal facility.

PROCESS DESCRIPTION: This process consists of pumping the Class A LLW grout into hollow concrete cylinders, sealing the cylinders and transporting them to a disposal facility southeast of the INTEC. The grout would be pumped from the Class A Grout Plant as it is produced. A total of 22,339 cylinders would be filled, sealed and transported to the disposal facility. A lowboy trailer with tractor, carrying 6 cylinders per load is proposed to accomplish the transfer. The grouted concrete cylinders would be 20 mR/hr or less at contact. The cylinders could therefore be contact handled.

The steps involved in performing the operations necessary to transport the grouted cylinder to the disposal facility would be: filling, sealing the cylinders, performing a contamination and radiation survey of the cylinders, moving the cylinders from the fill area to the load area, load the cylinders and transport the cylinders to the disposal facility, unload the cylinders and return. A portable crane would be provided at the disposal facility to unload the cylinders.

FACILITY DESCRIPTION: The Grout Packaging Facility would be located in the south end of the Class A Grout Plant. The Grout Plant would be located approximately 130 feet to the west and slightly to the north of the Waste Separations Facility, which would be located near the northeast corner of the INTEC. This would include a station where the hollow concrete cylinders would be filled, sealed, and stored awaiting transportation. A hatchway in the main floor, with a 40-ton overhead bridge crane would allow for removal and installation of equipment as well as handling the empty and filled concrete waste cylinders.

The filling, sealing, handling and removal equipment would be located on the basement level. The container filling station and the container sealing station would be located on the east side of the enclosure. A grout supply line from the Class A Grout Plant with necessary grout flow controls would enter the container fill station on the east side. The sealing station would be located to the north of the fill station and also on the east side of the filling, sealing and handling enclosure. There would also be available floor space near the filling and sealing stations to store several empty cylinders and several cylinders that have been filled but not sealed. Storage space for filled and sealed cylinders would be provided on the west side of the enclosure with storage space for 36 cylinders.

An overhead rollup door located at the south end of the facility would provide access into the main floor level. This would allow lowboy access into the main floor area for loading the grouted concrete cylinders.

Table C.6.2-41. Construction and operations project data for the Class A Grout Packaging and Shipping to a New Low-Activity Waste Disposal Facility (P35D).

Table C.6.2-42. Decontamination and decommissioning project data for the Class A Grout Packaging and Shipping to a New Low-Activity Waste Disposal Facility (P35D).

C.6.2.18 Class A Grout Packaging and Loading for Offsite Disposal (P35E)

GENERAL PROJECT OBJECTIVE: The project objective is to provide for the design, construction, operation, and decommissioning of a facility to fill and seal landfill-disposable hollow concrete cylinders with Class A low-level waste (LLW) grout and load them onto rail cars for offsite disposal.

PROCESS DESCRIPTION: This process consists of pumping the Class A LLW grout into hollow concrete cylinders, sealing the cylinders and loading them onto rail cars for offsite disposal. The grout would be pumped from the Class A Grout Plant as it is produced. A total of 22,100 cylinders are to be filled, sealed and loaded for offsite disposal. The grouted concrete cylinders would read 20 mR/hr or less at contact and therefore can be contact handled.

The steps involved in performing the operations necessary to package and load the grouted cylinders for offsite disposal are: filling and sealing the cylinders, performing a contamination and radiation survey of the cylinders, moving the cylinders from the fill area to the load area, and loading the cylinders onto rail cars for offsite disposal.

FACILITY DESCRIPTION: The Grout Packaging Facility would be located in the south end of the Class A Grout Plant. The Class A Grout Plant would be located approximately 130 feet to the west and slightly to the north of the Waste Separations Facility, which would be located near the northeast corner of the INTEC. This would include a station where the hollow concrete cylinders would be filled, sealed, and stored near term prior to loading for offsite disposal. A hatchway in the main floor, with a 40-ton overhead bridge crane, would allow for removal and installation of equipment as well as handling the empty and filled concrete waste cylinders.

The filling, sealing, handling and removal equipment would be located on the basement level. The container filling station and the container sealing station would be located on the east side of the enclosure. A grout supply line from the Class A Grout Plant with necessary grout flow controls would enter the container fill station on the east side. The sealing station would be located to the north of the fill station and also on the east side of the filling, sealing and handling enclosure. There would also be available floor space near the filling and sealing stations to store several empty cylinders and several cylinders that have been filled but not sealed. Storage space for filled and sealed cylinders would be provided on the west side of the enclosure with storage space for approximately 36 cylinders. Space would also be provided for transporting the cylinders from the basement area to the main floor, i.e. the floor area directly beneath the overhead hatch would be clear.

An overhead rollup door located at the south end of the Grout Packaging Facility would provide access into the main floor level. This would allow transporter access into the main floor area for loading the grouted concrete cylinders. Due to its low specific activity (LSA) and low radiation field, the grouted concrete disposal cylinders would also serve as the shipping containers.

Table C.6.2-43. Construction and operations project data for the Class A Grout Packaging and Loading for Offsite Disposal (P35E)

Table C.6.2-44. Decontamination and decommissioning project data for the Class A Grout Packaging and Loading for Offsite Disposal (P35E).

C.6.2.19 Packaging and Loading Transuranic Waste at INTEC for Shipment to the Waste Isolation Pilot Plant (P39A)

GENERAL PROJECT OBJECTIVES: The proposed project encompasses the handling and loading of transport casks with remote-handled Waste Isolation Pilot Plant (RH-WIPP) type half-canisters containing transuranic waste before immediate transport to WIPP for disposal. Truck transport is assumed with transport casks modeled after an existing spent fuel transport cask. The handling and loading of casks and canisters would occur in the Waste Separations Facility. The RH-WIPP half-canisters would be ready for shipment; therefore, there would be no waste packaging issues relative to this project. Handling and loading of casks would occur over a 21-year period but would not start before WIPP was opened to accept TRU waste. Loaded cask transport from the INEEL to WIPP, subsequent handling at WIPP, and empty cask return to the INEEL are not part of this project.

PROJECT DESCRIPTION: Approximately 550 RH-WIPP half-canisters would be produced over a 22-year timeframe and shipped directly to WIPP for disposal.

All shipments to WIPP would require the use of a Type-B (M), Fissile Class 1, shielded ground shipping package (cask). The shipping cask designated for use by this project would be the RH-TRU 72-B, developed for RH-WIPP half-canister transport. One cask would be carried on a trailer for truck transport to WIPP. The cask has been tested and licensed by the NRC for TRU waste ground shipment. Each shipping cask would be capable of transporting one RH-WIPP half-canister; however, the containerized waste would require NRC approval as an authorized cask content prior to any shipment.

Table C.6.2-45. Construction and operations project data for Packaging and Loading of Transuranic Waste at INTEC for Shipment to the Waste Isolation Pilot Plant (P39A)

Table C.6.2-46. Decontamination and decommissioning project data for the Packaging and Loading of Transuranic Waste at INTEC for Shipment to the Waste Isolation Pilot Plant (P39A)

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C.6.2.20 Transuranic/Class C Separations (P49A)

OVERVIEW: This project describes the costs and impacts of the Transuranic Separations Facility and some smaller, related facilities. These related facilities include the Bulk Chemical Storage Facility, Condensate Collection Facility, and the Low Activity Waste Collection Facility. The Transuranic Separations Facility receives liquid sodium-bearing waste from the Tank Farm Facility and solid calcine from the Calcined Solids Storage Facility. After some initial treatment of these feed streams, the radionuclides are chemically separated into two streams, one containing the transuranic nuclides and a second waste stream containing the rest of the nuclides (including cesium and strontium). The transuranic stream is dried to a solid form that would be shipped to the Waste Isolation Pilot Plant. The other stream is routed to other facilities (addressed as separate projects) for further treatment.

GENERAL PROJECT OBJECTIVES: The project described in this Project Summary is part of the Transuranic Separations Option. The Transuranic Separations Option involves the processing of the liquid sodium-bearing waste and solid calcine that is currently stored at the INTEC. This project addresses the Transuranic Separations Facility and related facilities.

PROCESS DESCRIPTION: The Transuranic Separations Facility receives liquid sodium-bearing waste from the Tank Farm and solid calcine from the Calcined Solids Storage Facility (CSSF or bin sets). After some initial treatment of these feed streams, the radionuclides would be chemically separated into two streams, one containing the transuranic nuclides and another low activity waste stream containing the rest of the nuclides. The transuranic stream would be dried to a solid form to be shipped to the Waste Isolation Pilot Plant. The low-activity waste stream is routed to another facility (addressed as a separate project) for further treatment.

Sodium-bearing waste (SBW) is transferred from the Tank Farm to a day storage tank in the Transuranic Separations Facility. The equipment for retrieval of this stream is included in this project. The SBW would then be filtered to remove undissolved solid particles before further processing. Calcine retrieval from the bin sets is addressed as a separate project. This project starts with receipt of the calcine at the Transuranic Separations Facility and includes the equipment (filters, storage bins, etc.) necessary. After the calcine is received at the Transuranic Separations Facility, it would be dissolved in nitric acid and filtered, in preparation for further processing.

After filtration of either SBW or dissolved calcine, the waste would be sent to the transuranic extraction process.

Transuranic Extraction is a solvent extraction process that removes dissolved actinides from a liquid. The organic solvent extracts a high percentage of actinides from the aqueous feed and also extracts a portion of other radioactive and nonradioactive ions. To minimize the partitioning of these non-actinide species into the solvent, the solvent would be "scrubbed" with a weak nitric acid solution that back-extracts most of the non-actinide species into the scrub effluent, which is combined with the feed. The solvent would then be "stripped" of actinides by contacting it with a weak nitric acid solution containing 1-hydroxyethane 1,1 diphosphonic acid. The strip solution would remove the actinides and a few other metal ions such as molybdenum and zirconium. The solvent would then be contacted with an aqueous sodium carbonate solution to remove additional ions, primarily mercury. Contact with the carbonate solution also neutralizes acid present in the solvent and removes organic degradation products. Finally the solvent would be contacted with weak nitric acid to re-acidify the solution, which is then recycled back to the front end of the transuranic extraction process.

Mixing and separation of the various solutions in the transuranic extraction process would take place in a series of centrifugal contactors. The centrifugal contactors would provide high aqueous organic interface to promote mixing and then accomplish quick separation between the organic and aqueous phases to minimize degradation of the organic solvent.

A portion of the carbonate wash solution would be sent to a mercury removal system, in which dissolved mercury in the waste would be reduced to elemental mercury using formic acid. The metallic mercury would then be amalgamated and packaged for storage and disposal.

The transuranic bearing stream would be concentrated in an evaporator and transferred to a drier where it would be dried to a powder-like form. This remote-handled transuranic powder would be packaged and sealed in WIPP half-canisters for disposal at the Waste Isolation Pilot Plant.

The non-transuranic bearing stream would be transferred to another facility for additional processing.

FACILITY DESCRIPTIONS: This project addresses the Transuranic Separation Facility and related facilities. The other facilities associated with this project are the:

- Bulk Chemical Storage Facility, a steel-framed structure that would be used for storage of non-radioactive bulk chemicals needed for processing.

- Low Activity Waste Collection Facility, a concrete shielded structure containing tanks that would collect low activity waste from various locations on the INTEC. This facility would be a 21.1-meters

(69-feet) by 12.9-meters (42-feet) long concrete structure that houses the three collection tanks. Each collection tank has a 303-cubic meter capacity (80,000 gallons). The three tanks are located on one side of the facility behind a shield wall. The pumps used to transfer the liquids to the Transuranic Separations Facility would be located on the other side of the wall. This would reduce radiation exposures when maintenance of the pumps is required.

- Condensate Collection Facility, a steel-framed structure housing tanks that would collect condensed steam (non-radioactive) from various process and building users before transfer back to the steam plant. This facility would be a 21.1-meters (69-feet) by 12.9-meters (42-feet) structural steel building with a reinforced concrete slab floor. It houses the two 150-cubic meter (40,000 gallons) tanks that would be used to collect condensed steam from the various process heaters before transferring it back to the steam plant.

The overall dimensions of the Transuranic Separation Facility would be 101 meters (332 feet) by 55.8 meters (183 feet). It would extend 15.5 meters (51 feet) below grade and 13.5 meters (44 feet) above grade. The Transuranic Separation Facility is designed to house the equipment and systems for receiving both the SBW and calcine feed materials and separating them into the transuranic and low-activity waste streams. It would be based on a concept of centrally located, below grade, process cells with thick concrete walls surrounded by areas that contain progressively less radioactive hazards. Equipment that would be in highly radioactive service and not expected to require maintenance (e.g., tanks) would be located in the central cells. Equipment in radioactive service that would require maintenance would be located in corridors (pump and valve corridors) that are adjacent to the process cells. Finally, personnel access corridors would be located outside the pump and valve corridors and allow visual access to the pump and valve corridors via shielded windows. Stainless steel liners would be provided in areas where equipment and valves create a need for spill protection and decontamination.

In addition to the cells housing the process equipment, there would be three additional cells located at the north end of the facility. These cells would be the manipulator repair cell, for repair of manipulators and other equipment, a decontamination cell, for decontamination of equipment prior to maintenance activities, and a filter leach cell, in which process filters are treated (by leaching in nitric acid) to remove much of the contamination before they are disposed of. Administrative areas, the control room, and cold chemical make up areas would be located on the main floor (elevation 1.5 meters).

As in any nuclear facility, the Transuranic Separation Facility would be divided into ventilation zones depending on the potential for contamination. Pressure differentials would be maintained so that air flows from areas of lowest contamination potential to areas of highest contamination potential. The areas of highest potential for contamination would be maintained at the lowest pressure (typically -0.75 inch of water). Administrative areas with no contamination potential (designated clean areas) would be ventilated using separate systems designed to commercial standards.

Table C.6.2-47. Construction and operations project data for the Transuranic/Class C Waste Separations (P49A).

Table C.6.2-48. Decontamination and decommissioning project data for the Transuranic/Class C Separations (P49A).

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C.6.2.21 <u>Class C Grout Plant (P49C)</u>

GENERAL PROJECT OBJECTIVES: This project is related to the Separations Alternative and describes the costs and impacts of one of the facilities supporting that alternative, the Class C Grout Plant, designated the Low Activity Waste Treatment Facility.

PROCESS DESCRIPTION: The Class C Grout Plant would receive concentrated low-activity waste from another facility, the Transuranic Separations Facility. This low-activity waste would be the product of a process that chemically separates various radionuclides from the liquid sodium-bearing waste and granular solid calcined material that is currently stored at INTEC. After the transuranic nuclides have been removed from the SBW and dissolved calcine, the solution containing the remaining radionuclides would be concentrated in an evaporator and transferred to the Class C Grout Plant. The concentrated stream is subjected to a high temperature denitration process. The denitration would be accomplished in a fluidized bed that uses air as the fluidization gas and burns kerosene with oxygen to provide the reaction temperature. The nitrates in the concentrated liquid stream are evolved as nitrogen oxides. Offgas from the denitrator would be treated to reduce emissions of unburned hydrocarbons and nitrogen oxides to acceptable levels. Solids from the denitrator would be pneumatically conveyed to a storage bin. At intervals (currently assumed to be about once per month) the solids would be combined with Portland cement, blast furnace slag and flyash to form a grout. Based on the concentrations of nuclides in this mixture, the grout is expected to meet the definition of Class C LLW, as given in 10 CFR 61. These projects end with the grout ready to be pumped (pump included with this project) to disposal facilities or LLW containers. The packaging for disposal and disposal facilities are addressed in other projects.

FACILITY DESCRIPTIONS: The Class C Grout Plant is about 57-m (187-ft) long (north-south) and about 43-m (144-ft) wide (east-west). It would extend about 22-m (72-ft) above grade and about 12-m (40-ft) below grade. The areas that contain radioactive material would be generally located below grade, in a central concrete core. Hatches in the tops of the cells would be provided for initial installation of this equipment and non-routine access later. The cell floors and walls would be lined with stainless steel to allow easy decontamination. The process areas would be located on the lower level, and consist of a number of cells that contain the waste feed storage tanks, the denitrator, offgas treatment equipment, solids separation and storage equipment, and grout mixing and pumping equipment. A decontamination cell would also be located on the lower level and provides an area where equipment can be decontaminated before hands-on maintenance is performed.

As in any nuclear facility, the Class C Grout Plant would be divided into ventilation zones depending on the potential for contamination. Pressure differentials would be maintained so that air flows from areas of lowest contamination potential to areas of highest contamination potential. The areas of highest potential for contamination would be maintained at the lowest pressure (typically -0.75 in. of water). Administrative areas with no contamination potential (designated clean areas) would be ventilated using separate systems designed to commercial standards.

Table C.6.2-49. Construction and operations project data for the Class C Grout Plant (P49C)

Table C.6.2-50. Decontamination and decommissioning project data for the Class C Grout Plant (P49C)

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C.6.2.22 Class C Grout Packaging and Shipping to a New Low-Activity Waste Disposal Facility (P49D)

GENERAL PROJECT OBJECTIVES: This project would provide a facility and process for packaging, loading, and shipping to INEEL disposal facility the Class C low-level radioactive waste (LLW) grout resulting from the Transuranic (TRU) Separations process.

PROJECT DESCRIPTION: Low activity waste, from the transuranic separation process, would be denitrated and combined with cement and other additives in the Class C Grout Plant, resulting in a Class C grout. The Class C grout would be pumped to the Container Filling, Storage and Shipping Area of the project. Because of the presence of the cesium and strontium in this stream, this grout would be much more radioactive than the Class A grout produced under the Full Separations Option and requires additional shielding and remote handling. Concrete landfill containers would be remotely filled with the grout and the grout is allowed to solidify. The containers would be capped, loaded into a shielded cask, transported to an INEEL landfill disposal facility and placed into the disposal facility.

NEW FACILITY DESCRIPTION: The Class C grout Container Filling, Storage and Shipping Area would be a new design and construction project and would be sited contiguous to or adjacent to the Class C Grout Plant. Concrete landfill containers, with a capacity of about 1 m^3 would be filled with the grout within the facility and allowed to set. Then a cap would be placed on the container and it would be surveyed and decontaminated, or covered with a coating to fix the contamination. The finished containers would be loaded into a shielded cask, transported to an INEEL landfill disposal facility and placed into the disposal facility.

The Container Filling, Storage and Shipping Area would be designed with enough space to hold 72 concrete waste containers in temporary (surge) storage. The container loading area would be located in a cell below grade. A hatch in the top of the cell would be provided for initial installation of equipment and routine access for transfer of empty and loaded waste containers and transport casks. One-meter thick concrete walls would separate the process cell and corridors to shield personnel from radiation. The Class C grout could have radiation fields as high as 123 R/hr. The cell floor and walls would be lined with stainless steel to allow easy decontamination.

The Container Filling, Storage and Shipping Area would handle 21,100 landfill disposal containers over the 22-year operating period. Type B shielded casks would be used to transport the containers to an INEEL disposal area. It is estimated that 16 of the casks would be required.

Table C.6.2-51. Construction and operations project data for the Class C Grout Packaging and Shipping to a New Low-Activity Waste Disposal Facility (P49D).

Table C.6.2-52. Decontamination and decommissioning project data for the Class C Grout Packaging and Shipping to a New Low-Activity Waste Disposal Facility (P49D).

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C.6.2.23 Class C Grout Disposal in Tank Farm and Bin Sets (P51)

GENERAL PROJECT OBJECTIVE: The Tank Farm currently stores sodium-bearing liquid waste (SBW). The Calcined Solids Storage Facility (CSSF or bin sets) stores high-level waste (HLW) calcined solids resulting from the calcination of liquid waste. Other projects would remove the liquid waste or calcine (except for the heel) from these facilities. This project would provide for the Resource Conservation Recovery Act (RCRA) Performance-Based Clean Closure of the Tank Farm and bin sets and subsequent disposal of Class C Low-Level Waste (LLW) grout in these facilities. RCRA would no longer regulate either facility once the performance-based closure has been achieved. This would allow other uses for the remaining void spaces.

This project assumes that the facilities would be decontaminated to the maximum extent that is technically and economically practical. It is further assumed that the residual levels of contamination would meet the performance requirements for performance-based closure under RCRA. Meeting the performance criteria means:

- The waste has been removed from the tank system, and
- The contamination remaining in a tank or bin is within an acceptable risk level to the public or environment and is consistent with the remediation goals for the INTEC.

After the facilities are closed, they would then be used as LLW disposal facilities to receive the LLW grout generated by the Separations process.

FACILITY DESCRIPTIONS: The Tank Farm consists of underground storage tanks, tank vaults, interconnecting waste transfer lines, valve boxes, valves, airlift pits, cooling equipment, and several small buildings that contain instrumentation and valving for the waste tanks. The eleven stainless steel 300,000- to 318,000-gallon tanks (hereafter referred to as 300,000-gallon tanks) are contained in underground, unlined concrete vaults. The tanks have a 50-foot diameter and an overall height of approximately 30 feet (includes the dome height). The vault floors are approximately 45 feet below grade level and are patterned after three basic designs: cast-in-place octagonal vaults, pillar-and-panel style octagonal vaults, or cast-in-place square 4-pack configuration. A thin sand layer was placed between the vault floor and tank on nine of the eleven tanks. To protect personnel from radiation, the concrete vault roofs are covered with approximately 10 feet of soil.

The 300,000-gallon tanks are used to store mixed liquid wastes. Eight of the eleven 300,000-gallon tanks contain stainless steel cooling coils, which are located on the tank walls and floors. These cooling coils were used, as required, to maintain the liquid waste below predetermined temperatures in order to minimize corrosion of the stainless steel tanks.

Liquid waste is transferred throughout the Tank Farm in underground, stainless steel lines. The stainless steel lines are housed in stainless steel-lined concrete troughs or double-walled stainless steel pipe. The waste is transferred using steam jets or airlifts. Generally, the intakes are located 4 to 12 inches above the tank floor, which limits the amount of liquid waste that can be removed from the tanks. The liquid waste that remains after the tanks have been emptied as low as possible with the steam jets and airlifts is referred to as a “heel.” The heels are expected to range in volume from 5,000 to 15,000 gallons when cease use occurs.

The systems used for closure would involve remotely operated equipment to wash down the tanks, remove the heel to the extent possible, solidify the remaining heel, and fill the vault with clean grout. During the processing of the HLW in the Class C Grout Plant, grout would be pumped, at intervals, from the Grout Plant to the Tank Farm in shielded lines.

The Calcined Solids Storage Facilities contain seven bin sets, with each bin set containing multiple bins used for calcine storage. Each set of bins is arranged inside a concrete structure called a vault. The bins themselves are large vertical cylinders constructed of stainless steel. Bin set 1, the first constructed, is much smaller than the other six. In bin set 1, the bins vary in diameter from 3 feet to 12 feet, and in length from 20 feet to 24 feet. The bins in the rest of the bin sets are 12 feet to 13.5 feet in diameter and from 40 feet to almost 70 feet in length. The bins (with the exception of those in bin set 1) are equipped with retrieval risers or pipes that connect to the surface. These risers would be used during calcine retrieval operations. New risers would be installed on the bins in bin set 1 during the calcine retrieval activities. The vaults for bin sets 2 through 7 are hollow cylinders, with inside diameters of 40 feet to 60 feet, and a wall thickness of 2 feet to 4 feet. The vault for bin set 1 is a square design, with walls about 2.5 feet thick.

The systems used for closure of the bin sets would include remotely operated drilling and cutting equipment, remotely operated carbon dioxide pellet blasting systems, remotely operated robots for cleaning the interior surfaces of the bins, and equipment for filling the lines and vaults with clean grout.

The Class C grout would be pumped to the bin sets using the same systems as in the Tank Farm.

PROCESS DESCRIPTION: The processes considered in this project are best described in two phases: (1) closure of the facilities as required for a RCRA interim status facility, and (2) subsequent use of the remaining tank and bin voids as a grout landfill.

RCRA PERFORMANCE-BASED CLOSURE: During the closure phase, the facilities would be decontaminated to the maximum extent that is technically and economically practical. For the Tank Farm, the tanks and vaults would be washed and the resulting liquid pumped out to remove the majority of the heel waste residues. The remaining liquid heel would be solidified using clean grout. The ancillary piping, such as waste transfer lines, would be flushed and grouted with clean grout. Tank leak monitoring lances would then be installed in four equally spaced locations inside the vaults. Afterwards, the vaults would be completely filled with clean grout to prevent the intrusion of liquid and to act as a temporary cover or cap over the tank. When pouring is complete, the 11 tanks, and the sand under nine of the 11 tanks, would be encapsulated between the newly poured grout and the vault floor.

A similar closure approach is proposed for the bin sets. The interior surfaces of the bins, piping, and ancillary equipment would be decontaminated, again to the maximum extent that is technically and economically practical. It is proposed that decontamination be accomplished by blasting the contaminated surfaces with carbon dioxide pellets to minimize the generation of any secondary waste and maintain the structural integrity of the bins. This blasting process would dislodge the residual calcine remaining on the bin walls and floors. This dislodged calcine would then be removed from the bins using robots and the calcine removal equipment previously installed to remove the calcine.

It is assumed, for this project, that the bins would be sufficiently decontaminated such that performance criteria would be met. The vault void (the space between the bins and the surrounding concrete structure) would be filled with clean grout to provide added structural rigidity to the bins and minimize the chance of subsidence within the bin sets over time.

SUBSEQUENT USE: After the Tank Farm and the bin sets have been closed, they would be used as LLW grout landfills. The tank and bin voids would be filled with Class C grout that would be produced at the Grout Plant and delivered to the Tank Farm and bin sets in shielded piping.

Table C.6.2-53. Decontamination and decommissioning project data for Performance-Based Clean Closure of the Bin Sets for the Class C Grout Disposal in Tank Farm and Bin Sets (P51 & P26).

Table C.6.2-54. Decontamination and decommissioning project data for the Performance-Based Clean Closure of the Tank Farm for the Class C Grout Disposal in Tank Farm and Bin Sets (P51 & P26).

Table C.6.2-55. Construction and operations project data for Bin Set Closure for the Class C Grout Disposal in Tank Farm and Bin Sets (P51).

Table C.6.2-56. Decontamination and decommissioning project data for Bin Set Closure for the Class C Grout Disposal in Tank Farm and Bin Sets (P51).

Table C.6.2-57. Construction and operations project data for Tank Farm Closure for the Class C Grout Disposal in Tank Farm and Bin Sets (P51).

Table C.6.2-58. Decontamination and decommissioning project data for Tank Farm Closure for the Class C Grout Disposal in Tank Farm and Bin Sets (P51).

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C.6.2.24 Calcine Retrieval and Transport (P59A)

GENERAL PROJECT OBJECTIVE: The general objectives of the proposed calcine retrieval and transportation project at the INTEC are to prepare the bin sets for retrieval of the calcine, retrieve the calcine from the bin sets, and transport the retrieved calcine to the waste processing facility for processing. Each of these objectives are necessary for all waste processing alternatives except for the No Action and Continued Current Operations Alternatives.

PROJECT DESCRIPTION: The complete calcine retrieval and transportation system would be discussed in three sections: bin set access, calcine retrieval, and calcine transportation.

BIN SET ACCESS: Bin set access activities prepare the bin sets for retrieval of the calcine. A confinement enclosure and Ventilation Instrumentation and Control building would be constructed for each bin set. A confinement enclosure, located on top of each bin set, would provide secondary confinement for bin set access and calcine retrieval activities. These enclosures would be prefabricated metal buildings with the surfaces of the enclosure coated with a strippable coating. A Ventilation Instrumentation and Control building would be located adjacent to each bin set, housing ventilation equipment for one bin set and its associated confinement enclosure. Additionally, the instrumentation for the bin set and retrieval system would be located inside the Ventilation Instrumentation and Control building. The retrieval and transportation system would be operated from the Ventilation Instrumentation and Control building.

Once the confinement enclosure and Ventilation Instrumentation and Control buildings are constructed, decontamination of the vaults, cells, and rooms located above the bin storage vault (also known as the superstructure of the bin set). The ventilation, instrumentation, and operational (including the cyclone) equipment housed inside these vaults would be removed. Piping that enters the superstructure through the walls, roof, or floor would be cut at the point of entry and capped. These lines would be decontaminated during bin set closure activities after the retrievable calcine has been removed from a bin set. Piping that lead away from the bin set (such as calcine transport lines used to deliver the calcine to the bin sets) would be decontaminated at the time they are cut.

The superstructures of bin sets 1, 2, 3, and 4 would be demolished after the equipment and piping has been removed in order to provide a flat surface for retrieval activities. A thick concrete pad would be poured on top of the bin storage vaults for bin sets 1-4. The pad would provide additional shielding during retrieval activities. Access to the capped piping would be provided. Bin sets 5, 6, and 7 would not require the demolition of the superstructure or installation of a concrete pad. The design of these bin sets allows a confinement enclosure to be built on the roof. The superstructure would provide the necessary shielding.

Existing retrieval risers would be accessed where available. However, retrieval risers must be remotely installed in bin sets 1, 2, and 3. A remote drilling platform would be used to drill through the concrete floor of the confinement enclosure on those bin sets and a resistance type welder would be used to install a stem to the top of each bin. Each bin in bin set 1 and the center bin in bin set 2 require two retrieval risers to be installed. One retrieval riser must be installed for the remaining bins in bin set 2 and all the bins in bin set 3. The bins would be entered by remotely cutting a hole through the top of the bins but inside the newly installed retrieval risers. The retrieval risers would be capped with removable, stepped, concrete plugs.

At the end of these activities, the bin sets are ready for retrieval of the calcine.

CALCINE RETRIEVAL: The calcine retrieval and transportation occur simultaneously as a result of an integrated system. Two calcine retrieval and transportation systems would be installed. This would allow calcine from two bins within two separate bin sets to be retrieved at any given time. The various calcines can be blended to optimize the waste process, which results in minimizing the waste product volume. Each system would deliver 2700 kg/hr of calcine to the waste processing facility.

Calcine would be remotely retrieved from the storage bin by two retrieval lines. The retrieval lines are sized to fit inside the retrieval risers that extend from the top of the bins to the floor of the confinement enclosure. An air jet would fluidize the calcine and a suction nozzle would remove it from the bin and place it in the transport system. It is assumed (based upon testing of bin set stored calcine and pilot plant produced calcine) that the calcine would not be significantly agglomerated, thus allowing the air jet to fluidize it.

In pilot plant studies, this retrieval method could efficiently remove 95% of the simulated calcine from a bin. The retrieval lines are disconnected from the system and remain in the bin after 95% of the calcine has been retrieved. The retrieval lines are thus available for later retrieval of the final 5% of the calcine.

CALCINE TRANSPORTATION: Currently, calcine is transported from the New Waste Calcining Facility to bin set 6 in a vacuum transport system. This method of calcine transport has proven to be reliable and safe. In industry, this type of transport system is generally accepted to have a limited transport distance of 250 feet to 300 feet. The optimum location for the waste processing facility is within this boundary.

The transport air blower would provide the suction to retrieve calcine from the bin sets and transport it to the waste processing facility. The exhaust air from the blower would be returned to the bin set and acts as the air jet to fluidize the calcine. Each transport system would have a back up transport pipe in case the transport line becomes plugged. The air lines would be heat traced to prevent water vapor from condensing and freezing inside. A concrete pipe chase would encase the transport lines, air lines, and heat tracing and would be covered by an earthen berm. The transport line pipe chase would run above grade.

The transportation system equipment would be housed in the waste processing facility. Each of the two transport systems would have a transport air blower, cyclone, sintered metal filter (or equivalent), high-efficiency particulate air (HEPA) filter bank, and a balancing air blower. The transport air blower would provide motive force for calcine retrieval and transport. The cyclone and sintered metal filter would separate the calcine from the transport air. The HEPA filter bank would remove 99.97% of the calcine remaining in the transport air before it enters the transport air blower. The balancing air blower would exhaust 10% of the transport air to the waste processing facility offgas system. The remaining 90% of the transport air would be recycled to the bin set to be used as the air jet.

If the waste processing facility were located outside the accepted range of a vacuum transport system, an intermediate transport station located midway between the bin sets and the waste processing facility would be required. The calcine would be delivered to the intermediate transport station as if it were at the waste processing facility. The calcine would be separated from the transport air and placed in a receiving bin. The transport air from the first leg of the system is filtered and recycled back to the bin set. A rotary valve would fluidize the calcine as it enters the second leg of the transport system. The calcine would be transported to the waste processing facility by the second leg of the transport system. Again the calcine would be separated from the transport air. The transport air would be recycled back to the intermediate transport system. The calcine would be gravity fed to the waste treatment process.

Table C.6.2-59. Construction and operations project data for the Calcine Retrieval and Transport (P59A).

Table C.6.2-60. Decontamination and decommissioning project data for the Calcine Retrieval and Transport (P59A).

C.6.2.25 Calcine Retrieval and Transport Just-in-Time (P59B)

GENERAL PROJECT OBJECTIVE: The general objectives of the proposed calcine retrieval and transportation project at INTEC are to prepare the bin sets for retrieval of the calcine, retrieve the calcine from the bin sets, and transport the retrieved calcine to a treatment facility for processing.

PROCESS DESCRIPTION: The calcined solids currently stored in the Calcined Solids Storage Facilities (CSSF), also referred to as the bin sets, would be retrieved so that additional treatment can be performed to convert this waste to an acceptable final form. This project includes the modifications necessary to access the bin sets, the calcine retrieval systems that would be deployed in the bins, and the calcine transportation systems that would transfer the calcine to the treatment facilities.

Calcine would be remotely retrieved from the storage bin by two retrieval lines. The retrieval lines would be sized to fit inside the retrieval risers that extend from the top of the bins to the floor of the confinement enclosure. An air jet would fluidize the calcine and a suction nozzle would remove it from the bin and place it in the transport system. It is assumed (based upon testing of bin set stored calcine and pilot plant produced calcine) that the calcine would not be significantly agglomerated thus allowing the air jet to fluidize it. The transport system would then pneumatically convey the calcine to the treatment facility. The start of retrieval and the retrieval durations would support “just-in-time” delivery of the calcine to a waste treatment facility.

FACILITY DESCRIPTION: The bin sets are, simply, arrangements of large cylindrical vessels installed underground (to take advantage of the natural shielding) that are used to store the granular sand-like solids that resulted from the processing of high-level liquid waste in fluidized bed calciners. Confinement enclosures and Ventilation Instrumentation and Control buildings would be constructed for each bin set. The confinement enclosure, located on top of each bin set, would provide secondary confinement for bin set access and calcine retrieval activities. These enclosures would be prefabricated metal buildings. A negative pressure would be maintained inside the enclosures. The equipment necessary for retrieval would be housed inside the enclosure. It would be used to place retrieval equipment and remote drilling equipment. The surfaces of the enclosure would be coated with a strippable coating. The enclosure would be decontaminated several times; therefore workers can enter it, if necessary. A Ventilation Instrumentation and Control building would be located adjacent to each bin set. Each Ventilation Instrumentation and Control building would contain ventilation equipment for one bin set and its associated confinement enclosure. The instrumentation for the bin set and retrieval system would be located inside the Ventilation Instrumentation and Control building. The retrieval and transportation system would be located inside the Ventilation Instrumentation and Control building. The retrieval and transportation system would be operated from the Ventilation Instrumentation and Control building.

Existing retrieval risers would be accessed where available. However, retrieval risers would have to be remotely installed in bin sets 1, 2, and 3. A remote drilling platform would be used to drill through the concrete floor of the confinement enclosure on those bin sets and a resistance type welder would be used to install a stem to the top of each bin.

Table C.6.2-61. Construction and operations project data for the Calcine Retrieval and Transport Just-in-Time (59B)

Table C.6.2-62. Decontamination and decommissioning project data for the Calcine Retrieval and Transport Just-in-Time (P59B)

C.6.2.26 Vitrified HLW Interim Storage (P61)

GENERAL PROJECT OBJECTIVE: The general objective of this project is to provide design, construction, startup, operation, and decommissioning of a facility to receive and store the vitrified non-separated waste. The storage would be for an interim period of time until a repository is ready to receive the waste.

PROJECT DESCRIPTION: The scope of included work for this project is the effort to construct, operate, and decommission a facility to receive and store the vitrified non-separated waste canisters. The vitrified treated waste would be placed in storage canisters that are qualified and approved for shipment to a repository. The canisters would be the same as those used at the Defense Waste Processing Facility (DWPF) at the Savannah River Site. The canisters would be loaded at the vitrification facility and sent directly to the Interim Storage Facility on a transfer cart through an underground transfer cart tunnel.

FACILITY DESCRIPTION: The Interim Storage Facility would be located at the INTEC and would be capable of receiving, handling, and storing the waste canisters. The Interim Storage Facility would be newly designed and constructed and sited adjacent to the process building.

The new Interim Storage Facility would be designed to hold waste canisters in vertical sealed storage tubes located in a concrete storage vault. The storage tube would provide structural support for the stacked canisters with each storage tube holding three canisters. The storage vault would have a concrete floor and walls with inlet and outlet air cooling ducts. The roof of the storage vault would be a composite steel and concrete structure called the charge face structure. The storage tubes would be located in holes in the charge face structure extending down to the floor of the storage vault. Removable shield plugs in the charge face structure would be removed and replaced as the canisters are placed in the storage tubes. Two canister-handling machines would be located above the charge face structure. The canister handling machines are designed to move and handle the canisters.

After each canister is prepared for storage at the process facility, it would be placed in a transfer cart. The transfer cart would then move to the new Interim Storage Facility through a below ground transfer cart tunnel to a transfer cart reception bay at the new Interim Storage Facility. The canister-handling machine would have overhead access to the canisters in the transfer carts and would remove the canisters from the handling cart through the charge hall floor up into a shielded storage cask. The waste-handling machine would then be positioned over the designated storage tube, where it would remove the shielded plug, place the canister in the tube, and replace the plug.

Supplementary lag storage locations would be provided at the end of the transfer cart tunnel to provide more immediate storage in the event of equipment maintenance or failure. This would help prevent a bottleneck in shipments from the production line. The work associated with the loading of the canister at the process facility and with the removal and shipping of the canisters to the disposal facility is not within the scope of this project.

Table C.6.2-63. Construction and operations project data for Vitrified HLW Interim Storage (P61)

Table C.6.2-64. Decontamination and decommissioning project data for Vitrified HLW Interim Storage (P61)

C.6.2.27 Packaging and Loading of Vitrified HLW at INTEC for Shipment to a Geologic Repository (P62A)

GENERAL PROJECT OBJECTIVE: The proposed project encompasses the handling and loading of transport casks with vitrified non-separated HLW canisters before immediate transport to the National Geological Repository. Rail transport is assumed with the rail cask modeled after an existing spent fuel transport cask. The handling and loading of casks would occur in the Interim Storage Facility after all canisters had been produced and transferred into the Interim Storage Facility from the vitrification facility. Handling and loading of casks would occur over a 20-year time period but would not start before the repository was opened to accept HLW. Loaded cask transport from the INEEL to the repository, subsequent handling at the repository, and empty cask return to the INEEL are beyond the scope of this study.

PROCESS DESCRIPTION: Approximately 11,700 canisters would be produced by the vitrification facility over a 20-year timeframe and stored in the Interim Storage Facility. Since the Interim Storage Facility is not designed to handle incoming canisters for storage and cask loading simultaneously, it is assumed that cask handling and loading of canisters would not start until all canisters had been produced and placed into interim storage. It is also assumed that cask loading would occur over a 20-year period.

Each canister would contain 0.72 cubic meters (nominal) of vitrified HLW and be based on the Savannah River Site-type stainless steel canister. All canisters would be remote handled and would be clean and without outer surface contamination prior to cask loading.

All shipments to the repository would require the use of a Type-B shielded shipping packaging (cask). The shipping cask chosen as the model for canister transport is the MP-187, a commercial, spent-fuel type, rail cask currently being processed for certification by the NRC. Each shipping cask would be capable of transporting four HLW canisters; however, to transport the HLW canisters in this cask, the application for NRC approval would need to be amended and approved by the NRC. In addition, the cask configuration would have to be modified to NRC requirements because the total plutonium content of four HLW canisters exceeds 20 Curies. This modification would also require NRC’s approval.

An estimated 32 casks with internals and railcars (including standby units) would be required to continuously transport canisters to the repository. The round trip time duration of casks and railcars for an uninterrupted disposal operation is estimated to be four weeks and would require 16 casks to be in operation throughout the duration. The standby of eight empty casks with railcars at INEEL and eight at the repository would allow two extra weeks of time duration to accommodate loading, unloading, cask maintenance, weather, and railroad logistics problems. The Interim Storage Facility would load four canisters per day into a cask, thereby producing four casks per week for immediate transport to the repository. With four railcars loaded with casks shipped per week, 26 rail carrier trips to the repository would be made per year.

The packaging, loading, and transport process is as follows:

- Load four casks and railcars (duration one-week).
- Transport four casks and railcars by commercial train to a railhead near the repository (duration one-week).
- Transport four loaded casks from the railhead to the repository by truck and return with four empty casks (duration one-week).
- Return four empty casks with railcars via commercial train to the INEEL (duration one-week).

Table C.6.2-65. Construction and operations project data for the Packaging and Loading of Vitrified HLW at INTEC for Shipment to a Geological Repository (P62A).

Table C.6.2-66. Decontamination and decommissioning project data for the Packaging and Loading of Vitrified HLW at INTEC for Shipment to a Geologic Repository (P62A).

C.6.2.28 Mixing and Hot Isostatic Pressing (P71)

GENERAL PROJECT OBJECTIVES: The project described in this project summary is part of the Hot Isostatic Press (HIP) Waste Option for treating calcined waste at the INTEC. All of the sodium-bearing waste at the INTEC would be calcined through the existing New Waste Calcining Facility under a separate project. The HIPing process would involve mixing the calcine with amorphous silica and titanium powder in special cans, then applying a HIP technology to produce a glass-ceramic. The resulting product would then be packed into Savannah River Site (SRS) canisters for ultimate disposal in a national geological repository. The information presented here describes plans for the design, construction, and operation of HIP facilities.

PROCESS DESCRIPTION: This project directly interfaces with calcine retrieval at the front end and with HIP product interim storage at the back end (both are separate projects). The HIP facility would be set up in four separate process lines or trains, each of which is the same. Each of the four process lines would be designed to operate simultaneously with the other lines, but independent of them. This process description follows one line through from beginning to end.

Calcine treatment by mixing and HIPing begins by taking calcine from the retrieved-calcine storage hoppers (calcine retrieval is covered under another project) and transporting it to a temporary storage cell in the HIP facility. In the temporary storage cell, the calcine would be sized in a ball mill and fed into a storage/blending vessel (a ribbon blender). Pre-sized amorphous silica and titanium (or aluminum) powder would be added with the calcine in the blender in portions specified by the selected recipe. The mixture containing around 70% calcine is blended and about 1600 lbs. of the homogenous feed would be fed to a stainless steel HIP can (approximately 2 feet in diameter by 3 feet high). A lid with a venting tube would be welded to the can, and the filled can would be devolatilized for approximately 24 hours at about 650°C. The offgas would be vented to the offgastreatment system. The can would be evacuated to 0.5 torr, the vent/evacuation port is welded shut, and the can placed into one of 3 HIPing vessels. The HIPing vessel (filled with one can) would be pressurized with argon and heated to 1050°C. The final pressure inside the HIPing vessel after it is heated would be about 20,000 psi. The HIPing step (including overpacking, placement in the HIP vessel, pressurization, heatup, and time at temperature or soaking) would take about 24 hours.

After the HIPing step is complete the argon gas would be evacuated and analyzed for radioactivity to determine whether the HIP can was breached. (If it was breached that material would be recycled through the process). If the analysis indicates that the can was not breached, the can would be unloaded from the

HIPing machine and allowed to cool. Once an SRS disposal canister is filled with 3 HIP cans, the canister would be welded closed and transported to interim storage. (The interim storage facility, canister-transport tunnel, and cars are covered under another project.)

The HIPing facility would be designed for a production rate of 9 cans per day with an operating schedule consisting of 10 hour days, 4 days per week. A down time of 50% is allowed for maintenance. About 5,700 canisters of HIP HLW would be produced by the HIP facility.

FACILITY DESCRIPTION: The HIP facility would be located in close proximity to the bin sets. The HIP facility would be designed to house the equipment and operations for processing waste and provide essential features for safe and efficient operation and maintenance of the facility. Its layout is based on centrally located process cells with heavy concrete walls for shielding. Limited personnel access is provided. The cells are intended to house equipment that presents a high radiation hazard but requires minimal maintenance. The HIP facility would be set up on two levels: a below grade level and an above grade level. The cells on each level would be set up in four rows where each row houses a process train. An heating, ventilation, and air conditioning canyon would run between the first and second row and the third and fourth rows for a total of two heating, ventilation, and air conditioning canyons per level. On each level operating corridors would run around the outer perimeter of the four rows of cells and between the second and third rows of cells. This would cause each row to have an operating corridor next to one wall and on each end. The perimeter of the facility would contain office space, support facilities and non-radioactive operation areas. The building would occupy an area measuring 302 × 320 feet.

The HIP facility below-grade level would contain six cells in each of the four rows. These cells would provide storage for pallets of empty HIP cans and contain equipment for filling, welding and decontaminating the HIP cans. A cell for sizing/grinding off spec HIP cans would also be provided. Also, on the below grade level are the bottom of the HIP cell, which contains the HIPing furnace and the bottom of a cell for leading the final product canisters for transport to interim storage.

Each of the four rows in the above grade level would contain eleven process cells with 3-ft-thick reinforced concrete walls for shielding. Each set of eleven cells would contain blending equipment, decontamination chemical tank storage, a fill tank, and weld equipment. Also included would be decontamination, devolatilization/heat/weld, HIP, QA/assay, canister loading, load-out, remote maintenance, and crane maintenance cells. The HIPing and final loading cells would be continued from below grade.

Table C.6.2-67. Construction and operations project data for the Mixing and Hot Isostatic Pressing (P71).

Table C.6.2-68. Decontamination and decommissioning project data for the Mixing and Hot Isostatic Pressing (P71).

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C.6.2.29 Interim Storage of Hot Isostatic Pressed Waste (P72)

GENERAL PROJECT OBJECTIVE: The general objective of this project is to provide design, construction, startup, operation, and decommissioning of a facility to receive and store the waste-filled canisters produced in the Hot Isostatic Press (HIP) option. The storage would be for an interim period of time until a repository is ready to receive the waste.

PROJECT DESCRIPTION: This project provides for a facility for the interim storage of the waste-filled canisters produced by the HIPed Waste option. The HIP treated waste would be placed in storage canisters that are qualified and approved for shipment to a repository. It is estimated that the HIP process option would generate 5,700 canisters. The Savannah River Site-type canisters would be loaded at the HIP Facility and sent directly to the Interim Storage Facility on a transfer cart through an underground transfer cart tunnel. The canisters would be delivered at a rate of 3 per day.

Two Interim Storage Facility concepts (a new or modified existing facility) have been evaluated for the storage of the HIP waste. Either facility would be located at the INTEC and would be capable of receiving, handling, storing, retrieving, and loading the waste canisters.

NEW FACILITY DESCRIPTION: If a new Interim Storage Facility is built, it would be all new design and construction and would be sited adjacent to the HIP Facility. Storage tubes in the new Interim Storage Facility would hold waste canisters in vertical sealed storage tubes located in a concrete storage vault with each storage tube holding three canisters.

After each canister is prepared for storage at the process facility, it would be moved on a transfer cart through a below ground transfer cart tunnel to a reception bay at the new Interim Storage Facility. The canister-handling machine would have overhead access to the canisters in the transfer carts and would remove the canisters from the handling car. The canister-handling machine would then be positioned over the designated storage tube, where it would remove the shielded plug, place the canister in the tube, and replace the plug.

Supplementary lag storage locations would be provided at the end of the transfer cart tunnel to provide more immediate storage in the event of equipment maintenance or failure. This would help prevent a bottleneck in shipments from the production line.

When the waste canisters are removed for shipment to disposal, the process would be reversed. The canisters would be moved from the storage tube by the canister-handling machine to a location directly above the shipping cask bay and placed in the shipping cask. A rail car load-out bay called the shipping cask bay would be incorporated into the facility. A specialized cask maneuvering hydraulic platform would be provided to upright and recline the shipping cask for loading while on the rail car.

MODIFIED EXISTING FACILITY: If an existing building is to be modified rather than building a new one, the modified Interim Storage Facility would be located in the building originally built to contain the Fuel Processing Restoration process. That project was cancelled with the building mostly finished, but before most of the process equipment was installed. Internal specific areas of the building would have to be modified and/or finished to provide the modified Interim Storage Facility. The major reason that the Fuel Processing Restoration building was evaluated for the modified Interim Storage Facility are the existing concrete vaults that would have held the radioactive process equipment.

The modified Interim Storage Facility was designed to hold waste canisters in vertical sealed storage tubes. The storage tubes would be located in a concrete storage vault just as described for a new facility but would hold four canisters.

The concrete walls between the existing process vaults would be removed to form one storage vault. A steel grid arrangement would be installed on the existing concrete floor of the vault to level and position the storage tubes, and a steel lining would be installed on the east vault wall to provide the additional necessary personnel shielding. The bottoms of the storage tubes would be sealed with steel plate and the tops would be closed with steel shield plugs. Spacers would be used at the top of the pipes to position them and provide radiation shielding. The spacers and the pipes would be welded together to provide adequate air sealing so the fans can force the flow of cooling air from east to west. The combinations of spacers and pipe plugs would form a relatively flat floor.

After each canister is prepared for storage at the process facility, it would moved in a transfer cart into a shielded storage cask just as described above for a new Interim Storage Facility. Likewise, a shipping cask bay is incorporated into the facility and would be equipped with specialized cask maneuvering hydraulic platform.

Table C.6.2-69. Construction and operations project data for the Interim Storage of Hot Isostatic Pressed Waste (P72).

Table C.6.2-70. Decontamination and decommissioning project data for the Interim Storage of Hot Isostatic Pressed Waste (P72).

C.6.2.30 Packaging and Loading Hot Isostatic Pressed Waste at INTEC for Shipment to a Geologic Repository (P73A)

GENERAL PROJECT OBJECTIVES: The proposed project encompasses the handling and loading of transport casks with Hot Isostatic Pressed (HIPed) high-level waste (HLW) canisters preparatory to immediate transport to the National Geological Repository. Rail transport is assumed with the rail cask modeled after an existing spent fuel transport cask. The handling and loading of casks would occur in the Interim Storage Facility after all HIPed canisters have been produced and transferred into the Interim Storage Facility from the HIP Facility. The HIP would produce about 5,700 canisters. Handling and loading of casks would occur over a 20-year time period but would not start before the repository was opened to accept HLW.

Loaded cask transport from the INEEL to the repository, subsequent handling at the repository, and empty cask return to the INEEL are not part of this project.

PROJECT DESCRIPTION: Approximately 5,700 HIPed canisters would be produced by the HIP Facility over a 20-year timeframe and stored in the Interim Storage Facility. Canister production as proposed would start in January 2015 and end in December of 2035. It is assumed that cask handling and loading of canisters would not start until all canisters had been produced and placed into interim storage because the Interim Storage Facility is not designed to handle incoming canisters for storage and cask loading simultaneously. Operations for this project would begin with cask loading, which is assumed to occur over a 20-year period.

Each canister would contain 0.72 cubic meters (nominal) of HIPed HLW (three HIP cans containing a glass-ceramic waste material) and be based on the Savannah River Site Defense Waste Processing Facility stainless steel canister design. All canisters would be remote handled and would be clean and without outer surface contamination prior to cask loading.

All shipments to the repository would require the use of a Type-B shielded shipping packaging (cask). The shipping cask chosen as the model for canister transport is the MP-187, a commercial, spent-fuel type, rail cask currently being processed for certification by the NRC. Each shipping cask would be capable of transporting four HLW canisters; however, to transport the HIPed HLW in this cask, the application for NRC approval would need to be amended and approved by the NRC. In addition, the cask configuration would have to be modified to NRC requirements because the total plutonium content of four HLW canisters exceeds 20 Curies. This modification would also require NRC's approval.

The Interim Storage Facility would load two canisters per day into a cask, thereby producing two casks per week. Two weeks of cask loading would provide four casks/railcars ready for immediate transport to the repository. An estimated 24 casks with internals and railcars (including standby units) would be required to continuously transport the HIPed canisters to the repository. The round trip time duration of casks and railcars for an uninterrupted disposal operation is estimated to be five weeks requiring 16 casks to be in operation throughout the duration. The standby of four empty casks with railcars at INEEL awaiting loading and four at the repository unloaded, or waiting to be unloaded, would allow two extra weeks of time duration to accommodate loading, unloading, cask maintenance, weather, railroad logistics, and other problems. With four railcars with loaded casks shipped every other week, approximately 9 rail carrier round trips from the INEEL to the repository and back could be made per year.

The loading, and transport logic is presented as-follows:

- Load four casks and railcars (duration two-weeks).
- Transport four casks and railcars by commercial train to a railhead near the repository (duration one-week).
- Transport four loaded casks from the railhead to repository by truck and return with four empty casks (duration one-week).
- Return four empty casks with railcars via commercial train to the INEEL (duration one-week).

Table C.6.2-71. Construction and operations project data for Packaging and Loading of Hot Isostatic Pressed Waste for Shipment to a Geologic Repository for Waste Processing (P73A).

Table C.6.2-72. Decontamination and decommissioning project data for Packaging and Loading of Hot Isostatic Pressed Waste for Shipment to a Geologic Repository for Waste Processing (P73A).

C.6.2.31 Direct Cement Process (P80)

GENERAL PROJECT OBJECTIVE: The general objective of this project is to provide information for the design, construction, startup, operation, and decommissioning of a new Direct Grouting Facility under the Direct Cement Option. The facility would be used to directly grout the INTEC calcine, including calcined SBW waste, into a cementitious waste form for disposal as high level waste (HLW). Under a separate project, the waste filled canisters would be put in interim storage until final repository space is available for their disposal.

PROJECT DESCRIPTION: In the hydroceramic grouting process, calcined HLW and calcined sodium-bearing waste (SBW) would be combined with clay, blast furnace slag, and caustic soda to generate a hydroceramic form of naturally occurring feldspathoids/zeolites. The grouting process is used, which generally involves the following steps:

- Mixing a thick paste of calcine and hydroceramic additives.
- Casting the paste into a waste canister.
- Curing the hydroceramic under temperature and pressure.
- Removing the free water from the hydroceramic by baking.
- Sealing the canister.

The process is described in more detail below.

Calcine would be received at the grouting facility on demand for batch processing via the Calcine Retrieval and Transport System. Once the grout recipe is determined, the calcine blend and the grout ingredients consisting of clay, blast furnace slag, sodium hydroxide, and water would be delivered through a series of blenders and mixers to a kneeder extruder for final mixing. From the kneeder extruder the grout mixture would be delivered to the canister injection head through which each canister is filled with approximately 1,225 kg (2,700 lb) of grout. The waste would be grouted into Savannah River Site Defense Waste Plant Facility HLW stainless steel canisters measuring 0.6 m (24 inches) in diameter by 3 m (10 foot) in length.

Grout curing would occur in saturated steam conditions through an autoclave process operating in the range of 250° C (577 psia) to 300° C (1,246 psia). Eighteen canisters at a time would be placed in the single autoclave that would operate through a 48-hour cycle.

Following curing, the canisters would be removed from the autoclave and sent to the dewatering chambers. Dewatering serves to dry the cured grout in the canisters such that the residual moisture content of the grout is less than 2% of the grout by weight. Total time in the dewatering cycle would be approximately seven days. The chambers would be sized to accommodate 50 canisters.

From the dewatering chamber, the canisters would travel to the welding room where the canisters' caps would be remotely installed and welded in place. After welding and testing steps are complete, the canisters are once again be processed through a decontamination check station for surface surveys and cleaning, if required.

Canisters that have completed the process through the grouting facility would be sent to interim storage via an underground tunnel connecting the grouting and interim storage facilities. The interim storage facility and operations are covered in another project description.

NEW FACILITY DESCRIPTION: The grouting facility would be located in the northeast area of INTEC within the existing security perimeter fence. No previously undisturbed soils would be affected. The estimated size of the facility would be approximately 18,327 m^2 (197,275 $feet^2$).

The grouting facility would be designed to house all activities involving the grouting process from receipt of calcine and grout ingredients to preparation of the filled canisters for transfer to the interim storage facility. Radiological shielding would be incorporated into the facility designs and criticality is not a concern. The design would be based on a concept of centrally located process cells with thick concrete walls surrounded by areas that contain progressively less radioactive hazards. Equipment in radioactive service that requires maintenance would be located in areas with remote handling and maintenance capabilities. Radiological contamination control would be maintained throughout the process through the use of engineered building boundaries, filtration systems, and canister surface checks and cleaning. Off gassing from the various tanks and vessels would be routed through a high-efficiency particulate air (HEPA) filtration system.

All processes would be operated remotely from a control room with a number of operations requiring robotic handling. Processes involving calcine and the grouted waste form would be performed remotely and under computer control. Robotic handling would include remotely controlled canister movement through the facility and canister manipulation at the filling station, monitoring and decontamination stations.

Table C.6.2-73. Construction and operations project data for the Direct Cement Process (P80)

Table C.6.2-74. Decontamination and decommissioning project data for the Direct Cement Process (P80)

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C.6.2.32 Unseparated Cementitious HLW Interim Storage (P81)

GENERAL PROJECT OBJECTIVE: The general objective of this project is to provide design, construction, startup, operation, and decommissioning of a facility to receive and store the waste-filled canisters produced in the Direct Cement option. The storage would be for an interim period of time until a repository is ready to receive the waste.

This project does not include the transfer cart loading area in the process facility and associated equipment, the rail car and cask, or the railroad tracks. Additionally, the loading of the canister at the process facility as well as the removal and shipping of the canister to the disposal facility are not included in this project.

PROJECT DESCRIPTION: The scope of this project includes construction, operation, and decommissioning the facility where the treated waste would be placed in storage canisters that are qualified and approved for shipment to a repository. The canisters would be the same as those used at the Defense Waste Processing Facility at the Savannah River Site. After each canister is prepared for storage at the process facility, it would be placed in a transfer cart. The transfer cart would then move to the new Interim Storage Facility through a below ground transfer cart tunnel to a transfer cart reception bay at the new Interim Storage Facility. The canister-handling machine would have overhead access to the canisters in the transfer carts. The canister-handling machine would remove the canisters from the handling cart through the charge hall floor up into a shielded storage cask. The waste-handling machine would then be positioned over the designated storage tube, where it would remove the shielded plug, place the canister in the tube, and replace the plug.

FACILITY DESCRIPTION: The Interim Storage Facility would be a new facility located at the INTEC, adjacent to the process building, and would be capable of receiving, handling, and storing the waste canisters.

The new Interim Storage Facility would be designed to hold waste canisters in vertical sealed storage tubes. The storage tubes would be located in a concrete storage vault. The storage tube would provide structural support for the stacked canisters. Three canisters would be placed in each storage tube. A cushion block would be placed between each of the canisters and between the bottom canister and the bottom of the storage tube.

The storage vault would have a concrete floor and walls with inlet and outlet air cooling ducts. The roof of the storage vault would be a composite steel and concrete structure called the charge face structure.

The storage tubes would be located in holes in the charge face structure extending down to the floor of the storage vault. Removable shield plugs in the charge face structure would be removed and replaced as the canisters are placed in the storage tubes.

Supplementary lag storage locations would be provided at the end of the transfer cart tunnel to provide more immediate storage in the event of equipment maintenance or failure. This would help prevent a bottleneck in shipments from the production line.

Table C.6.2-75. Construction and operations project data for Unseparated Cementitious HLW Interim Storage (P81).

Table C.6.2-76. Decontamination and decommissioning project data for Unseparated Cementitious HLW Interim Storage (P81).

C.6.2.33 Packaging and Loading Cementitious Waste at INTEC for Shipment to a Geologic Repository (P83A)

GENERAL PROJECT OBJECTIVES: The proposed project encompasses the handling and loading of transport casks with Cement canisters before immediate transport to a Geologic Repository. The handling and loading of casks would occur in the Interim Storage Facility after all waste canisters had been produced and transferred into the Interim Storage Facility from the cement facility. Handling and loading of casks would occur over a 20-year time period but would not start before the repository was opened to accept high-level waste (HLW).

Loaded cask transport via rail from the INEEL to the repository, subsequent handling at the repository, and empty cask return to the INEEL are not part of this project.

PROJECT DESCRIPTION: Approximately 18,000 canisters would be produced by the grouting facility and stored in the Interim Storage Facility. Canister production as proposed would start in January 2015 and end in December of 2035. It is assumed that cask handling and loading of canisters would not start until all canisters had been produced and placed into interim storage because the Interim Storage Facility (as currently proposed) would not be designed to handle incoming canisters for storage and cask loading simultaneously. Operations for this project would begin with cask loading which would occur over a 20-year period.

Each canister would contain 0.72 cubic meters (nominal) of HLW and be based on the Savannah River Site Defense Waste Processing Facility stainless steel canister design. All canisters would be remote handled and would be clean and without outer surface contamination prior to cask loading.

All shipments to the repository would require the use of a Type-B shielded shipping packaging (cask). The shipping cask chosen as the model for canister transport is the MP-187, a commercial, spent-fuel type, rail cask currently being processed for certification by the NRC. Each shipping cask would be capable of transporting four HLW canisters; however, to transport the Cement HLW in this cask, the application for NRC approval would need to be amended and approved by the NRC. In addition, the cask configuration would have to be modified to NRC requirements because the total plutonium content of four HLW canisters exceeds 20 Curies. This modification would also require NRC's approval.

The Interim Storage Facility would load five (5) canisters per day into several casks, thereby producing five (5) casks per week for immediate transport to the repository. With five (5) railcars with loaded casks being shipped every week, then approximately 12 rail carrier round trips from the INEEL to the repository and back could be made per year.

An estimated 40 casks with internals and railcars (including standby units) would be required to continuously transport the canisters to the repository. The round trip time duration of casks and railcars for an uninterrupted disposal operation is estimated to range between four (4) and six (6) weeks and would require 20 casks to be in operation throughout the duration. The standby of 10 empty casks with railcars at INEEL awaiting loading and 10 at the repository unloaded or waiting to be unloaded would allow two extra weeks of time duration to accommodate loading, unloading, cask maintenance, weather, railroad logistics, and other problems.

The loading, and transport logic is presented as-follows:

- Load five (5) casks and railcars (duration one-week).
- Transport five (5) casks and railcars by commercial train to a railhead near the repository (duration one-week).
- Transport five (5) loaded casks from the railhead to the repository by truck and return with four empty casks (duration one-week).
- Return five (5) empty casks with railcars via commercial train to the INEEL (duration one-week).

Table C.6.2-77. Construction and operations project data for Packaging and Loading of Cementitious Waste at INTEC for Shipment to a Geologic (P83A).

Table C.6.2-78. Decontamination and decommissioning project data for Packaging and Loading of Cementitious Waste at INTEC for Shipment to a Geologic Repository (P83A).

C.6.2.34 <u>Early Vitrification Facility with Maximum Achievable Control Technology (P88)</u>

GENERAL PROJECT OBJECTIVE: The general objective of this project is to provide design, construction, startup, operation, and decommissioning of a new Early Vitrification Facility to process liquid waste from the Tank Farm and high level waste (HLW) solid calcine. Liquid waste would include either sodium-bearing waste (SBW) or non-SBW liquid which is also known as newly generated liquid waste (NGLW). The liquid waste and the dry calcine granules would be converted into a geologically stable borosilicate glass suitable for disposal. The glass produced from the liquid waste would be remote-handled transuranic waste that would be disposed of at the Waste Isolation Pilot Plant. The glass produced from the calcine would be HLW that would be disposed of at the National Geologic Repository.

PROJECT DESCRIPTION: The Early Vitrification project includes the Early Vitrification Facility for vitrifying and packaging calcine and liquid waste, an SBW (and NGLW) retrieval and transport system for transporting liquid waste from the Tank Farm to the Early Vitrification Facility, and a grout plant for stabilizing Process Equipment Waste Evaporator bottoms resulting from processing of the Early Vitrification Facility offgas liquid. The Early Vitrification process is designed to vitrify both calcine and liquid wastes. Liquid wastes would be mixed with glass frit and fed to the melter in the dry condition. Liquid waste and calcine would be treated in separate campaigns. The liquid waste would be collected continuously in the Early Vitrification Facility, and then vitrified and packaged in one or two campaigns per year.

The vitrified waste would be placed in glass storage canisters that are qualified and approved for shipment to a repository. The canisters for the HLW-glass and a small quantity of LLW-glass would be the same as those used at the Defense Waste Processing Facility at the Savannah River Site. They are 2 feet in diameter and 10 feet in length. The canisters would be loaded at the Vitrified Product Process Facility and sent directly to the Interim Storage Facility on a transfer cart through an underground transfer cart tunnel. WIPP half-canisters would be used for the remote-handled transuranic glass.

Both the liquid waste and the dry calcine would have to be blended with additional chemicals to form glass. In the Early Vitrification Facility, these chemicals would be received as specially-formulated powdered glass called frit. Because of the many chemistries of liquid waste and many types of calcine generated at INTEC, the chemical compositions to be vitrified are not uniform. Based on laboratory work, up to six different frit formulations would be needed to make acceptable glass with the liquid waste calcine. The Early Vitrification Facility would provide equipment to store and blend liquid waste or calcine with the frit, melt those materials to form glass, cast the glass into appropriate canisters, manage full and empty canisters, and treat liquid and gaseous effluents.

NEW FACILITY DESCRIPTION: The Early Vitrification Facility would be located near the northeast corner of the INTEC. The facility would be a multistory building that would extend from elevations of 32 feet below grade, to 75 feet above grade, and would have a floor plan occupying an area measuring 433 feet x 178 feet. The Early Vitrification Facility layout would be based on a centrally located process-cell complex with limited personnel access and heavy concrete walls for shielding. The facility would have a separate system for processing melter offgas and reclaiming mercury waste.

The heart of the Early Vitrification Facility would be the vitrification system that would include the melters and the offgas treatment system with its scrubber blowdown processing systems. Liquid waste and calcine would be vitrified in separate campaigns and would not be mixed or melted together in the same campaign. The liquid waste would be pumped to the process. The pumping system would consist of a tie-in in to an existing INTEC Tank Farm valve box, a lift station to pump the liquid to a transport line, and a 1,200-ft long transport line from the lift station to the vitrification system. The vitrification system would receive liquid waste, dry calcine, and frit, from separate handling systems. Liquid waste from the Tank Farm would be received by two 24,000-gallon storage tanks in the Early Vitrification Facility.

Liquid waste from other sources would be transferred into one of the two storage tanks and blended before being characterized. After the liquid has been characterized, it would be transferred to one of two 8,000-gallon tanks for mixing with the appropriate frit. Additional characterization would be performed on the mixture as part of the certification process. Once the contents of a mix tank would be certified, the entire volume of the tank would be transferred to one of two feed tanks. Each mix tank and each feed tank would hold enough liquid and frit mixture for about one day of operation.

Dry calcine form the existing storage bins would be received and stored in two large blender tanks. The calcine would be fluidized and homogenized in each blender tank by air injection systems. A secondary pneumatic transfer system for each tank would deliver calcine to a weigh hopper that would measure and dispense it into a ribbon blender for mixing with a measured amount of frit. This mixture would then be dispensed into the melter.

Each type of frit would be conveyed to a separate silo outside the Early Vitrification Facility. Other sets of conveyors would transport the frit into six separate indoor storage tanks. The proper frit would be conveyed from these tanks to the frit weigh tank, and finally to a mix tank for mixing with liquid waste or to the ribbon blender where it would be mixed with dry calcine and dispensed into the melter.

The Early Vitrification Facility would include two joule heated (i.e., electrically powered) melters. One would be installed as a spare. The feed material, called “batch”, would be a mixture of liquid waste or dry calcine and dry frit. Before melting, the feed material would float on top of the molten glass, forming a “cold cap” that would reduce emissions of volatile species in the melter offgas. Large quantities of condensable, low-quality steam would be released as the liquid waste and frit mixture would contact the melter cold cap. The steam would be exhausted from the melter by the offgas ventilation system, and condensed and treated in the offgas system components. Product glass would be gravity drained through a separate port into the canisters.

A limited amount of ventilation air would be allowed to enter the melter to cool instrument and viewing ports. The ventilation air would collect steam, volatile gases, and fine particulates, that would later be removed in the offgas treatment system. The offgas treatment train would include a Noxidizer™ (a two-chambered incinerator designed to chemically reduce NO_x and oxidize organics), a quench column, a venture, a packed bed absorber, and a granular activated carbon column. Contaminated water form the offgas treatment system would be processed in the Early Vitrification Facility to collect and immobilize mercury. Elemental mercury from the activated carbon absorber system and from the wastewater would be amalgamated. Further treatment of the scrubber blowdown water would be performed at other facilities at the INTEC.

The vitrified remote handled transuranic waste glass from the liquid waste would be drained from the melter into Waste Isolation Pilot Plant canisters, and the vitrified HLW glass from the calcined waste would be drained from the melter into Defense Waste Processing Facility-type canisters. The canisters would then be cooled, capped, and transported through three separate cells for lid welding and leak checking, decontamination, and exterior contamination swiping. Finally, the filled canisters would be placed in a below-grade tunnel and transferred to a separate Interim Storage Facility located near the Early Vitrification Facility.

Table C.6.2-79. Construction and operations project data for the Early Vitrification Facility with Maximum Achievable Control Technology (P88).

Table C.6.2-80. Decontamination and decommissioning project data for the Early Vitrification Facility with Maximum Achievable Control Technology (P88).

C.6.2.35 Packaging and Loading Vitrified SBW at INTEC for Shipment to the Waste Isolation Pilot Plant (P90A)

GENERAL PROJECT OBJECTIVES: This project includes the handling and loading of shipping casks with remote handled Waste Isolation Pilot Plant (WIPP) type containers containing transuranic waste before immediate truck transport to WIPP for disposal. The interim storage, handling, and loading of casks and containers would occur in the Interim Storage Facility. The transuranic waste would be processed in the Early Vitrification Facility. Handling and loading of casks would occur over a 26-year period but would not start before WIPP was opened to accept transuranic waste. Loaded cask transport from the INEEL to WIPP, subsequent handling at WIPP, and empty cask return to the INEEL are not part of this project.

PROJECT DESCRIPTION: Approximately 900 remote-handled WIPP half-canisters would be produced by the Early Vitrification Facility over a 21-year timeframe and transferred to the Interim Storage Facility for interim storage and cask loading prior to shipment to WIPP for disposal. Interim storage would be provided in the Interim Storage Facility to allow for accumulation before shipment. Production would start in January 2015 and end in December of 2035.

Each remote-handled WIPP half-canisters would contain about 0.4 cubic meters of vitrified transuranic waste to satisfy NRC fissile-gram equivalent (FGE) requirements. All remote-handled WIPP containers without outer surface contamination prior to cask loading.

The shipping cask designated for use by this project would be the remote-handled TRU 72-B, developed for remote-handled WIPP container transport. One cask would be carried on a trailer for truck transport to WIPP. The cask has been tested and licensed by the NRC for transuranic waste ground shipment. Each shipping cask would be capable of transporting one remote-handled WIPP container; however, the containerized waste would require NRC approval as an authorized cask content prior to any shipment.

The Early Vitrification Facility three-year regime would produce approximately 14 remote-handled WIPP half-canisters per week. Four half-canisters would be loaded each week and the remainder (10) placed into interim storage for future transport. The additional containers (about 90) produced over the following years would be generated at about 1.9 remote-handled containers per year. At the end of the first three-years of production approximately 820 half-canisters would be stored in the Interim Storage Facility awaiting transport to WIPP.

The Interim Storage Facility would load about two casks per week with each cask containing 1-2 remote-handled WIPP half-canisters. If two trailers with loaded casks were shipped every week, then approximately 90 truck carrier round trips from the INEEL to WIPP could be made per year. The decision to provide shipments of two casks per week to WIPP would reduce the quantity of remote-handled WIPP containers placed into interim storage during the first three years of Early Vitrification Facility operation.

An estimated 16 cask and trailer units (including standby units) would be required to continuously transport the remote-handled WIPP containers to WIPP. The round trip time duration of casks and trailers for an uninterrupted disposal operation is estimated to be four weeks, requiring 8 casks to be in operation throughout the duration. The standby of 4 empty casks with trailers at INEEL awaiting loading and 4 at WIPP, unloaded or waiting to be unloaded, would allow two extra weeks to accommodate loading, unloading, cask maintenance, weather, trucking logistics, and other problems. The loading, and transport logic is presented as-follows:

- Load two casks/trailers (duration one-week).
- Transport two casks/trailers by commercial truck transport to WIPP (duration one-week).
- Unload two casks/trailers at WIPP and pickup two empty casks/trailers (duration one-week).
- Return two empty casks/trailers via commercial truck transport to the INEEL (duration one-week).

Table C.6.2-81. Construction and operations project data for the Packaging and Loading of Vitrified SBW at INTEC for Shipment to the Waste Isolation Pilot Plant (P90A).

Table C.6.2-82. Decontamination and decommissioning project data for the Packaging and Loading of Vitrified SBW for Shipment to the Waste Isolation Pilot Plant (P90A).

C.6.2.36 SBW and Newly Generated Liquid Waste Treatment with Cesium Ion Exchange of Contact-Handled Transuranic Grout and Low-Level Waste Grout (P111)

GENERAL PROJECT OBJECTIVE: The proposed project provides for design and construction of a new treatment facility for processing the existing sodium-bearing waste (SBW) by a means other than calcination and for processing Type I and Type II newly generated liquid waste at the INTEC. Type I and Type II are defined as follows:

- Type I liquid waste - Liquid radioactive waste generated at the New Waste Calcining Facility (NWCF) associated with NWCF operations and the decontamination of the NWCF.

- Type II liquid waste - Liquid radioactive waste not associated with the calciner operation or decontamination. This waste originates from other facilities at the INTEC, Test Reactor Area, and Test Area North. The quantity of Type II wastes are very small.

PROCESS DESCRIPTION: This project would produce a contact-handled transuranic grout, a small quantity of ion-exchange resin saturated with cesium isotopes removed from the SBW, and a low-level grout from the newly generated liquid waste. A small amount of transuranic waste in the form of undissolved solids would also be produced, but it would be blended with the contact-handled transuranic grout. For disposal, the contact-handled transuranic grout would be sent to the Waste Isolation Pilot Plant (WIPP), the low-level waste (LLW) grout would remain at INEEL, and the resin would be sent with the high-level waste (HLW) calcine to Hanford for vitrification.

The treatment facility would begin processing activities in 2009. Until then, all newly generated liquid waste and the existing SBW would be stored in the existing Tank Farm. From 2009 through 2012, SBW and newly generated liquid waste would be processed together until the SBW processing is completed. Newly-generated liquid waste would then be processed through 2025, the time when operations would be completed. The quantity of Type II wastes would be very small and this project assumes there is no separation of Type II waste from the SBW and Type I waste. From 2013 through 2019, the generation of Type I waste would rapidly decrease and the Type II waste would increase from about 3% of the newly generated liquid waste in 2013 to about 60% in 2015. The generation of Type I and II after 2014 would be constant at approximately 2,000 gallons per year. Because of this significant change in operation demands, the operating schedule has been divided into Primary Operations dates, which are from 2011 through 2015, and Reduced Operations dates from 2016 through 2025.

The treatment of the wastes includes the following basic steps:

- remove cesium from the existing SBW liquid
- evaporate the remaining liquid to a specified solids concentration
- neutralize the waste by the addition of calcium oxide
- mix the waste with portland cement, blast furnace slag, and flyash to produce a grouted waste form
- place the grouted waste into 55-gal waste drums

The grouted waste in the 55-gal waste drums, from 2009 through 2012, would be contact-handled transuranic waste which would be ready for shipment to WIPP. The major waste form between 2013 and 2025 would be LLW, due to the reduction in the Type I to Type II ratio. This LLW would also be mixed into a grouted form which would be ready for disposal in a LLW landfill.

FACILITY DESCRIPTION: The new facility would be located to the west of the Non-Separations facilities near the northeast corner of the INTEC. This 2-story building would be above grade with the exception of below grade canyon areas for process lines. The areas of the building requiring the most radiological shielding (5 feet thick concrete walls) would be the ion exchange rooms and the packaging and loading high bay which are centrally located. Except for the rooms where raw grouting and neutralization materials are handled, all processing rooms would be considered radiation areas with operations being performed remotely. The SBW and newly generated liquid waste would be brought to the facility through a new underground pumping/piping system which would interface with the treatment facility in the underground canyon vault and connects to the existing Tank Farm.

Treatment process components and systems housed in the facility include:

- A system to retrieve the liquid waste and transfer it to the treatment facility
- Storage tank sized for 24-hour operations
- A system to adjust the pH of SBW feed to increase Cs removal
- Ion exchange columns filled with a crystalline silicotitanate sorbant to remove Cs from the filtered waste
- A tank to provide holding capacity for ion exchange effluent

- An evaporator to concentrate and partially crystallize the ion exchange effluent
- A tank which serves both as a neutralization tank for the concentrated waste and a feed tank for the grouting process
- A system to add CaO to the concentrated waste to neutralize it
- Storage bins for grout additives
- A grout mixing tank
- A system to clean the grout mixing tank
- A system to load grouted waste into 55-gal drums
- Assay equipment to determine radionuclide concentrations in the drums of grouted waste
- A system to back-flush, drain, and dry spent sorbant columns
- A heater, filters, and blower to superheat, remove particulate, and exhaust noncondensible gases from the process.

The packaging and loading area would be a shielded high bay to accommodate the remote handling of the spent sorbant containers. The principle product would be contact-handled transuranic waste drums which can be loaded into a container in either the shielded high bay or in the unshielded truck loading bay. Radioactively hot and cold areas are provided for use in the various radioactive and non-radioactive maintenance activities required in a facility of this nature.

Table C.6.2-83. Construction and operations project data for the SBW and Newly Generated Liquid Waste Treatment with Cesium Ion Exchange to Contact-Handled Transuranic Grout and Low-Level Waste Grout (P111).

Table C.6.2-84. Decontamination and decommissioning project data for the SBW and Newly Generated Liquid Waste Treatment with Cesium Ion Exchange to Contact-Handled Transuranic Grout and Low-Level Waste Grout (P111).

C.6.2.37 Packaging and Loading Contact-Handled Transuranic Waste for Shipment to the Waste Isolation Pilot Plant (P112A)

GENERAL PROJECT OBJECTIVES: The proposed project encompasses the handling and loading of transport casks with contact handled 55 gallon drums containing transuranic waste before immediate transport to the Waste Isolation Pilot Plant (WIPP) for disposal. Truck transport is assumed with transport casks modeled after an existing spent fuel transport cask. The handling and loading of casks and drums would occur in the Sodium-Bearing Waste (SBW)/Newly Generated Liquid Waste Facility. No interim storage would be provided. The drums would be of standard 55 U.S. Gallon configuration ready for shipment; therefore, there would be no waste packaging issues relative to this project. Handling and loading of casks would occur over a four-year period but would not start before WIPP was opened to accept Transuranic (TRU) waste.

Loaded cask transport from the INEEL to WIPP, subsequent handling at WIPP, and empty cask return to the INEEL are not part of this project.

PROCESS DESCRIPTION: Approximately 37,500 TRU drums would be produced over a four-year timeframe and shipped directly to WIPP for disposal. About 20 drums would be produced in the facility and loaded into casks per day. No interim storage would be provided.

Each drum would contain about 0.2 cubic meters of powdered or granulated transuranic waste and would satisfy NRC fissile-gram equivalent requirements. All drums would be contact handled due to calculated gamma radiation levels of-less-than 200 mR/hr at contact. The calculated maximum thermal output per drum would be 0.4 Watts. All drums would be clean and without outer surface contamination prior to cask loading. The estimated maximum weight of each drum would be 777 pounds. Nine drums and five empty drums (49 pounds/drum) would be required to fill a TRUPACT-II cask (14 drums total) and achieve a total payload weight of about 7,238 pounds. The weight of all drums is less than the maximum cask payload allowable of 7,265 pounds.

All shipments to WIPP would require the use of a Type-B shipping package (cask) per the requirements of the U.S. Nuclear Regulatory Commission 10 CFR 71 and Department of Transportation Hazardous Materials Regulations. Only those packagings that have been approved by the U.S. Nuclear Regulatory Commission as meeting the applicable NRC requirements of 10 CFR 71 are suitable for these transports.

The shipping cask identified for contact handled WIPP drum transport is the TRUPACT-II; a commercial cask designed for transuranic contact-handled waste. Three casks would be carried on a trailer for truck transport to WIPP. Each shipping cask would transport a transuranic drum to WIPP; however, the contents would have to be listed within the transuranic content transport codes for the TRUPACT-II prior to any shipment. No cask shipment may exceed a 325 fissile-gram-equivalent of plutonium-239.

Each shipping cask would include the internal “payload pallet” required for the linear and radial positioning and support of the drums. Three casks would be carried on one dedicated trailer. Three casks with payload pallets plus a trailer would be purchased as a unit; however, the casks and trailer of each unit must be interchangeable with other units. The estimated weight of each loaded shipping cask would be about 9.61 tons: approximately 5.99 tons for the cask and 3.62 tons for the payload.

The 20 drums per day or 140 drums per week would be loaded for immediate transport to WIPP. Since 27 TRU drums and 15 empty drums are required to fill three casks for one trailer load, there would be about 5.2 trailer loads per week transported to WIPP. For cask/trailer quantity determination, and simplicity, six trailer loads (18 casks) would be used per week for this project. It is assumed that 18 personnel would be dedicated to cask loading.

An estimated 108 casks with payload pallets and 36 trailers (including standby units) would be required to continuously transport the drums to WIPP. The round trip time duration of casks and trailers for an uninterrupted disposal operation is estimated to be four weeks, requiring 24 casks and eight trailers to be in operation throughout the duration. The standby of 18 empty casks with six trailers at INEEL, awaiting loading, and 18 casks with six trailers at WIPP, unloaded or waiting to be unloaded, would allow one extra week to accommodate loading, unloading, cask maintenance, weather, trucking logistics, and other problems. Considering 200 operations work-days per year (about 28.5 weeks), a 24-hour-a-day seven-day workweek operation, and six trailers with 18 loaded casks shipped every week, then approximately 171 truck carrier round trips from the INEEL to WIPP and back could be made per year. The loading, and transport logic is presented as-follows:

- Load 18 casks/six trailers (duration one-week).
- Transport 18 casks/six trailers by commercial truck transport to WIPP (duration one-week).
- Unload 18 casks/six trailers at WIPP and pickup 18 casks/six trailers (duration one-week).
- Return 18 casks/six trailers via commercial truck transport to the INEEL (duration one-week).

Table C.6.2-85. Construction and operations project data for the Packaging and Loading Contact-Handled Transuranic Waste for Shipment to the Waste Isolation Pilot Plant (P112A).

Table C.6.2-86. Decontamination and decommissioning project data for the Packaging and Loading Contact-Handled Transuranic Waste for Shipment to the Waste Isolation Pilot Plant (P112A).

C.6.2.38 Calcine Packaging and Loading to Hanford (P117A)

GENERAL PROJECT OBJECTIVES: This project provides for the facility supporting the Minimum INEEL Processing Alternative, the Waste Packaging Facility (WPF). The Waste Packaging Facility would package unprocessed calcined solids and spent cesium-saturated resin into the 15-foot long "Hanford" canisters for shipment by dedicated rail to the Hanford Site for further processing.

PROCESS DESCRIPTION: The Waste Packaging Facility would start packaging calcine in 2012 and would complete the removal in 2025. Calcine would be retrieved from the storage bins on an as needed basis and collected in a dispensing vessel in the WPF. Calcine would be metered from the vessel into re-useable canisters. The calcine processing campaign is expected to take about 14 years. Intermittently, small amounts of spent, cesium-contaminated resin from the cesium extraction process in the SBW/Newly Generated Liquid Waste Facility would be transported to the dispensing vessels in the Waste Packaging Facility for loading into containers. The spent resin would be held in the Newly Generated Liquid Waste Facility until enough is available to fill a Hanford canister. Any decontamination solution or other liquid wastes generated in the Waste Packaging Facility would be collected in the process liquid hold tank would be sent to the SBW/ Newly Generated Liquid Waste Facility for treatment.

FACILITY DESCRIPTION: The Waste Packaging Facility would be designed to house the equipment and systems for packaging calcine and spent cesium contaminated resin into re-usable containers and for loading those containers into casks that are part of railcars used for transportation to the Hanford Site.

The Waste Packaging Facility process area would be a large cell housing the process equipment (i.e., the cyclone separators, dispensing vessel, sintered metal filters, pumps). Four cells would be arranged along the north wall of the basement area: a remote filter cell, a filter leaching cell, a decontamination cell, and a filter packaging cell. A cell housing the calcine transport air blowers and aftercoolers would be located along the west wall of the basement. The main operating floor and canister loadout area would be at grade level.

Table C.6.2-87. Construction and operations project data for Calcine Packaging and Loading to Hanford (P117A).

Table C.6.2-88. Decontamination and decommissioning project data for Calcine Packaging and Loading to Hanford (P117A).

C.6.2.39 Calcine Packaging and Loading to Hanford Just-in-Time (P117B)

GENERAL PROJECT OBJECTIVES: This project provides for the Waste Packaging Facility operating on a just-in-time schedule with the Hanford vitrification campaign under the Minimum INEEL Processing Alternative. The Waste Packaging Facility would package unprocessed calcined solids and spent cesium-saturated resin into canisters that are proposed for Hanford high level waste disposal and would prepare them for shipment by dedicated rail to the Hanford Site for further processing.

PROCESS DESCRIPTION: The Waste Packaging Facility would start packaging calcine in February 2028 and would complete the removal in March 2030. This just-in-time schedule would support the Hanford vitrification campaign schedule. In order to meet this schedule three identical processing lines and load-out bays would be required in the Waste Packaging Facility. Calcine would be retrieved from the INTEC bins on an as needed basis and collected in a dispensing vessel in the Waste Packaging Facility. Calcine would be metered from the vessel into the Hanford canisters. Intermittently, small amounts of spent, cesium-contaminated resin from the cesium extraction process in the SBW/Newly Generated Liquid Waste Facility would be transported to one of the Waste Packaging Facility dispensing vessels and metered into Hanford canisters. The spent resin would be generated starting in 2009 but would be held in the SBW/Newly Generated Liquid Waste Facility until enough is available to fill four canisters or one shipping cask's worth. All decontamination solution and other contaminated liquid wastes generated in the Waste Packaging Facility would be collected in the Waste Packaging Facility process liquid hold tank and sent to the SBW/Newly Generated Liquid Waste Facility for treatment.

This project includes the facilities and equipment for receiving and packaging the calcine and spent resin. Additionally, it includes the costs for the containers, casks, and railcars needed for shipment. It does not include the costs of the calcine retrieval system external to the Waste Packaging Facility, the rail spur, shipping to and unloading at Hanford, or the return of the railcar/cask assemblies to the INEEL.

FACILITY DESCRIPTION: The Waste Packaging Facility would be designed to house the equipment and systems for packaging calcine and spent cesium contaminated resin into re-usable containers and for loading those containers into casks that are part of railcars used for transportation to the Hanford Site.

The Waste Packaging Facility would consist of an upper and lower level and would house an empty canister storage area for eighty-eight canisters, an open area for the three canister loading ports leading to the below grade fill cells, and three separate but identical shielded calcine receiving/dispensing and filled canister transport cells. A separate room attached to the eastside of the upper level structure would contain the HEPA filters. Connected to the northwest side would be an open area with access to the remote HEPA filter train cells below. The administration area which would include the process control room and the electrical and mechanical areas would be located off the northwest corner of the upper level structure.

The lower level would consist of two sections. Located along the west wall would be the calcine transport air blower cell housing the calcine transport air blowers, water-cooled aftercoolers and balancing blowers. Four cells would be aligned along the north wall of this area; a remote HEPA filter train cell, a filter leach cell, a decontamination cell, and a filter packaging. Three separate fill cells with airlocks on either end for empty canister insertion and filled canister removal would occupy the rest of the area. The three cask/railcar assembly load-out bays would be located on the lower level.

Table C.6.2-89. Construction and operations project data for Calcine Packaging and Loading to Hanford Just-in-Time (P117B).

Table C.6.2-90. Decontamination and decommissioning project data for Calcine Packaging and Loading to Hanford Just-in-Time (P117B).

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C.6.2.40 Separations Organic Incinerator (P118)

GENERAL PROJECT OBJECTIVES: The project addresses the treatment of spent organic solvents that would be used in conjunction with the transuranic extraction, strontium extraction, and ion-exchange separation processes. The Separations Organic Incinerator would operate in support of the INTEC Waste Separations Facility or Transuranic Separations Facility.

The design and requirements of the Separations Organic Incinerator have not been finalized. It is assumed that the incinerator would control emissions without the addition of additional offgas control systems for NO_x, mercury, and dioxin.

PROCESS DESCRIPTION: The primary separation processes would be ion exchange and liquid-liquid extraction. Cesium would be removed by an ion exchange process. Actinides would be removed through the transuranic extraction liquid-liquid extraction process. Finally, strontium would be removed from the stream using the strontium extraction liquid-liquid process. Although each of these processes would recycle extraction solvents, they would become spent at some point in the process. At that time, solvent disposal is necessary. This project assumes that the solvents would be incinerated in the Separations Organic Incinerator.

FACILITY DESCRIPTION: The Separations Organic Incinerator would be made up of three sections, a combustion chamber, quench chamber, and an ash collection sump. The incinerator would be designed for four nine-day incineration campaigns per year. The normal feed rate would be 147 pounds per hour.

The feed would consist of a composition of the following:

- Two thousand gallons per year of transuranic separations spent solvent.
- Two thousand gallons per year of strontium extraction spent solvent.
- Fourteen thousand gallons per year of dodecane spent solvent.

Table C.6.2-91. Construction and operations project data for the Separations Organic Incinerator (P118).

Table C.6.2-92. Decontamination and decommissioning project data for the Separations Organic Incinerator (P118).

C.6.2.41 Waste Treatment Pilot Plant (P133)

GENERAL PROJECT OBJECTIVES: The proposed project would provide a pilot plant that would be used for process and equipment development testing. The facility would have both radioactive and non-radioactive testing areas for laboratory, bench, component, and integrated pilot scale tests. These tests would be required to study and identify the design parameters for the Waste Treatment Facility equipment and process. The Waste Treatment Facility would treat the high level radioactive waste at INTEC.

PROCESS DESCRIPTION: Waste Treatment Pilot Plant testing would include both radiologically hot and cold tests. Hot testing would be done at roughly 1/50 scale relative to the corresponding full-scale operations and would be expected to include the following:

- Bench scale testing of calcine dissolution processes.
- Bench scale integrated testing of the liquid-liquid separations process to extract fission products and actinides from dissolved radioactive calcines.
- Bench scale testing of ion-exchange extraction of cesium-137 from dissolved calcine
- Testing of filtration systems to separate undissolved solids from dissolved calcines
- Bench scale denitration and vitrification of high activity aqueous raffinates from separations
- Sample preparation and chemical/physical analysis of hot glass samples
- Sample preparation and chemical/physical analysis of glass frit/waste mixtures prior to vitrification

The sizes of the hot cells were selected by consideration of (a) the size of the hot cell currently being used for 1/50 scale testing of radioactive separations in the Radiological Analytical Laboratory at INTEC, (b) the size of the hot cell being used at Hanford for subscale vitrification testing, and (c) the size of analytical hot cells being used at the Savannah River Site to support the Defense Waste Processing Facility.

In addition to hot process testing described above, hot analytical cells would be included in the facility to allow wet chemistry, remoted analytical determinations (e.g., scanning electron microscopy, X-ray diffraction measurements, and inductively-coupled plasma/mass spectroscopy), and dilution and preparation of hot samples for glove box analytical procedures. The facility would also include ample glove box space to complement the hot analytical cells.

Cold pilot scale testing in the facility is expected to encompass the following:

- Integrated pilot scale testing of liquid-liquid separations of fission product and actinide simulants from cold calcines
- Scaleup testing of glass melters (hot melter testing is expected to be done at crucible scale, only)
- Integrated vitrification system pilot scale demonstration, including pretreatment of vitrification feeds from separations (i.e., evaporation and denitration) and offgas treatment
- Treating of offgas treatment systems for denitration, vitrification, and dissolution systems, including thermal quench, acid and/or caustic scrubbing, NOx reduction, mercury extraction, and HEPA filtration
- Production of cold calcine simulants for all calcine stored at INTEC
- Synthesis of cold simulants for high activity liquid wastes from separations for vitrification system development testing
- Cold pilot scale testing of calcine dissolution and undissolved solids filtration systems
- Cold testing of undissolved slurry handling/transport systems
- Mockup of full scale process equipment

Non-radioactive laboratory scale tests would also be performed to complement pilot scale testing. Laboratory testing would be done in the following areas:

- Materials testing/evaluation of coupons from pilot testing
- Stability (precipitation) testing of stored, concentrated waste solutions from separations
- Treatability tests for secondary waste streams (e.g., mercury)
- Laboratory tests to optimize extraction solvent compositions for separations
- Cold analytical procedures supporting pilot plant testing (e.g., leach testing of glass made from high activity separations effluent and of grouted waste from low activity separations effluent, sample analysis from offgas system testing, etc.)

Equipment that would be utilized in hot process cells would likely include subscale centrifugal liquid-liquid contactors, ion-exchange columns, calcine dissolution vessels (breakers/flasks), crucible furnaces, sintered metal filters, small-scale denitration equipment (kilns, fluidized beds), and equipment for sizing and dissolution of glass samples. Standard analytical equipment such as stirrers, crucible ovens, titrators, etc. would also be used.

Cold pilot facilities would include pilot scale centrifugal liquid-liquid contactors and ion-exchange columns, heated calcine dissolution tanks with mixing, subscale glass melters, sub- and full-scale sintered filters, and subscale rotary kilns and/or fluidized bed calciners. The 15-cm pilot plant for the INTEC New Waste Calcining Facility would be moved from CPP-637 to the Waste Treatment Pilot Plant to provide cold calcine simulants for used in pilot scale development/demonstration work. Tankage equipment would be used for makeup and storage of feedstocks for pilot scale processes, and full-scale process equipment mockups would be used for training, evaluation, and development of operating/maintenance procedures. Coring equipment for sampling and testing of grouted low activity waste would be used, and typical laboratory equipment would be installed and used in the cold laboratory space. Analytical equipment such as scanning/transmission electron microscope, optical microscopes, microprobes, X-ray diffractometers, viscometers, mass spectrometers, balances, gas analysis and particulate sizing equipment might also be used. All cold laboratories would include hood space with suitable air filtering/conditioning systems.

Cold pilot plant for separations and vitrification, and analytical hot cells would continue operation beyond full-scale startup to support waste processing operations in the Waste Treatment Facility.

FACILITY DESCRIPTION: The Waste Treatment Pilot Plant would be located in the northeast corner of INTEC, north of Palm Avenue and Hemlock Street. The ground floor footprint of the building would be approximately 34,500 feet^2. The main areas of the facility would consist of hot cells, crane bay, cold pilot plant, receiving and storage, and general support areas with office space and laboratories. Two floors above ground level would provide low-cost space for laboratories (8,800 feet^2) and mechanical/electrical equipment (5,000 feet^2). The crane bay (with 20-ton bridge crane) and crane maintenance areas (5,000 feet^2) above the hot cells would be arranged to provide removal of concrete hatchways allowing access to the hot cells below, and allowing maintenance and decontamination of large items exposed to the hot cell environments. The total floor space in the facility is anticipated to be not less than 58,000 feet^2.

Two types of hot cells (analytical cells and process cells) would be arranged in two parallel rows. The rows would be separated by a buffer area (with a 30-ton and 5-ton crane) and a decontamination cell. Each row of hot cells would have a manipulator running the entire length and eleven shield windows for viewing inside the cells (twenty-two shield windows in all). Twenty of the windows would each be equipped with a pair of manipulators, and the remaining two windows are to be used for operating the manipulators.

The facility would be all above grade with a minimum overall height of 58 feet plus the stack and would be divided into different building classifications by code to reduce construction costs. Construction types that would be employed would include shielded concrete, pre-cast concrete, pre-engineered metal building fabrications, and combinations thereof for cost containment.

Table C.6.2-93. Construction and operations project data for the Waste Treatment Pilot Plant (P133).

Table C.6.2-94. Decontamination and decommissioning project data for the Waste Treatment Pilot Plant (P133).

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Facility Disposition Projects

C.6.2.42 <u>Bin Set 1 Performance-Based Closure (P1F)</u>

GENERAL PROJECT OBJECTIVES: The proposed project defines and describes the activities that would be required for performance-based closure of the bin set 1 following the transfer of calcine from bin set 1 to bin set 7 (P1E). This includes the regulatory, compliance, and design requirements, cost estimates, and estimated schedules. Bin set 1 would then be filled with clean grout for stabilization purposes.

PHYSICAL DESCRIPTION: Bin set 1 consists of four sets of three concentric, stainless steel bins for a total of 12 bins. The storage capacity for bin set 1 is approximately 7,844 cubic feet. All of the bins are enclosed in a square concrete vault to provide secondary containment for the calcine. The vault for bin set 1 is buried 54.83 feet in the ground. The bins in bin set 1 are not anchored to the vault.

CLOSURE PROCESS DESCRIPTION

Performance-Based Closure of the Calcined Solids Storage Facilities would be expected upon completion of the following activities:

1. Filling the vault void to provide added structural rigidity to the bins and minimize the chance of subsidence within the Calcined Solids Storage Facilities over time. (Subsidence minimization is not a regulatory requirement but would be done as a best management practice.)

2. Decontaminating the interior surfaces of the piping, bins, vault (if necessary), and ancillary equipment.

3. Removing the residual calcine from the bins.

4. Sampling the calcine material in bin set 1.

5. Performing a risk analysis of the remaining bin contaminants.

6. Verifying that the risk to public health from the remaining bin residual contaminants, when combined with all other health risk sources at INTEC, is consistent with the cumulative risk assessment limits.

7. Filling the remaining bin voids with clean gout to solidify the remaining contaminants.

Performance-based closure would involve the use of robotics (snake-like crawler robots, tractor/vacuum robots, and light duty utility arms), existing retrieval equipment, and carbon dioxide blasting to clean the bottoms of the bins, as well as the ledges and pipe supports. Robots would be used due to the high radiation fields expected in the bins, as they could be deployed and operated remotely through the use of controllers and camera systems. Carbon dioxide blasting would be used for decontamination purposes because it is more effective than other decontamination methods, it minimizes the generation of secondary waste, and it would not adversely affect the bin surfaces.

Table C.6.2-95. Decontamination and decommissioning project data for the Performance-Based Clean Closure with Subsequent Clean Fill of Bin Set 1 in the Calcined Solids Storage Facility (P1F).

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C.6.2.43 Performance-Based Closure with Subsequent Clean Fill of the Tank Farm Facility (P3B)

GENERAL PROJECT OBJECTIVE: The general objective of this project is to provide for the Resource Conservation and Recovery Act (RCRA) performance-based closure of the 11 stainless steel tanks contained within the Tank Farm Facility. The Tank Farm Facility currently stores High-Level Liquid Waste and sodium-bearing liquid waste. Closure activities would begin once usage of a tank or tanks ceases. Each tank and vault would be filled with clean grout as part of the closure process. Existing operations would remove the liquid waste (except for the heel) from the Tank Farm Facility.

PROCESS DESCRIPTION: Each individual tank system would be isolated from the rest of the Tank Farm by cutting, grouting (as applicable), and capping the ancillary piping. Tank and vault wall contamination residue would be washed into the heel using water or decon solution. The residual heel material in the tanks and vaults would then be stabilized. The stabilization process would include washing, flushing, pumping, pH adjustment, heel displacement, and free liquid elimination.

A material sampling and risk analysis of the remaining tank heel and vault contaminants would be performed. The analysis would have to verify that the risk to public health from the remaining Tank Farm residual heels meets the Closure Plan performance criteria and the total Tank Farm Facility closure risk, when combined with all other health risk sources at the INTEC, would be consistent with the cumulative risk assessment limits for the INTEC.

The vault void (the space between the tanks and the surrounding concrete structure) would be filled with clean grout. The tank and vault voids would be filled with clean grout to provide added structural rigidity to the tanks and minimize the chance of subsidence over time.

The closure method presented in the study would involve using heel characterization equipment, liquid removal, tank and vault washing systems, and grout placement systems to close each tank.

FACILITY DESCRIPTION: The Tank Farm Facility is used to temporarily store mixed waste until the waste is converted into a solid form at the New Waste Calcining Facility. The Tank Farm Facility consists of mixed waste underground storage tanks, tank vaults, interconnecting waste transfer lines, valve boxes, valves, airlift pit, cooling equipment, and several small buildings containing instrumentation and valving for the waste tanks. The closure study focuses on closing the nine 300,000-gallon (1,135,624-liter) and two 318,000-gallon (1,203,761-liter) stainless steel storage tanks (WM-182 through WM-190, and WM-180 plus WM-181, respectively) and associated Tank Farm Facility item. All 11 storage tanks are cylindrical in shape with a dome on top and a flat bottom. Each tank is contained in an underground, unlined concrete vault.

Liquid waste enters the tanks via a process waste feed line. Waste is removed using a steam-jet system that uses steam to lift the waste out of the tank. The waste can be directed to a specific tank via various approved valving arrangements. The waste can be placed or removed from any tank and placed into another tank or processing facility depending on the valve configuration and the desired end location.

Table C.6.2-96. Decontamination and decommissioning project data for Closure of the Tank Farm – Performance-Based Clean Closure with Clean Fill (P3B).

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C.6.2.44 Tank Farm Closure to RCRA Landfill Standards (P3C)

GENERAL PROJECT OBJECTIVES: The proposed project defines and describes the activities that would be required to close eleven 300,000-gallon tanks contained within the Tank Farm to landfill standards. This would include the major regulatory, compliance, and design requirements, cost estimates, and estimated schedules. Closure to landfill standards activities would begin once cease use of a Tank Farm tank or tanks occur. Each Tank Farm tank and vault void would be filled with clean grout as part of the closure process. Filling both tank and vault voids would prevent future ground subsidences from occurring within the Tank Farm.

PHYSICAL DESCRIPTION: The Tank Farm is used to store mixed waste until the waste is converted into a solid form at the New Waste Calcining Facility. The Tank Farm consists of mixed waste underground storage tanks, tank vaults, interconnecting waste transfer lines, valve boxes, valves, airlift pit, cooling equipment, and several small buildings containing instrumentation and valving for the waste tanks. The closure would focus on closing the nine 300,000-gallon (1,135,624-liter) and two 318,000-gallon (1,203,761-liter) stainless steel storage tanks (WM-182 through WM-190 and WM-180 plus WM-181, respectively) and associated Tank Farm items. All 11 storage tanks are cylindrical in shape with a dome on top and a flat bottom. Each tank is contained in an underground, unlined concrete vault.

Liquid waste enters the tanks via a process waste feed line. Waste is removed using a steam-jet system that uses steam to lift the waste out of the tank. The waste can be directed to a specific tank via various approved valving arrangements. The waste can be removed from any tank and placed into another tank or processing facility depending on the valve configuration and the desired end location.

CLOSURE PROCESS DESCRIPTION: Closure to landfill standards/clean fill of the Tank Farm would be expected upon completion of the following activities:

1. Leaving the tanks, vaults, and piping in place. This would include isolating each individual tank system from the rest of the Tank Farm by cutting, grouting (as applicable), and capping the ancillary piping.

2. Washing the bulk of the tank wall contamination residue into the heel using water (once only).

3. Stabilizing the residual heel material in the tank bottoms. (Heel stabilization would include washing, flushing, pumping, pH adjustment, heel displacement, and free liquid elimination.)

4. Filling the tank and vault voids with clean grout. (Excavation would be required to create additional access risers into each vault. The excavated soils would be used to back fill against the risers. The soil displaced by the access riser (approximately 0.25 m^3 per riser) would be sent to a CERCLA soils repository.)

The closure to landfill standards method would involve using heel characterization equipment, liquid removal and agitation pumps, tank washing systems, and wet and dry grout placement systems to close each tank.

It is assumed that the closure to landfill standards cleaning efforts would be directed at removing as much residual waste from the tanks as possible without going to the level of cleanliness required by performance-based clean closure. To accomplish this, the cleaning effort would be directed at washing the tank wall once then removing as much waste residue as possible during the pH adjustment portion of heel stabilization.

Table C.6.2-97. Decontamination and decommissioning project data for Tank Farm Closure to RCRA Landfill Standards (P3C).

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C.6.2.45 Performance-Based Closure with Class A Grout Placement in Tank Farm Facility and Calcined Solids Storage Facility (P26)

GENERAL PROJECT OBJECTIVE: The general objective of this project is to provide for the Resource Conservation Recovery Act (RCRA) performance-based closure of the Tank Farm Facility and the Calcined Solids Storage Facility (CSSF) and subsequent disposal of Class A Low-Level Waste grout in these facilities. The Tank Farm Facility currently stores High-Level Liquid Waste and sodium-bearing liquid waste (SBW). The Calcined Solids Storage Facility stores High-Level Waste calcined solids resulting from the calcination of liquid waste. Other projects would remove the liquid waste or calcine (except for the heel) from these facilities.

PROCESS DESCRIPTIONS: During the performance-based closure phase, the facilities would be decontaminated to the maximum extent that is technically and economically practical. For the Tank Farm, the tanks and vaults would be washed and the resulting liquid pumped out to remove the majority of the heel waste residues. The remaining liquid heel would be solidified using clean grout. The ancillary piping, such as waste transfer lines, would be flushed and grouted with clean grout. Afterwards, the vaults would be completely filled with clean grout to prevent the intrusion of liquid and to act as a temporary cover or cap over the tank. When pouring is complete the 11 tanks and the sand under 9 of the 11 tanks would be encapsulated between the newly poured grout and the vault floor.

A similar closure approach is proposed for the CSSF. The interior surfaces of the CSSF bins, piping, and ancillary equipment would be decontaminated, again to the maximum extent that is technically and economically practical. It is assumed, for this project, that the bins will be sufficiently decontaminated such that performance criteria would be met. The vault void (the space between the bins and the surrounding concrete structure) would be filled with clean grout to provide added structural rigidity to the bins and minimize the chance of subsidence within the CSSF over time.

After the Tank Farm and the CSSF have been closed, they would be used as low-level waste disposal facilities. The tank and bin voids would be filled with Class A grout that would be produced at the Class A Grout Plant and delivered to the Tank Farm and CSSF in shielded piping.

FACILITY DESCRIPTIONS: The Tank Farm consists of underground storage tanks, tank vaults, interconnecting waste transfer lines, valve boxes, valves, airlift pits, cooling equipment, and several small buildings that contain instrumentation and valving for the waste tanks. The eleven stainless steel tanks are contained in underground, unlined concrete vaults and are used to store mixed liquid wastes. Liquid waste is transferred throughout the Tank Farm in underground, stainless steel lines. The liquid waste that remains after the tanks have been emptied as low as possible with the steam jets and airlifts is referred to as a “heel.” The heels are expected to range in volume from 5,000 to 15,000 gallons when cease use occurs. During HLW processing, grout would be pumped, at intervals, from the Class A Grout Plant to the Tank Farm in shielded lines.

The CSSF contains seven bin sets, with each bin set containing multiple bins used for calcine storage. Each set of bins is arranged inside a concrete structure called a vault. The bins themselves are large vertical cylinders constructed of stainless steel. The grout would be pumped to the CSSF using the same systems as in the Tank Farm.

Please see Project 26 under “Waste Processing Projects” for project data tables.

C.6.2.46 Performance-Based Closure and Class C Grout Disposal in Tank Farm & CSSF (P51)

GENERAL PROJECT OBJECTIVE: The Tank Farm Facility currently stores High-Level Liquid Waste and sodium-bearing liquid waste (SBW). The Calcined Solids Storage Facility (CSSF) stores HLW calcined solids resulting from the calcination of liquid waste. Other projects would remove the liquid waste or calcine (except for the heel) from these facilities. This project provides for the Resource Conservation Recovery Act (RCRA) performance-based closure of the Tank Farm and CSSF and subsequent disposal of Class C low-level waste grout in these facilities. RCRA would no longer regulate either facility once the performance criteria have been achieved. This allows other uses for the remaining void spaces.

This project assumes that the facilities would be decontaminated to the maximum extent that is technically and economically practical. It is further assumed that the residual levels of contamination would meet the performance requirements for Performance-Based Closure under RCRA. Meeting the performance criteria means:

1. The waste has been removed from the tank system, and

2. The contamination remaining in a tank or bin is within an acceptable risk level to the public or environment and is consistent with the remediation goals for the INTEC.

After the facilities are closed, it is proposed that they then be used as low-level waste disposal facilities to receive the grout generated by the separations process.

FACILITY DESCRIPTIONS: The Tank Farm consists of underground storage tanks, tank vaults, interconnecting waste transfer lines, valve boxes, valves, airlift pits, cooling equipment, and several small buildings that contain instrumentation and valving for the waste tanks. The eleven stainless steel 300,000 to 318,000-gallon tanks (hereafter referred to as 300,000-gallon tanks) are contained in underground, unlined concrete vaults. The tanks have a 50-foot diameter and an overall height of approximately 30 feet (includes the dome height). The vault floors are approximately 45 feet below grade level and are patterned after three basic designs: cast-in-place octagonal vaults, pillar-and-panel style octagonal vaults, or cast-in-place square 4-pack configuration. A thin sand layer was placed between the vault floor and tank on nine of the eleven tanks. To protect personnel from radiation, the concrete vault roofs are covered with approximately 10 feet of soil.

The 300,000-gallon tanks are used to store mixed liquid wastes. Eight of the eleven 300,000-gallon tanks contain stainless steel cooling coils, which are located on the tank walls and floors. These cooling coils were used, as required, to maintain the liquid waste below predetermined temperatures in order to minimize corrosion of the stainless steel tanks.

Liquid waste is transferred throughout the Tank Farm in underground, stainless steel lines. The stainless steel lines are housed in stainless steel-lined concrete troughs or double-walled stainless steel pipe. The waste is transferred using steam jets or airlifts. Generally, the intakes are located 4 to 12 inches above the tank floor, which limits the amount of liquid waste that can be removed from the tanks. The liquid waste that remains after the tanks have been emptied as low as possible with the steam jets and airlifts is referred to as a “heel.” The heels are expected to range in volume from 5,000 to 15,000 gallons when cease use occurs.

The systems used for closure will involve remotely operated equipment to wash down the tanks, remove the heel to the extent possible, solidify the remaining heel, and fill the vault with clean grout. During the processing of the HLW in the Class C Grout Plant, LLW grout will be pumped, at intervals, from the Class C Grout Plant to the Tank Farm in shielded lines.

The CSSF contains seven bin sets, with each bin set containing multiple bins used for calcine storage. Each set of bins is arranged inside a concrete structure called a vault. The bins themselves are large vertical cylinders constructed of stainless steel. Bin set 1, the first constructed, is much smaller than the other six. In bin set 1, the bins vary in diameter from 3 feet to 12 feet, and in length from 20 feet to 24 feet. The bins in the rest of the bin sets are 12 feet to 13.5 feet in diameter and from 40 feet to almost 70 feet in length. The bins (with the exception of those in Bin set 1) are equipped with retrieval risers or pipes that connect to the surface. These risers will be used during calcine retrieval operations. New risers will be installed on the bins contained in bin set 1 during the calcine retrieval activities. The vaults for bin sets 2 through 7 are hollow cylinders, with inside diameters of 40 feet to 60 feet, and a wall thickness of 2 to 4 feet. The vault for bin set 1 is a square design, with walls about 2.5 feet thick.

The systems used for closure of the bin sets will include remotely operated drilling and cutting equipment, remotely operated carbon dioxide pellet blasting systems, remotely operated robots for cleaning the interior surfaces of the bins, and equipment for filling the lines and vaults with clean grout.

The grout would be pumped to the CSSF using the same systems as in the Tank Farm.

PROCESS DESCRIPTION: The processes considered in this project are best described in two phases:

- Closure of the facilities as required for a RCRA interim status facility, and
- Subsequent use of the remaining tank and bin voids as a low-level landfill.

RCRA CLOSURE: During the closure phase, the facilities would be decontaminated to the maximum extent that is technically and economically practical. For the Tank Farm, the tanks and vaults would be washed and the resulting liquid pumped out to remove the majority of the heel waste residues. The remaining liquid heel would be solidified using clean grout. The ancillary piping, such as waste transfer lines, would be flushed and grouted with clean grout. Tank leak monitoring lances would then be installed in four equally spaced locations inside the vaults. Afterwards, the vaults would be completely filled with clean grout to prevent the intrusion of liquid and to act as a temporary cover or cap over the tank. When pouring is complete, the 11 tanks, and the sand under nine of the 11 tanks, would be encapsulated between the newly poured grout and the vault floor.

A similar closure approach is proposed for the CSSF. The interior surfaces of the CSSF bins, piping, and ancillary equipment would be decontaminated, again to the maximum extent that is technically and economically practical. It is proposed that decontamination be accomplished by blasting the contaminated surfaces with carbon dioxide pellets to minimize the generation of any secondary waste and maintain the structural integrity of the bins. This blasting process would dislodge the residual calcine remaining on the bin walls and floors. This dislodged calcine would then be removed from the bins using robots and the calcine removal equipment previously installed to remove the calcine.

It is assumed, for this project, that the bins would be sufficiently decontaminated such that performance criteria would be met. The vault void (the space between the bins and the surrounding concrete structure) would be filled with clean grout to provide added structural rigidity to the bins and minimize the chance of subsidence within the CSSF over time.

SUBSEQUENT USE: After the Tank Farm and the CSSF have been closed, they would be used as low-level waste landfills. The tank and bin voids would be filled with Class C grout that is produced at the Class C Grout Plant and delivered to the Tank Farm and CSSF in shielded piping.

Please see Project 51 tables under the “Waste Processing Projects” for project data information.

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C.6.2.47 <u>Performance-Based Clean Closure of the Calcined Solids Storage Facility (P59C)</u>

GENERAL PROJECT OBJECTIVE: The project defines and describes the activities required for performance-based closure of the Calcined Solids Storage Facility (CSSF) following the end of use of the bins within a given bin set. The bins comprising the bin set would then be filled with clean grout for stabilization purposes.

PHYSICAL DESCRIPTION: The Calcined Solids Storage Facility consists of seven bin sets, each bin set contains from three to twelve bins. A bin is a single, stainless steel, vertical vessel that holds, or will hold, processed calcine for long-term storage. Three different bin types have been installed in the Calcined Solids Storage Facility. Bin set 1, the pilot-scale bin set, contains four main bins, each main bin consisting of three individual, concentric shells. The storage capacity for bin set 1 is approximately 7,844 cubic feet. Bin sets 2-4 are comprised of cylindrical bins (total storage capacity of 17,895 to 40,686 cubic feet). Bins sets 5-8 are composed of annular bins resembling a donut (total storage capacity of 36,544 to 64,778 cubic feet).

All of the bins within a given bin set are enclosed in a concrete vault (cylindrical or square) to provide secondary containment for the calcine. The vaults have all been buried, the depth varying from one bin set to the next. The bins in bin sets 2-7 are anchored to the vault by means of a metal skirt welded to the bin bottom and bolted to the vault floor. The bins in bin set 1 are not anchored to the vault.

Calcine enters each bin set via a main feed line. This line then enters a distributor, which routes the calcine to the individual bins. The distributor piping does not contain any control valves, thus the flow of calcine cannot be directed into a specific bin within a bin set.

CLOSURE PROCESS DESCRIPTION: Performance-based closure/clean fill of the Calcined Solids Storage Facility would be expected upon completion of the following activities:

1. Filling the vault void to provide added structural rigidity to the bins and minimize the chance of subsidence within the Calcined Solids Storage Facility over time.

2. Decontaminating the interior surfaces of the Calcined Solids Storage Facility piping, bins, vaults (if necessary), and ancillary equipment.

3. Removing the residual calcine from the bins.

4. Performing a material sampling and risk analysis of the remaining bin contaminants.

5. Verifying that the risk to public from the remaining bin residual contaminants, when combined with all other health risk sources at the INTEC, is consistent with the cumulative risk assessment limits for the INTEC.

6. Filling the remaining bin voids with clean grout to solidify the remaining contaminants.

This method of closure would involve the use of robotics, existing retrieval equipment, and carbon dioxide blasting to clean the bottom of the bins, as well as the ledges and pipe supports. Robots would be used due to the high radiation fields expected in the bins, as they could be deployed and operated remotely through the use of controllers and camera systems.

Table C.6.2-98. Decontamination and decommissioning project data for the Performance-Based Clean Closure of the Calcined Solids Storage Facility (P59C).

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C.6.2.48 Closure to Landfill Standards with Subsequent Clean Fill of the Calcined Solids Storage Facility (P59D)

GENERAL PROJECT OBJECTIVES: The proposed project defines and describes the activities which would be required to close the Calcined Storage Facility (CSSF) to landfill standards when use of the bins within a given bin set ceases. This includes the major regulatory, compliance, and design requirements, cost estimates, and estimated schedules. The bins comprising the bin set would then be filled with clean grout for stabilization purposes.

PHYSICAL DESCRIPTION: The Calcined Solids Storage Facilities consist of seven bin sets, each bin set containing from three to twelve bins. A bin is a single, stainless steel, vertical vessel that holds, or would hold, processed calcine for long-term storage. Three different bin types have been installed in the CSSF. Bin set 1, the pilot-scale bin set, contains four main bins, each main bin consisting of three individual, concentric shells. The storage capacity for bin set 1 is approximately 7,844 cubic feet. Bin sets 2–4 are comprised of cylindrical bins (total storage capacity of 17,895 to 40,686 cubic feet). Bin sets 5–8 are composed of annular bins resembling a donut (total storage capacity of 36,544 to 64,778 cubic feet).

All of the bins within a given bin set are enclosed in a concrete vault (square cylindrical or) to provide secondary containment for the calcine. The vaults have all been buried, the depth varying from one bin set to the next. The bins in bin sets 2–7 are anchored to the vault by means of a metal skirt welded to the bin bottom and bolted to the vault floor. The bins in bin set 1 are not anchored to the vault.

Calcine enters each bin set via a main feed line. This line then enters a distributor, which routes the calcine to the individual bins. The distributor piping does not contain any control valves, thus the flow of calcine cannot be directed into a specific bin within a bin set. All bins within the bin set are filled at the same time.

CLOSURE PROCESS DESCRIPTION:

Closure to Landfill Standards with subsequent Clean Fill of the Calcined Solids Storage Facility would be expected upon completion of the following activities:

1. Leaving the bins, vaults, and piping in place. This would include isolating each individual bin system from the rest of the Calcined Solids Storage Facility by cutting, grouting (as applicable), and capping the ancillary piping.

2. Filling the vault void with grout to provide a cap. This temporary cap would minimize subsidence within the Calcined Solids Storage Facility. (Subsidence minimization is not a regulatory requirement, but would be done as a Best Management Practice.)

3. Managing the residual waste material in the bin bottoms. Residue management would include partial removal of the contaminants, decontamination, and residue solidification using clean grout.

4. Making provisions for a landfill monitoring system.

5. Filling the remaining bin voids with clean grout to solidify the remaining contaminants.

6. The method of closure would involve the use of robotics (tractor/vacuum robots), in conjunction with the existing retrieval equipment, to clean the floor of the bins after the vault void had been grouted. Robots would be used due to the high radiation fields expected in the bins, as they can be deployed and operated remotely through the use of controllers and camera systems.

7. The cleaning efforts during Closure to Landfill Standards would be directed at removing as much residual calcine from the bins as possible without going to the level of cleanliness required by Performance-Based Clean Closure. To accomplish this, the cleaning efforts would be directed at removing the calcine from the floors, as this is where the majority of the calcine would be expected. The ledges and interior surfaces of the walls would not be expected to be cleaned under this scenario, as they would be expected to have minimal contamination.

8. The bin voids would then be grouted with clean grout to solidify the remaining contaminants.

Table C.6.2-99. Decontamination and decommissioning project data for the Closure of the Calcined Solids Storage Facility to Landfill Standards with Subsequent Clean Fill (P59D).

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C.6.2.49 Clean Closure to Detection Limits of the Calcined Solids Storage Facility (P59F)

GENERAL PROJECT OBJECTIVES: The Calcined Solids Storage Facility (CSSF), or bin sets, stores high-level waste calcined solids resulting from the calcination of liquid waste. This project provides for the Resource Conservation Recovery Act (RCRA) clean closure of the Calcined Solids Storage Facility. This closure method removes the hazardous and radioactive wastes still contained inside each bin down to detection limits, demolishes the remaining concrete vault structures to grade level, and fills any remaining vault voids. Long-term monitoring would not be required since the facility would be clean closed and would no longer pose a threat to human health or the environment. Other projects would remove the liquid waste or calcine (except for the heel) from these facilities.

PROCESS DESCRIPTION: The project processes are best described in the following steps:

1. Cleaning the facility to the levels identified in EDF-PDS-B-002 (P51),

2. Remotely removing the vault roof,

3. Remotely removing each bin from the vault and transporting the bin to the debris treatment facility built as part of this project to handle each bin,

4. Remotely dismantling, decontaminating, and disposing of the bins, and

5. Demolishing the remaining reinforced concrete vaults to grade level and filling each vault with clean fill.

The Calcined Solids Storage Facility would be closed to clean standards once the above steps were completed. No additional regulatory oversight would be required for the closed area. Final stages of the process would include construction of a new low-level waste storage landfill as well as dismantling and removal of the new debris treatment facility.

FACILITY DESCRIPTION:

The Calcined Solids Storage Facility contains seven bin sets, with each bin set containing multiple bins used for calcine storage. Each set of bins is arranged inside a concrete structure called a vault. The bins themselves are large vertical cylinders constructed of stainless steel. Bin set 1, the first constructed, is much smaller than the other six. The bins (with the exception of those in bin set 1) are equipped with retrieval risers or pipes that connect to the surface. These risers would be used during calcine retrieval operations. New risers would be installed on the bins contained in bin set 1 during the calcine retrieval activities. The vaults for bin sets 2 through 7 are hollow cylinders, with inside diameters of 40 feet to 60 feet, and a wall thickness of 2 feet to 4 feet. The vault for bin set 1 is a square design, with walls about 2.5 feet thick.

The systems used for clean closure of each bin set would include:

1. Remotely operated drilling and cutting equipment,

2. Remotely operated carbon dioxide pellet blasting systems,

3. Remotely operated robots for cleaning the interior surfaces of the bins,

4. Remotely operated equipment for removing the vault roof and disconnecting each bin from the other bins contained in the vault, and

5. Equipment for removal and transport of bins to a new Debris Treatment facility (also referred to as the Bin Cutting facility).

Table C.6.2-100. Decontamination and decommissioning project data for the Clean Closure to Detection Limits of the Calcined Solids Storage Facility (P59F).

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C.6.2.50 <u>Total Removal Clean Closure of the Tank Farm Facility (P59G)</u>

GENERAL PROJECT OBJECTIVE: The proposed project defines and describes the activities required for the total removal clean close of the eleven 300,000-gallon tanks contained within the Tank Farm Facility. This includes the major regulatory, compliance, and design requirements, cost estimates, and estimated schedules. Clean closure activities would begin once cease use of a Tank Farm tank or tanks occurs. Total removal of the wastes, tanks, vaults, ancillary piping, and contaminated soils are part of the closure process.

PHYSICAL DESCRIPTION: The Tank Farm consists of mixed waste underground storage tanks, tank vaults, interconnecting waste transfer lines, valve boxes, valves, airlift pit, cooling equipment, and several small buildings containing instrumentation and valving for the waste tanks. The closure study focuses on closing the nine 300,000-gallon (1,135,624-liter) and two 318,000-gallon (1,203,761-liter) stainless steel storage tanks (WM-182 through WM-190 and WM-180 plus WM-181, respectively) and associated Tank Farm items. Each tank is contained in an underground, unlined concrete vault.

A Debris Cleaning Facility would be constructed for processing the removed equipment, tanks, and vaults. The facility will be used for cleaning and sizing debris. This facility would have extensive contamination controls to reduce air emissions: A vacuum system attached to the carbon dioxide blasting system. Both the vacuum system and cell ventilation system will have a cyclone, sintered metal filter, and two HEPA filters to remove airborne contamination.

A Low Level Waste Disposal site, which meets RCRA Subtitle D landfill requirements, would be built for the Tank Farm waste.

CLOSURE PROCESS DESCRIPTION: The Clean closure method requires the removal of all waste residues and the decontamination of equipment and structures to be left in place. The waste and equipment removed must be managed properly. This process provides for the complete removal of contaminated Tank Farm components including tanks, vaults, piping, and valve boxes. Following removal, these contaminated components are treated and disposed of in accordance with Land Disposal Restrictions.

Table C.6.2-101. Decontamination and decommissioning project data for the Total Removal Clean Closure of the Tank Farm Facility (P59G).

C.6.2.51 Closure to Landfill Standards of the Process Equipment Waste Condensate Lines (P154A, B)

GENERAL PROJECT OBJECTIVE: The proposed project defines and describes the activities required for the deactivation and demolition of the Process Equipment Waste Condensate Lines.

PHYSICAL DESCRIPTION: This project addresses two transfer lines:

- Process Equipment Waste and Cell Floor Drain Lines (154A)
- Process Equipment Waste Condensate Lines (P154B)

The transport lines are used to transport waste and condensate from the process facility to the treatment or storage facility.

Process Equipment Waste and Cell Floor Drain Lines (P154A):

The original lines between INTEC-601 and –604 were replaced about 1982 (at the same time the high-level liquid waste lines were replaced). The lines were capped and abandoned in place and may have several places where they were cut and capped. Each 3-inch diameter stainless steel pipeline was surrounded with a 6-inch diameter tile pipe which was encased in concrete. The lines are between 6 and 12 feet below ground. The total linear footage is approximately 700 feet. The capping effort would require 6 caps per line (18 capping points).

Two 3-inch diameter stainless steel pipelines replaced the original lines. The new lines are encased in 4-inch stainless steel pipe, which is buried directly in the ground (approximately 6 to 12 feet deep). The lines are approximately 300 feet long. The lines will be capped and abandoned in place. The capping effort would require 2 caps total for both lines.

Process Equipment Waste Condensate Lines (P154B):

Above ground: The new Process Equipment Waste Condensate Discharge Line runs from CPP-601 to CPP-605. This project considers the outdoors portion of the line. A portion of the line runs over CPP-649 and CPP-604. The line is approximately 300 feet in length and consists of a 2-inch pipe contained in a 4-inch insulated pipe. Seven support stanchions support the line. The landfill closure requires the line to be capped and abandoned in place. However, since the line is above ground, the line would be completely removed. There is 50 feet of this piping run that is underground. It must be capped on each end.

Below ground: The old Process Equipment Waste Condensate Discharge Line runs from CPP-601 to CPP-605. The line is approximately 1,200 feet in length and consists of a 2-inch to 3-inch diameter that was buried directly in the ground at a depth of between 6 to 12 feet. The performance-based closure requires the line to be flushed, capped, and abandoned in place. Since the line has been cut in a number of places over the years to make way for new facility piping, the line must be capped in 8 places.

Table C.6.2-102. Decontamination and decommissioning project data for the PEW and Cell Floor Lines (P154A).

Table C.6.2-103. Decontamination and decommissioning project data for the PEW Condensate Lines (P154B).

C.6.2.52 Tank Farm Complex Closure (P156B-F, G, L)

GENERAL PROJECT OBJECTIVES: The project included activities that would be associated with the deactivation and demolition of the Tank Farm Complex.

PROCESS DESCRIPTION: The complex is currently undergoing deactivation and is targeted for a "land-fill" closure, except for the Waste Holdup Pumphouse (CPP-641) which would be clean closed. The below ground levels of the complex would be demolished in place and covered with an earthen cap. The ridged asbestos siding and roofing would be removed and either placed in the below ground areas of the existing building prior to grouting or placed in a land-fill approved for asbestos disposal.

The Tank Farm Complex facilities scheduled for deactivation and demolition include:

Facility	Complete Deactivate	Complete D&D
CPP-619: Tank Farm Area-CPP (Waste Storage Control House) (P156B)	2015	2023
CPP-628: Tank Farm Area-CPP (Waste Storage Control House) (P156C)	2015	2023
CPP-634: Tank Farm Area (Waste Storage Pipe Manifold Building) (P156D)	2015	2023
CPP-638: Waste Station (WM-180) Tank Transfer Building (P156E)	2012	2015
CPP-641: Waste Holdup Pumphouse (P156L)	2012	2015
CPP-712: Instrument House (VES-WM-180, 181) (P156F)	2015	2023
CPP-717: STR Waste Storage Tanks (WM-103, 104, 105, 106) (P156G)	2015	2023

COMPLEX DESCRIPTION: The total multi-level building area of the complex is approximately 4,699 $feet^2$.

The Tank Farm Area-CPP (Waste Storage Control House) (CPP-619) houses the computer that receives data transmitted by radio frequency probes on the levels in the big tanks of the Tank Farm. The Waste Storage Control House is a one-story, 416 square-foot masonry-exterior building. The building is rated as a low-hazard facility.

The Tank Farm Area-CPP (Waste Storage Control House) (CPP-628) houses the pneumatic instrument readouts for the big tanks in the Tank Farm. The CPP-628 Tank Farm Area-CPP (Waste Storage Control House) is a one-story, 1,562 square-foot masonry-exterior building. It was built in 1953 as a Tank Farm control house. The building is rated as a high-hazard facility. High levels of radiation are present in the northeast corner around the jet. Low levels of hazardous chemical contamination exist due to a leaky chromate water system. Low quantities of asbestos exist in the piping insulation.

The Tank Farm Area (Waste Storage Pipe Manifold Building) (CPP-634) is one of the primary locations of the Tank Farm’s cooling system valves. The CPP-634 Tank Farm Area (Waste Storage Pipe Manifold Building) is a one-story, 231 square-foot masonry-exterior building. It was built in 1958 to house the valves for the water cooling system in the Tank Farm. The building is rated as a low-hazard facility. Low quantities of asbestos contamination are present in the piping insulation.

The Waste Station (WM-180) Tank Transfer Building (CPP-638) houses the valves and controls of the offgascondenser system. The CPP-638 Waste Station (WM-180) Tank Transfer Building is a one-story, 87 square-foot masonry-exterior building. The building is rated as a medium-hazard, medium-radiation facility. Medium quantities of asbestos are located in the transite and piping insulation.

The Waste Holdup Pumphouse (CPP-641) houses the monitoring systems for the WL-103, WL-104, WL-105 tanks. These tanks receive waste from laboratories in the INTEC-637 Process Improvement Low Bay, but the laboratories do not currently generate waste; therefore, the tanks are inactive. The CPP-641 Waste Holdup Pumphouse is a 442 square-foot, one-story, masonry-exterior building. The building is rated as a medium-hazard-facility, medium-radiation facility. Medium quantities of asbestos are located in the transite insulation.

The CPP-712 Instrument House (VES-WM-180, 181) is a 216 square-foot concrete block building. It is rated as a low-hazardous, low-radiation facility.

The CPP-717 STR Waste Storage Tanks (WM-103, 104, 105, 106) are four 30,200 gallon tanks buried approximately 15 feet below grade. The tanks set on 12-inch thick concrete pads. The tanks are rated low radiation.

Table C.6.2-104. Decontamination and decommissioning project data for the Waste Storage Control House (P156B).

Table C.6.2-105. Decontamination and decommissioning project data for the Waste Storage Control House (P156C).

Table C.6.2-106. Decontamination and decommissioning project data for the Waste Storage Pipe Manifold Building (P156D).

Table C.6.2-107. Decontamination and decommissioning project data for the Waste Station (WM-180) Tank Transfer Building (P156E).

Table C.6.2-108. Decontamination and decommissioning project data for the Instrument House (P156F).

Table C.6.2-109. Decontamination and decommissioning project data for the Closure of STR-Waste Storage Tank (WM-103, 104, 105, 106) – CPP 717 to Landfill Standards (P156G).

Table C.6.2-110. Decontamination and decommissioning project data for the West Side Waste Holdup (P156L).

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C.6.2.53 Facility Closure of the Bin Set Group (P157A-F)

GENERAL PROJECT OBJECTIVES: The project included activities that would be associated with the deactivation and demolition of the bin set complex.

PROCESS DESCRIPTION: Deactivation of the complex would be scheduled for completion in 2037. Demolition would be scheduled to start in 2038 and would be completed in 2043.

The project addresses these facilities:

- CPP-639: Instrumentation Building for bin set 1 (P157A)
- CPP-646: Instrument Building for 2nd Set of Calcined Solids (P157B)
- CPP-647: Instrument Building for 3rd Set of Calcined Solids (P157C)
- CPP-658: Instrument Building for 4th Set of Calcined Storage (P157D)
- CPP-671: Instrument Building for 5th Set of Calcined Storage (P157E)
- CPP-673: Service Building for 6th Set Calcined Solids (P157F)

COMPLEX DESCRIPTION: The INTEC bin set buildings house the instrumentation to monitor the bid sets. The total multi-level building area of the complex is approximately 1,131 feet^2. The complex is currently undergoing deactivation and would be targeted for a landfill closure. The above ground portion of the complex would be demolished in place and covered with an earthen cap.

The CPP-639 Instrumentation Building for bin set 1 is a one-story, 372 feet^2 masonry-exterior building. The building houses instrumentation to monitor bin set 1. The building is rated as a low-hazard facility. It contains low levels of radiation and medium quantities of asbestos in the roof, siding, and piping insulation.

The CPP-646 Instrument Building for 2nd Set of Calcined Solids is a one-story, 91 feet^2 masonry-exterior building. The building houses instrumentation to monitor bin set 2. The building is rated as a low-hazard facility. It contains low levels of radiation and low quantities of asbestos in the roof, siding, and piping insulation.

The CPP-647 Instrument Building for 3rd Set of Calcined Solids is a one-story, 91 feet^2 masonry-exterior building. The building houses instrumentation to monitor bin set 3. The building is rated as a low-hazard facility. It contains low levels of radiation and low quantities of asbestos in the roof, siding, and piping insulation.

The CPP-658 Instrument Building for 4^{th} Set of Calcined Storage is a one-story, 81 $feet^2$ reinforced-concrete building. The building houses instrumentation to monitor bin set 4. The building is rated as a low-hazard facility. It contains low levels of radiation and low quantities of asbestos in the roof, siding, and piping insulation.

The CPP-671 bin set 5 service building is a one-story, 240 $feet^2$ prefabricated building The building houses instrumentation to monitor bin set 5. The building is rated as a high-hazard, high-radiation facility. Low quantities of asbestos contamination are present in the roof.

The CPP-673 Service Building for 6^{th} Set Calcined Solids is a one-story, 256 $feet^2$ metal building. The building houses instrumentation to monitor bin set 6. The building is rated as a low-hazard, low-radiation facility.

Table C.6.2-111. Decontamination and decommissioning project data for the closure of the Instrumentation Building for Bin Set 1 (CPP-639) (P157A).

Table C.6.2-112. Decontamination and decommissioning project data for the Bin Set 2 Instrumentation Building (P157B).

Table C.6.2-113. Decontamination and decommissioning project data for the Bin Set 3 Instrumentation Building (P157C).

Table C.6.2-114. Decontamination and decommissioning project data for the Bin Set 4 Instrumentation Building (P157D).

Table C.6.2-115. Decontamination and decommissioning project data for the Bin Set 5 Service Building (P157E).

Table C.6.2-116. Decontamination and decommissioning project data for the Bin Set 6 Service Building (P157F).

C.6.2.54 Closure of the Process Equipment Waste Group (P158A-E, H)

GENERAL PROJECT OBJECTIVES: The project included activities that would be associated with the deactivation and demolition of the Process Equipment Waste Group.

PROCESS DESCRIPTION: The INTEC Process Equipment Waste complex would be targeted for a landfill closure, except for the Liquid Effluent Treatment and Disposal Building (CPP-1618), which would be targeted for clean closure. The below ground levels of the complex would be grouted with concrete. Subsequently, the above ground portion of the complex would be demolished in place and covered with an earthen cap. The rigid asbestos siding and roofing would be removed and placed in a landfill approved for asbestos disposal. Complete deactivation of the complex would be completed in 2037. Demolition would start in 2038 and would be completed in 2043.

COMPLEX DESCRIPTION: The INTEC Blower Building (CPP-605) houses three uninterruptible power supply blowers and the vessel offgassystems that supports the INTEC. The CPP-605 Blower Building is a 2,622 square-foot, one-story, reinforced concrete building. The building is rated as a low hazard, average radiation facility. The building is adjacent to the CPP-604. All utilities that support CPP-604 pass through CPP-605.

The INTEC Atmospheric Protection Building (CPP-649) houses blowers and ventilation for the Atmospheric Protection System. Ninety percent of the INTEC offgassystem runs through this building. (CPP-605 has its own offgassystem.) The building is a 3,572 square-foot, one-story, reinforced concrete building. The building is rated as a low hazard, average radiation facility.

The INTEC Liquid Effluent Treatment & Disposal Building (CPP-1618) is used to process the overheads from the process equipment waste system. Within the building, the acid is recaptured and transferred to the CPP-659 New Waste Calcining Facility or the Tank Farm.

The primary function of the Process Equipment Waste Evaporator, which is housed in CPP-604, is to separate liquid radioactive waste into two fractions. The high level waste is directed to the Tank Farm. The other fraction is directed to the Liquid Effluent Treatment and Disposal Facility.

The CPP-708 Exhaust Stack/Main Stack is a 250 foot high concrete stack with a stainless steel liner. The diameter of the stack ranges from 27.7 feet as the base and 14 feet at the top. The stack is rated as a high hazard, high radiation facility.

The CPP-756 Pre-Filter Vault is a 3,670 square-foot, below grade concrete vault. The building is rated as a low hazard, average radiation facility.

The CPP-1618 Liquid Effluent Treatment and Disposal Building is a 6,850 square-foot, three-story, steel frame building. The building is rated as a low hazard, low radiation facility.

The CPP-604 Process Equipment Waste Evaporator Building is a 24,275 square-foot, multi-level, steel frame and reinforced concrete building. The building has areas of medium to high asbestos, hazards, and radiation.

Table C.6.2-117. Decontamination and decommissioning project data for the Blower Building (P158A).

Table C.6.2-118. Decontamination and decommissioning project data for the closure of the Atmospheric Protection Building (CPP-649) (P158B).

Table C.6.2-119. Decontamination and decommissioning project data for the Exhaust Stack/Main Stack (P158C).

Table C.6.2-120. Decontamination and decommissioning project data for the Pre-Filter Vault (P158D).

Table C.6.2-121. Decontamination and decommissioning project data for the Liquid Effluent Treatment and Disposal Building (P158E).

Table C.6.2-122. Decontamination and decommissioning project data for the PEW Evaporator Facility (P158H).

C.6.2.55 Performance-Based Closure of the Remote Analytical Laboratory (P159)

GENERAL PROJECT OBJECTIVES: The project included activities that would be associated with the deactivation and demolition of the Remote Analytical Laboratory.

PROCESS DESCRIPTION: Deactivation of the complex would be complete in 1999. Demolition would begin in 2000 and would be completed in 2004.

COMPLEX DESCRIPTION: The Remote Analytical Laboratory (CPP-684) was designed to receive, analyze, and dispose of radioactive samples from the entire INTEC complex in a safe and timely manner. These samples sources include fuel dissolution, first, second, and third cycle extraction raffinate and product solutions, recycled solvents, waste solutions, waste calcination feed, waste calcine and scrub solutions, and Process Equipment Waste Evaporator feed and condensate solutions. The facility houses a cold and warm laboratories, an analytical cell, a waste handling cell, a uranium storage cabinet, and equipment support areas for decontamination and maintenance.

Table C.6.2-123. Decontamination and decommissioning project data for the Remote Analytical Laboratory (P159).

C.6.2.56 Performance-Based Closure and Closure to Land Fill Standards of the Fuel Processing Complex (P160A, C-G)

GENERAL PROJECT OBJECTIVES: The project included activities that would be associated with the deactivation and demolition of the Fuel Processing Complex.

The project addresses four facilities:

- CPP-601: Fuel Processing Facility (P160A & E)
- CPP-627: Remote Analytical Facility (P160C & F)
- CPP-640: Head-End Processing Facility (P160D & G)

PROCESS DESCRIPTION: The complex is currently undergoing deactivation and is targeted for a "land-fill" closure. Deactivation is scheduled to be complete in 2007. The below ground levels of the complex would be clean grouted with concrete. Subsequently, the above ground portion of the complex would be demolished in place and covered with an earthen cap. The ridged asbestos siding and roofing would be removed and either placed in the below ground areas of the existing building prior to grouting or placed in a land-fill approved for asbestos disposal. Demolition would start in 2015 and would be completed in 2025.

COMPLEX DESCRIPTION: The total multi-level building area of the complex is approximately 164,000 feet^2. The above ground areas are approximately 74,800 feet^2. CPP-601 is a steel frame building, while buildings 640 and 627 are constructed of concrete block. The majority of the complex is sided and roofed with a ridged asbestos material, i.e., transite.

The Process Building (CPP-601) contains 25 process cells, numerous corridors, and auxiliary cells that house equipment and controls for separating uranium from fission products. Much of the processing equipment in the building is located in heavily shielded cells and must be operated remotely. Fuel element processing consisted of a series of aqueous process steps. These included dissolution in acid, separation of the fission products from uranium by countercurrent solvent extraction, concentration and interim storage of uranyl nitrate hexahydrate solution, and conversion for the uranyl nitrate hexahydrate to solid uranium trioxide before shipping. The first three process steps for aluminum and zirconium clad fuels are performed in the process cells of CPP-601. CPP-601 contains a low bay area and process/storage cells.

Minimum functions are performed in the building, including monitoring heating and ventilation systems for contamination, supporting analytical activities, and maintaining the process makeup area for the high level waste activities. The building has high radiation areas, chemical contamination (i.e., nitric acid and aluminum nitrate), and high quantities of asbestos contamination in the form of piping insulation and transite siding and roofing. The facility includes treated, potable, and demineralized water system and plant air, steam and power. CPP buildings 604, 605, 621, 640, and 641 are supplied plant services through this building.

Electrolytic dissolution, combustion and dissolution of graphite fuels take place in the Head End Processing Plant (CPP-640), and custom dissolution takes in the Multicurie Cell in CPP-627. CPP-640 contains office space, operating and treatment areas and process cells. It has high levels of radiation contamination and medium quantities of asbestos contamination in the roofing and insulation materials. CPP-627 contains office space, decontamination rooms, a glove box area, the multi-curie cell and cave. It has high levels of radiation contamination and medium quantities of asbestos contamination in the roofing and insulation materials.

Table C.6.2-124. Decontamination and decommissioning project data for the Closure of the Fuel Processing Building to Landfill Standards (P160A).

Table C.6.2-125. Decontamination and decommissioning project data for the Closure of the Remote Analytical Facility Building to Landfill Standards (P160C).

Table C.6.2-126. Decontamination and decommissioning project data for the Closure of the Head End Process Plant to Landfill Standards (P160D).

Table C.6.2-127. Decontamination and decommissioning project data for the Performance-Based Closure of the Fuel Processing Building (P160E).

Table C.6.2-128. Decontamination and decommissioning project data for the Performance-Based Closure of the Remote Analytical Facility Building (P160F).

Table C.6.2-129. Decontamination and decommissioning project data for the Performance-Based Closure of the Head End Process Plant (P160G).

C.6.2.57 Fluorinel Dissolution Process and Fuel Storage Facility Closure (P161A, B)

GENERAL PROJECT OBJECTIVES: The project addresses the deactivation and demolition of the Fluorinel Dissolution and Fuel Storage Complex.

PROCESS DESCRIPTION: The complex is scheduled to complete deactivation in 2010. Demolition would begin in 2011 and would be completed in 2017.

The project addresses three facilities:

- CPP-666: Fuel Storage Area (P161A)
- CPP-666: Dissolution Process Area (P161A)
- CPP-767: Fluorinel Dissolution Process and Fuel Storage Facility Stack (P161B)

The Fuel Storage and Dissolution Process Facility would be targeted for closure to landfill standards, except for the facility stack which would be clean closed.

COMPLEX FUNCTION: The Fluorinel Dissolution Process and Fuel Storage building was a combination of fuel storage and fuel dissolution process area. The Fuel Storage Area provides facilities for receiving, preparing for storage, transferring, storage, and preparing for processing. The Fluorinel Dissolution Process Area consists of facilities for processing irradiated fuels. The resulting product could be characterized as a hydrofluoric-nitric acid solution containing dissolved zirconium, uranium, and other nuclides. Subsequently, this product was transferred to CPP-601 for further processing.

COMPLEX DESCRIPTION: The total multilevel area of the CPP-666 complex is approximately 175,000 feet^2. The complex is a combination of reinforced concrete and structural steel exterior walls. The complex was designed to provide office space, underwater fuel storage, and fuel dissolution areas. The entire fuel basin area, fuel dissolution cell, fuel handling area, air handling system area, and water treatment system area are radiologically contaminated.

The complex has potable, raw, treated, demineralized, and fire water systems; a steam/condendate system; plant air; and 480-volt power service. Special complex equipment includes two 25-ton cranes, one 130-ton overhead crane, several manipulators, cask handling equipment, water treatment system, high-efficiency particulate air filtration system, numerous basin filled with water for the storage of spent nuclear fuel, and a heavily shielded area for fuel dissolution and dissolution. The stack (CPP-767) is a simple steel stack.

Table C.6.2-130. Decontamination and decommissioning project data for the Performance-Based Closure of the Fluorinel Storage Facility (P161A).

C.6.2.58 <u>Closure of the Transport Lines Group (P162A-D)</u>

GENERAL PROJECT OBJECTIVES: The project will address the deactivation and demolition of the Transport Lines Group.

PROCESS DESCRIPTION: Deactivation of the complex would be completed in 2037. Demolition would be scheduled to start in 2038 and would be completed in 2043.

The project addresses seven transfer lines:

- High-Level Liquid Waste (Raffinate) Lines (P162A)
- Calcine Solids Transport Lines (P162B)
- Process Off Gas Lines (and drains) (P162C)
- Vessel Off Gas Lines (P162D)

COMPLEX FUNCTION: The transport lines are used to transport solid waste, liquid waste, and process offgas from the process facility to the treatment or storage facility.

COMPLEX DESCRIPTION:

<u>High-Level Liquid Waste (Raffinate) Lines</u>: The two original 1, 2, & 3 cycle raffinate lines between CPP-601 and CPP-604 were replaced about 1982. They were capped and abandoned in place and may have several places in the line that have been cut and capped.

Two-2" diameter stainless steel pipelines replaced the original raffinate lines. The new lines are encased in 4" stainless steel pipe, which is buried directly in the ground (approximately 6-12 feet deep). The lines are approximately 300 feet long and some portion of them would remain in service until all of the processes that create liquid waste would be shut down and closed. The sections of the lines that would no longer be needed would be capped and abandoned in place.

<u>Calcine Solids Transport Lines</u>: There are two calcined solids transport lines between the Waste Calcine Facility and bin sets 1, 2, 3, and 4. The stainless steel lines are 3 to 4 inches in diameter and inserted into clay tile sleeves. Each line is encased in concrete (approximately 3 feet by 3 feet) and buried at a depth of approximately four feet. These lines would be capped and abandoned in place.

There are two calcined solids transport lines between the New Waste Calcining Facility and bin sets 4, 5, 6, and 7. The stainless steel lines are 3 to 4 inches in diameter and inserted into clay tile sleeves. Each line is encased in concrete (approximately 3 feet by 3 feet) and buried at a depth of approximately four feet. These lines would be capped and abandoned in place.

Calciner Process Off-Gas Lines: The Process Off-Gas lines run from CPP-633 and CPP-659 to the Process Atmospheric Protection System filter system in CPP-649. The 10-inch diameter, stainless steel line from Waste Calcining Facility is directly buried in the ground, the 12-inch diameter stainless steel line from New Waste Calcining Facility has a secondary containment of 20-inch stainless steel pipe which is encased in concrete (approximately 3 feet by 3 feet) at a depth of approximately 8 to 10 feet. The lines are approximately 300 to 500 feet long. Clean closure would require the line to be flushed, capped, and abandoned in place.

Vessel Off-Gas Line: The Vessel Off-Gas line runs from CPP-601 to the Vessel Off-Gas filter system in CPP-604. The 8-inch diameter, stainless steel line has a secondary containment of clay tile which is encased in concrete (approximately 3 feet by 3 feet) at a depth of approximately 8 to 14 feet. The line is approximately 300 feet long. Clean closure would require the line to be flushed, capped, and abandoned in place.

Dissolver Off-Gas Lines: The “C & D” and RALA Dissolver Off-Gas lines run from CPP-601 to the CPM Dissolver Off-Gas filter system in CPP-604. The 4-inch diameter stainless lines have a secondary containment of clay tile which are encased in concrete (approximately 3 feet by 3 feet) buried in the ground at a depth of approximately 8 to 14 feet. The lines are approximately 300 feet long. The performance-based closure requires the lines to be flushed, capped, and abandoned in place.

The “E- Dissolver Off-Gas” and “CPM Dissolver Off-Gas” lines are 2-inch and 4-inch stainless steel lines are routed through the CPP-601 vent tunnel and then overhead along the vent duct to the filtering systems in CPP-604. The lines are approximately 300 feet long. Clean closure would require the lines to be flushed, capped, and abandoned in place. The overhead portion would be removed during closure.

Overhead Pneumatic Transfer Lines: The overhead pneumatic transfer lines are used to transport radioactive samples from various INTEC facilities to the Remote Analytical Laboratory.

CPP-1776 Utility Tunnel System throughout Chem Plant: The utility tunnel runs throughout the INTEC complex. The tunnel contains steam, condensate, sewer, water, and electric services. There is approximately 5000 linear feet of utility tunnel with a cross-section of 10 feet by 10 feet.

Table C.6.2-131. Decontamination and decommissioning project data for the Closure of the High-Level Waste (Raffinate) Lines (P162A).

Table C.6.2-132. Decontamination and decommissioning project data for the Closure of the Calcine Solids Transport Lines (P162B).

Table C.6.2-133. Decontamination and decommissioning project data for the Closure of the Process Offgas Lines and Drains (P162C).

Table C.6.2-134. Decontamination and decommissioning project data for the Closure of the Vessel Offgas Lines (P162D).

C.6.2.59 Performance-Based Closure and Closure to Landfill Standards of the New Waste Calcining Facility (P165A & B)

GENERAL PROJECT OBJECTIVE: These projects address the deactivation, decontamination, and demolition of the New Waste Calcining Facility. Activities supporting performance-based closure of the facility are covered by P165A while closure of the New Waste Calcining Facility to landfill standards is covered by P165B.

COMPLEX DESCRIPTION: The primary function of the New Waste Calcining Facility (CPP-659) is to calcine high-level liquid waste. The CPP-659 facility, which was built in 1980, is a combination of reinforced concrete and structural steel exterior walls. As a replacement facility for the Waste Calcining Facility, the new facility houses the calciner, the high-level liquid waste evaporator, the filter leach system, associated process equipment, equipment decontamination area, and heating/ventilation and air-conditioning equipment.

PROJECT DESCRIPTION:

P165A – Performance-based closure: The performance-based closure project option includes deactivating and decontaminating the New Waste Calcining Facility, cleaning tanks and vessels to lowest levels possible, filling the below-ground portion of the facility and associated tanks and vessels with clean, non-radioactive grout, and demolishing the above-ground portion of the facility.

P16B – Closure to landfill standards: The closure to landfill standards project option includes deactivating and decontaminating the New Waste Calcining Facility, flushing and eliminating free liquids in tanks and vessels, filling the below-ground portion of the facility and associated tanks and vessels with clean, non-radioactive grout, and demolishing the above-ground portion of the facility.

Table C.6.2-135. Decontamination and decommissioning project data for the Performance-Based Closure of the New Waste Calcining Facility (P165A).

Table C.6.2-136. Decontamination and decommissioning project data for the Closure to Landfill Standards of the New Waste Calcining Facility (P165B)

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EDF-PDS-D-019, *Draft Project Summary and Project Data Sheets for Treatment of Newly Generated Waste (NGLW) and Tank Farm Waste Heel Waste, (P1B)*, Rev. 2, Lockheed Martin Idaho Technologies Corporation, February 3, 1999.

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EDF-PDS-E-004, *Draft Project Summary and Project Data Sheet for TRU/Class C Waste Separations Facility (P49A)*, Rev. 1, Lockheed Martin Idaho Technologies Corporation, February 3, 1999.

EDF-PDS-E-008, *Draft Project Summary and Project Data Sheets for Separations Organic Incinerator Project (P118)*, Rev. 1, Lockheed Martin Idaho Technologies Corporation, February 3, 1999.

EDF-PDS-F-002, *Project Data Sheet and Draft Project Summary for Early Vitrification of SBW, NGLW, and Calcine (P88)*, Rev. 2, Lockheed Martin Idaho Technologies Corporation, February 3, 1999.

EDF-PDS-F-003, *Draft Project Summary and Project Data Sheets for Vitrification Plant (Projects P9B and P23B)*, Rev. 1, Lockheed Martin Idaho Technologies Corporation, February 3, 1999.

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EDF-PDS-G-002, *Draft Project Summary and Project Data Sheet for Class C Grout Plant (Project P49C)*, Rev. 1, Lockheed Martin Idaho Technologies Corporation, February 3, 1999.

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EDF-PDS-I-008, *Draft Project Summary and Project Data Sheet for the Packaging and Loading of Cementitious Waste for Shipment to the National Geologic Repository (P83A)*, Rev. 1, Lockheed Martin Idaho Technologies Corporation, February 3, 1999.

EDF-PDS-I-009, *Draft Project Summary and Project Data Sheet for the Packaging and Loading of TRU for Shipment to WIPP (P39A bounds P50A)*, Rev. 1, Lockheed Martin Idaho Technologies Corporation, February 3, 1999.

EDF-PDS-I-010, *Draft Project Summary and Project Data Sheet for the Packaging and Loading of Vitrified SBW for Shipment to WIPP (P90A)*, Rev. 1, Lockheed Martin Idaho Technologies Corporation, February 5, 1999.

EDF-PDS-I-011, *Draft Project Summary and Project Data Sheet for the Packaging and Loading of NGLW Contact Handled TRU to WIPP (P112A)*, Rev. 1, Lockheed Martin Idaho Technologies Corporation, February 3, 1999.

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EDF-PDS-J-001, *Project Data Sheet and Draft Project Summary for Class A Grout Packaging and Shipping to an INEEL Landfill (P35D)*, Rev. 2, Lockheed Martin Idaho Technologies Corporation, February 3, 1999.

EDF-PDS-J-002, *Project Data Sheet and Draft Project Summary for Class C Grout Packaging and Shipping to an INEEL Landfill (P49D)*, Rev. 1, Lockheed Martin Idaho Technologies Corporation, February 3, 1999.

EDF-PDS-J-003, *Project Data Sheet and Draft Project Summary for Class A Grout Packaging and Loading for Off-site Disposal (P35E)*, Rev. 1, Lockheed Martin Idaho Technologies Corporation, February 3, 1999.

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EDF-WPF-015, *Project Data Sheet and Draft Project Summary for the Minimum INEEL Processing (Calcine Only) Alternative – Just-in-Time (JIT) Option (P117B)*, Lockheed Martin Idaho Technologies Corporation, November 19, 1998.

Table C.6.2-1. Construction project data for the new liquid waste storage tank for the Calcine SBW Including New Waste Calcining Facility Upgrades (P1A).[a]

Generic Information	
Description/function and EIS Project number:	Storage facility for SBW & newly generated liquid waste (P1A)
EIS alternatives/options:	Continued Current Operations, Separations/Planning Basis Option, Non-Separations/HIP Waste & Direct Cement Options
Project type or waste stream:	Radioactive liquid waste
Action type:	New
Structure type:	Tank & vault
Size: (m^2)	344
Other features:	
(pits, ponds, power/water/sewer lines)	None
Location	
Inside/outside of fence:	Inside INTEC fence
Inside/outside of building:	New underground tank
Construction Information	
Schedule start/end	
Pre-construction[b]:	July 2000 – December 2006
Construction:	January 2006 – December 2009
SO test and start-up:	January 2009 – December 2010
Number of workers:	48 per yr
Number of radiation workers:	None
Heavy equipment	
Equipment used:	Excavator, grader, crane, trucks
Trips:	490
Hours of operation: (hrs)	3,499 (total)

Construction Information (continued)	
Acres disturbed	
New/Previous/Revegetated: (acres)	None/0.3/None
Air emissions: (None/Reference)	See Appendix C.2 for details.
Dust: (tons/yr)	5
Fuel combustion (diesel exhaust):	
Major gas (CO_2): (tons/yr)	152
Contaminants[c]: (tons/yr):	7
Effluents	
Sanitary wastewater (construction): (L)	2,057,000
Sanitary wastewater (SO testing): (L)	328,000
Solid wastes	
Construction trash: (m^3)	1,150
Sanitary/indust. trash (SO test.): (m^3/yr)	50
Radioactive wastes:	None
Hazardous/toxic chemicals & wastes:	None
Water usage	
Dust control: (L)	68,000
Domestic (construction): (L)	2,057,000
Domestic (SO testing): (L)	328,000
Energy requirements	
Electrical (construction): (MWh/yr)	3,000
Electrical (SO testing): (MWh/yr)	100
Fossil fuel:	
Heavy equipment (construction): (L)	79,000
Other use (construction): (L)	19,000

a. Sources: EDF-PDS-C-020; EDF-PDS-L-002.

b. Preconstruction schedule for Direct Cement Option: January 2001 – December 2006.

c. CO, particulates, NO_x, SO_2, hydrocarbons.

Table C.6.2-2. Construction project data for the New Waste Calcining Facility MACT Compliance Facility for the Calcine SBW Including New Waste Calcining Facility Upgrades (P1A).[a]

Generic Information		**Construction Information (continued)**	
Description/function and EIS Project number:	Modifications and additions to NWCF (P1A)	Air emissions: (continued) SO testing and start-up: Process chemical emissions[d]: (lbs/yr) Fossil fuel (steam use): (tons/yr)	 14 5,007
EIS alternatives/options:	Continued Current Operations, Seps. Alt./Planning Basis, Non-Seps./HIP Waste & Direct Cement Options	Effluents Sanitary wastewater (construction): (L) Sanitary wastewater (SO testing): (L)	 3,832,313 241,767
Project type or waste stream:	Radioactive liquid waste		
Action type:	Modifications/additions	Solid wastes Construction trash: (m^3) SO test & start-up: Sanitary/industrial trash: (m^3/yr)	 2,134 39
Structure type Size: (m^2) Other features: (pits, ponds, power/water/sewer lines)	 7,154 None		
Location Inside/outside of fence:	 Inside INTEC fence	Hazardous/toxic chemicals & wastes Solid hazardous waste: (m^3) Used lube oil: (L)	 8 1,133
Construction Information		Radioactive wastes:	None
Schedule start/end Pre-construction[b]: Construction: SO test and start-up:	 July 2000 – December 2006 January 2006 – December 2009 January 2009 – December 2010	Mixed wastes (LLW) Solid mixed wastes: (m^3)	 16
Number of workers:	48 per yr	Water usage Dust control (construction): (L) Domestic water (construction): (L) Domestic water (SO testing): (L) Process (SO testing): (L)	 230,000 3,832,313 241,767 21,895,347
Number of radiation workers per year:	48		
Avg. annual worker rad. dose: (rem/yr)	0.19		
Heavy equipment Equipment used: Trips: Hours of operation: (hrs)	 Dump trucks/flat beds 104 5,986 (total)	Energy requirements Electrical: Construction: (MWh/yr) SO testing & start-up: (MWh/yr) Fossil fuel: Heavy equipment: (L) Steam generation (SO testing): (L/yr)	 1.3 1,146 145,632.9 1,754,864
Acres disturbed New/Previous/Revegetated: (acres)	 None/0.34/None		
Air emissions: (None/Reference) Dust: (tons/yr) Fuel combustion (diesel exhaust): Major gas (CO_2): (tons/yr) Contaminants[c]: (tons/yr)	See Appendix C.2 for details. 5 120 6		

a. Sources: EDF-PDS-C-020; EDF-PDS-L-002.
b. Preconstruction schedule for Direct Cement Option: January 2001 – December 2006.
c. CO, particulates, NO_x, SO_2, hydrocarbons.
d. Source: EDF-PDS-C-043.

Table C.6.2-3. Operations project data for combined operations of facilities for the Calcine SBW Including New Waste Calcining Facility Upgrades (P1A).[a]

Generic Information		**Operational Information (continued)**	
Description/function and EIS project number:	Combined operations for liquid retrieval, PEW evaporator & LET&D, & NWCF which covers the calciner, MACT-related items, HLW evaporator, & filter leach (P1A)	Effluents Sanitary wastewater: (L/yr) Solid wastes Sanitary/industrial trash: (m^3/yr) Radioactive wastes Solid radioactive wastes (LLW): (m^3)	 5,111,643 821 2,250
EIS alternatives/options:	Continued Current Operations	HEPA filters (LLW): (m^3)	26
Operational Information		Hazardous/toxic chemicals & wastes:	None
Schedule start/end:	January 2011 – December 2016	Mixed wastes (LLW)	
Number of workers Operations: Maintenance: Support:	 58 20 70	PPEs & misc. mixed rad. waste: (m^3) Mixed liquid rad. wastes: (L) Water usage Process water: (L/yr)	864 277,200 149,000,000
Number of radiation workers:	96 (included in above totals)	Domestic water: (L/yr)	5,111,643
Avg. annual worker rad dose: (rem/yr)	0.19 per worker	Energy requirements	
Heavy equipment Equipment used:	 Mobile crane, trucks, flat bed	Electrical: (MWh/yr) Fossil fuel:	5,300
Air emissions: (None/Reference) Building ventilation: (Ci/yr) Process radioactive emissions[b]: (Ci/yr) Process tritium emissions[c]: (Ci) Process chemical emissions[d]: (lbs/yr) Fossil fuel emissions: (tons/yr)	See Appendix C.2 for details. 2.90E-07 0.0608 126 14 5,006.84	Steam generation: (L/yr) Kerosene (process use): (L/yr) Vehicle fuel: (L/yr)	1,754,864 3,500,000 75,000

a. Includes operation of new liquid waste storage tank. Sources: EDF-PDS-C-020; EDF-PDS-L-002.
b. Source: EDF-PDS-C-046.
c. 9.0 Ci/yr for 4 years via evaporator and 22.5 Ci/yr for 4 years via calciner. Source: EDF-PDS-C-046.
d. Source: EDF-PDS-C-043.

Table C.6.2-4. Decontamination and decommissioning project data for the new liquid waste storage tank for the Calcine SBW Including New Waste Calcining Facility with Upgrades (P1A).[a]

Decontamination and Decommissioning (D&D) Information			
Schedule start/end:	January 2017 – December 2019	Effluents	
Number of D&D workers each year:	42 per yr	Sanitary wastewater: (L)	2,448,000
Number of radiation workers (D&D):	31 new workers/yr	Radioactive wastes	
Avg. annual worker rad. dose: (rem/yr)	0.25 per worker	Solid LLW: (m^3)	625
Heavy equipment		Solid wastes	
Equipment used:	Mobile cranes, roll-off trucks, dozers, loaders	Building rubble: (m^3)	470
		Metals: (m^3)	2
Trips:	2 per day	Hazardous/toxic chemicals & wastes	
Total hours of operation: (hrs)	29,250	Used lube oil: (L)	5,500
Acres disturbed		Solids (paint, solvent, etc.): (m^3)	197
New/Previous/Revegetated: (acres)	None/0.3/None	Water usage	
Air emissions: (None/Reference)	See Appendix C.2 for details.	Domestic water: (L)	2,448,000
Fuel combustion:		Energy requirements	
Gases (CO_2): (tons/yr)	1,023	Electrical: (MWh/yr)	156
Contaminants[b]: (tons/yr)	50 (total)	Fossil fuel: (L)	664,000

a. Sources: EDF-PDS-C-020; EDF-PDS-L-002.
b. CO, particulates, NO_x, SO_2, hydrocarbons.

Table C.6.2-5. Decontamination and decommissioning project data for the New Waste Calcining Facility MACT Compliance Facility for the Calcine SBW Including New Waste Calcining Facility with Upgrades (P1A).[a]

Decontamination and Decommissioning (D&D) Information			
Schedule start/end:	January 2017 – December 2019	Radioactive wastes:	None
Number of D&D workers:	58 per yr	Solid wastes	
Number of radiation workers (D&D):	37 new workers/yr	Industrial: (m^3)	625
Avg. annual worker radiation dose:	0.25 rem/yr per worker	Hazardous/toxic chemicals & wastes:	None
Heavy equipment		Mixed wastes (LLW)	
Equipment used:	Mobile cranes, roll-off trucks, dozers, loaders	Decon solution: (L)	379
		Water usage	
Trips:	10 per day	Domestic water: (L)	1,232,684
Total hours of operation:	17,775 hours	Process water: (L)	2,284,875
Acres disturbed		Energy requirements	
New/Previous/Revegetated: (acres)	None/0.34/None	Electrical: (MWh/yr)	156
Air emissions: (None/Reference)	See Appendix C.2 for details.	Fossil fuel: (L)	403,670
Fuel combustion (diesel exhaust)			
Gases (CO_2): (tons/yr)	1,243		
Contaminants[b]: (tons/yr)	61 (total)		
Effluents			
Sanitary wastewater: (L)	1,232,684		

a. Sources: EDF-PDS-C-020; EDF-PDS-L-002.
b. CO, particulates, NO_x, SO_2, hydrocarbons.

Table C.6.2-6. Construction and operations project data for Newly Generated Liquid Waste and Tank Farm Heel Waste Management (P1B).[a]

Generic Information	
Description/function and EIS project number:	Treatment and stabilization of NGLW & tank heel waste (P1B)
EIS alternatives/options:	Continued Current Operations, Planning Basis, Hot Isostatic Pressed Waste, & Direct Cement options
Project type or waste stream:	NGLW and tank heels
Action type:	New
Structure type:	New facility
Size: (m^2)	2,638
Other features (pits, ponds, power/water/sewer lines):	None
Location	Inside INTEC fence
Inside/outside of fence/building:	Inside new building
Construction Information	
Schedule start/end	
Continued current operations:[b]	
Pre-construction:	January 2004 – December 2009
Construction:	January 2010 – December 2013
SO test and start-up:	January 2012 – December 2014
Number of workers:	20 per yr
Heavy equipment	
Equipment used:	Excavator, grader, crane, trucks
Trips/Hours of operations: (hrs)	569/758 (total)
Acres disturbed	
New/Previous/Revegetated: (acres)	None/0.9/None
Air emissions: (None/Reference)	See Appendix C.2 for details
Dust: (tons/yr)	14
Fuel combustion (diesel exhaust):	
Major gas (CO_2): (tons/yr)	66
Contaminants[c]: (tons/yr)	3
SO testing & start-up:	
Fossil fuel (steam use): (tons/yr)	4,123.8
Effluents	
Sanitary wastewater (construction): (L)	1,277,438
Sanitary wastewater (SO testing): (L/yr)	2,624,898

Construction Information (continued)	
Water usage	
Dust control (construction): (L)	454,200
Domestic (construction): (L)	1,277,438
Domestic (SO testing): (L)	7,874,693
Process (SO testing): (L)	69,038
Energy requirements	
Electrical: (MWh/yr)	180
Fossil fuel:	
Heavy equipment (construction): (L)	64,590
Steam generation (SO testing): (L/yr)	1,445,182
Process use (SO testing): (L)	1,998
Operational Information	
Schedule start/end:	January 2015 – December 2035
Number of workers:	
Operations:	43 per yr
Maintenance:	17 per yr
Support:	16 per yr
Number of radiation workers (included in above totals):	60 per yr
Avg. annual worker rad. dose: (rem/yr)	0.19 per worker
Heavy equipment:	Mobile cranes, forklifts, trucks
Trips:	8
Air emissions: (None/Reference)	See Appendix C.2 for details
Building ventilation: (Ci/yr)	1.77E-07
Process radioactive emissions[d]: (Ci/yr)	3.08E-02
Process chemical emissions: (tons/yr)	4.76E-02
Fossil fuel emissions: (tons/yr)	4,123.8
Effluents	
Sanitary wastewater: (L/yr)	2,624,898
Solid wastes	
Sanitary/Industrial trash: (m^3/yr)	421
Radioactive wastes	
RH (Dry) TRU: (m^3)/(Ci)	110/54,500
LLW (GTCC-Resin) (m^3)/(Ci)	3/131,000
LLW grout: (m^3)/(Ci)	7,000/350,000
HEPA filters (LLW): (m^3)	34

Table C.6.2-6. Continued (P1B).

Construction Information (continued)		**Operational Information (continued)**	
Solid wastes		Misc. solid rad. waste (LLW): (m^3)	82
Construction trash: (m^3)	711	Hazardous/toxic chemicals & wastes	None
SO testing & start-up		Mixed wastes (LLW)	
Sanitary/industrial trash: (m^3/yr)	421	PPEs & misc. rad. wastes: (m^3)	1,890
		Mixed radioactive liquids: (L)	357,840
Radioactive wastes		Water usage	
Contaminated soils (LLW): (m^3)	20	Domestic: (L/yr)	2,624,898
Hazardous/toxic chemicals & wastes		Process: (L/yr)	86,600,000
Used lube oil: (L)	100	Energy requirements	
Solid hazardous wastes: (m^3)	22	Electrical: (MWh/yr)	4,500
		Fossil fuel	
		Steam generation: (L/yr)	1,445,182
		Equipment/vehicle fuel: (L/yr)	666

a. Sources: EDF-PDS-D-019; EDF-PDS-L-002.

b. Schedule for other options: Planning Basis Option – Preconstruction: January 2004 – December 2009, Construction: January 2010 – December 2013, SO testing: January 2012 – December 2014; Hot Isostatic Press Waste & Direct Cement Options – Preconstruction: January 2006 – December 2010, Construction: January 2011 – December 2013, SO testing: January 2013 – December 2014

c. CO, particulates, NO_x, SO_2, hydrocarbons.

d. Source: EDF-PDS-C-046.

Table C.6.2-7. Decontamination and decommissioning project data for Newly Generated Liquid Waste and Tank Farm Heel Waste Management (P1B).[a]

Decontamination and Decommissioning (D&D) Information			
Schedule start/end:	January 2036 – December 2036	Effluents	
Number of D&D workers each year:	48 new workers per yr	Sanitary wastewater: (L)	2,224,291
Number of radiation workers (D&D):	36 new workers per yr	Solid wastes	
Avg. annual worker rad. dose: (rem/yr)	0.25 per worker	Non-radioactive (industrial): (m^3)	3,742
Heavy equipment		Radioactive waste	
Equipment used:	Mobile cranes, roll-off trucks, dozers, loaders	Solid rad. wastes (LLW): (m^3)/(Ci)	4,977/50
		Mixed wastes (LLW)	
Trips (roll-off trucks):	9 per day	Decon solution: (L)	10,749
Hours of operations		Hazardous/toxic chemicals & wastes	
(all heavy equipment): (hrs)	11,925	Solid hazardous wastes: (m^3)	60
Acres disturbed		Lube oil: (L)	2,257
New/Previous/Revegetated: (acres)	None/0.9/None	Water usage	
Air emissions: (None/Reference)	See Appendix C.2 for details	Domestic water: (L)	2,224,291
Fuel combustion (diesel exhasut):		Process water: (L)	761,625
Gases (CO_2): (tons/yr)	834	Energy requirements	
Contaminants[b]: (tons/yr)	41 (total)	Electrical: (MWh/yr)	180
		Fossil fuel: (L)	270,817

a. Sources: EDF-PDS-D-019; EDF-PDS-L-002.
b. CO, particulates, NO_x, SO_2, hydrocarbons.

Table C.6.2-8. Construction and operations project data for the PEW Evaporator and LET&D Facility (P1C).[a]

Generic Information	
Description/function and EIS project number:	Concentrates dilute newly generated liquid wastes (P1C)
EIS alternatives/options:	Early Vitrification Option; Minimum INEEL Processing
Project type or waste stream:	Concentrated NGLW
Action type:	Existing
Structure type:	Existing building
Size: (m^2)	NA
Other features:	NA
Location	
Inside/outside of fence:	Inside INTEC fence
Inside/outside of building:	Inside existing building
Construction Information	
Schedule start/end:	No construction data is required because the facilities already exist and could continue to operate after this project has been
Number of workers:	
Heavy equipment:	
Acres disturbed:	
New/Previous/Revegetated: (acres)	
Air emissions: (None/Reference)	
Effluents:	
Solid wastes:	
Hazardous/toxic chemicals & waste	
Energy requirements:	
Operational Information	
Schedule start/end	
Early Vitrification Option:	January 2000 – December 2035
Minimum INEEL Processing Alt.:	January 2000 – December 2025
Number of workers	
Operations/Maintenance/Support:	22/6/28 per yr

Operational Information	
Number of radiation workers per year:	28 (included in above total)
Avg. annual worker rad. dose: (rem/yr)	0.19 per worker
Heavy equipment	
Equipment used:	Mobile crane, pickup truck
Air emissions: (None/Reference)	See Appendix C.2 for details.
Building ventilation: (Ci/yr)	1.45E-07
Process radioactive emissions[b]: (Ci/yr)	3.08E-02
Process tritium emissions[c]: (Ci/yr)	9.0
Process chemical emissions: (tons/yr)	4.76E-02
Fossil fuel emissions: (tons/yr)	1,030.7
Effluents	
Sanitary wastewater: (L/yr)	967,068
Solid wastes	
Sanitary/Industrial trash: (m^3/yr)	155
Radioactive wastes	
HEPA filters (LLW): (m^3)	
Early Vitrif./Min. INEEL processing:	77/56
Hazardous/toxic chemicals & wastes	None
Mixed wastes (LLW)	
(Early vitrification/Min. INEEL):	
PPEs & misc. rad. waste: (m^3)	1,512/1,092
Mixed rad. liquid waste: (m^3)	816,480/589,680
Water usage	
Process water: (L/yr)	23,000,000
Domestic water: (L/yr)	967,068
Energy requirements	
Electrical: (MWh/yr)	3,000
Fossil fuel: (L/yr)	
Steam generation: (L/yr)	361,185
Equipment/vehicle fuel: (L/yr)	757

a. Sources: EDF-PDS-D-017; EDF-PDS-L-002.
b. Source: EDF-PDS-C-046.
c. Released for 4 years via evaporator. Source: EDF-PDS-C-046.

Table C.6.2-9. Construction and operations project data for the No Action Alternative (P1D).[a]

Generic Information	
Description/function and EIS project number:	Activities associated with taking no action (P1D)
EIS alternatives/options:	No Action Alternative
Project type or waste stream:	Liquid SBW and HLW calcine
Action type:	Existing
Structure type:	Existing structures
Size: (m^2)	7,153
Other features: (pits, ponds, power/water/sewer lines)	None
Location	
Inside/outside of fence:	Inside INTEC fence
Inside/outside of building:	Inside existing storage facilities
Construction Information	
Schedule start/end:	No construction data is required because the facilities already exist and could continue to operate after this project has been completed.
Number of workers:	
Heavy equipment:	
Acres disturbed:	
New/Previous/Revegetated:	
Air emissions: (None/Reference)	
Effluents:	
Solid wastes:	
Hazardous/toxic chemicals & wastes	
Water usage:	
Energy requirements:	

Operational Information		
Schedule start/end:	2000 – 2035	
Number of workers	2000 – 2017	2018 – 2035
Operations/Maintenance:	42	15
Support:	20	5
Radiation: (included in above totals)	42	NA
Avg. annual worker rad. dose: (rem/yr)	0.19 per worker	
Heavy equipment:	None	
Air emissions: (None/Reference)	See Appendix C.2 for details	
Fossil fuel emissions: (tons/yr)	5,204	
Process rad. emissions[b]: (Ci/yr)	3.08E-02	
Process tritium emissions[c]: (Ci/yr)	9.0	
Effluents:	Sanitary wastewater	
Years:	2000 – 2017	2018 – 2035
Quantity: (L/yr)	2,141,364	492,050
Solid wastes:	Sanitary/industrial trash	
Years:	2000 – 2017	2018 – 2035
Quantity: (m^3/yr)	356	115
Radioactive wastes		
HEPA filters (LLW): (m^3)	74	
Mixed wastes (LLW)		
PPEs & misc. radioactive waste: (m^3)	1,071	
Mixed rad. liquid waste: (L)	785,400 (processed as NGLW)	
Hazardous/toxic chemicals & wastes	None	
Water usage	2000 – 2017	2018 – 2035
Cooling water: (L/yr)	52,000,000	NA
Domestic water: (L/yr)	2,141,364	492,050
Energy requirements:	2000 – 2017	2018 – 2035
Electrical: (MWh/yr)	4,300	800
Fossil fuel (steam use): (L/yr)	1,823,682	

a. Sources: EDF-PDS-C-025; EDF-PDS-L-002
b. Source: EDF-PDS-C-046.
c. Released for 4 years via evaporator. Source: EDF-PDS-C-046.

Table C.6.2-10. Construction and operations project data for the Bin Set 1 Calcine Transfer (P1E).[a]

Generic Information	
Description/function and EIS project number:	Move calcine from Bin Set 1 to seismically-compliant bin set (P1E)
EIS alternatives/options:	No Action & Continued Current Operations Alternatives
Project type or waste stream:	Waste management program
Action type:	Prepare bin sets 1 & 7 and transfer calcine
Structure type:	Storage for HLW calcine
Size: (m^2)	93
Other features: (pits, ponds, power/water/sewer lines)	Pneumatic transfer lines
Location	
Inside/outside of fence:	Inside INTEC fence
Inside/outside of building:	Outside existing structures
Construction Information	
Schedule start/end	
Preconstruction:	2000 – 2004
Construction:	2005 – 2009
SO testing and start-up:	2010 – 2011
Number of workers:	21 per yr
Number of radiation workers per year:	21 (included in above total)
Avg. annual worker rad dose: (rem/yr)	0.69 per worker
Heavy equipment	
Equipment used:	Excavator, grader, crane, trucks
Trips:	73
Hours of operation: (hrs)	5,259 (total)
Acres disturbed	
New/Previous/Revegetated: (acres)	None/1.5/None
Air emissions: (None/Reference)	See Appendix C.2 for details.
Dust: (tons/yr)	22
Fuel combustion (diesel exhaust):	
Major gas (CO_2): (tons/yr)	77
Contaminants[b]: (tons/yr)	4
SO testing and start-up:	
Fossil fuel (steam use): (tons/yr)	1,301

Construction Information (continued)	
Radioactive wastes	
Contaminated soil (LLW): (m^3)	1,160
Mixed wastes (LLW)	
Solids (PPEs, HEPA, misc. trash): (m^3)	224
Decon solution: (L)	7,570
Hazardous/toxic chemicals & wastes	
Lube oil: (L)	996
Water usage	
Dust control (construction): (L)	771,000
Domestic (construction): (L)	2,236,000
Domestic (SO testing): (L)	511,000
Process (SO testing): (L)	308,000
Energy requirements	
Electrical	
Construction: (MWh/yr)	180
SO testing: (MWh/yr)	4,300
Fossil fuel:	
Heavy equipment fuel (construct.): (L)	125,511
Steam generation (SO testing): (L/yr)	455,920
Operational Information	
Schedule start/end:	January 2012 – December 2012
Number of workers	
Operations/Maintenance/Support:	11/6/1 per yr
Number of radiation workers per year:	17 (included in above total)
Avg. annual worker rad dose: (rem/yr)	0.19 per worker
Heavy equipment:	None
Air emissions: (None/Reference)	See Appendix C.2 for details.
Process radioactive emissions: (Ci/yr)	2.1E-07
Fossil fuel emissions: (tons/yr)	1,301
Effluents	
Sanitary wastewater: (L/yr)	622,000
Process wastewater: (L/yr)	231,000
Solid wastes	
Sanitary/industrial trash: (m^3/yr)	100
Radioactive wastes	
HEPA filters (LLW): (m^3)	11

Table C.6.2-10. Continued (P1E).

Construction Information (continued)		**Operational Information (continued)**	
Effluents		Mixed wastes (LLW)	
Construction:		PPEs & misc. rad. waste : (m^3)	33
Sanitary wastewater: (L)	2,236,000	Liquid waste: (L)	116,325
SO testing and start-up:		Hazardous/toxic chemicals & wastes	None
Sanitary wastewater: (L)	511,000	Water usage	
Process wastewater: (L)	308,000	Process: (L/yr)	231,000
Solid wastes		Domestic: (L/yr)	622,000
Construction trash: (m^3)	1,245	Energy requirements	
Demolition debris: (m^3)	3.6	Electrical: (MWh/yr)	4,300
Sanitary/industrial trash: (m^3)	133	Fossil fuel: (L/yr)	455,920

a. Sources: EDF-PDS-C-026; EDF-PDS-L-002.
b. CO, particulates, NOx, SO2, hydrocarbons.

Table C.6.2-11. Construction and operations project data for the Long-Term Storage of Calcine in Bin Sets (P4).[a]

Generic Information		**Construction Information (continued)**	
Description/function and EIS Project number:	Long-term monitoring after the last HLW calcine has been placed in the bin sets (P4)	Hazardous/toxic chemicals & wastes:	
		Water usage:	
EIS alternatives/options:	No Action & Continued Current Operations	Energy requirements Electrical: Fossil fuel:	
Project type or waste stream:	HLW	**Operational Information**	
Action type:	Existing	Schedule start/end:	1999
Structure type: Size: (m^2) Other features: (pits, ponds, power/water/sewer lines)	Existing building NA NA	Number of workers Operations/Maintenance: Support:	 3 0
		Number of radiation workers:	0
Location Inside/outside of fence: Inside/outside of building:	 Inside INTEC fence Inside existing bin sets	Heavy equipment:	None
		Air emissions: (None/Reference)	None
		Effluents Sanitary wastewater: (L/yr)	 103,614
Construction Information			
Schedule start/end: Preconstruction: Construction: SO test and start-up:	No construction data is required because the facilities already exist and no modifications are required for this project.	Solid wastes Sanitary/Industrial trash: (m^3/yr)	 17
		Radioactive wastes:	None
		Hazardous/toxic chemicals & wastes:	None
Number of workers:		Mixed waste (LLW):	None
Heavy equipment:		Water usage Domestic water: (L/yr)	 103,614
Acres disturbed: New/previous/revegetated: (acres)		Energy requirements	
Air emissions: (None/Reference)		Electrical: (MWh/yr)	10
Effluents:		Fossil fuel: (L)	0
Solid wastes:			

a. Sources: EDF-PDS-C-018; EDF-PDS-L-002.

Table C.6.2-12. Construction and operations project data for Full Separations (P9A).[a]

Generic Information	
Description/function and EIS project number:	Separations and storage facilities (P9A)
EIS alternatives/options:	Full Separations Option
Project type or waste stream:	LAW and HAW
Action type:	New
Structure type:	Concrete and metal structures
Size: (m^2)	17,466
Other features: (pits, ponds, power/water/sewer lines)	Storage tanks
Location	
Inside/outside of fence:	Inside INTEC fence
Inside/outside of building:	Inside new buildings
Construction Information	
Schedule start/end:	
Pre-construction:	July 2000 – December 2007
Construction:	January 2008 – December 2012
SO test and start-up:	January 2012 – December 2014
Number of workers:	301
Number of radiation workers:	None
Heavy equipment	Excavator, grader, crane, trucks
Trips:	4,864 (total)
Hours of operation: (hrs)	55,305 (total)
Acres disturbed	
New/Previous/Revegetated: (acres)	None/4.5/None
Air emissions: (none/reference)	See Appendix C.2 for details
Dust: (tons/yr)	64
Fuel combustion (diesel exhasut):	
Major gas (CO_2): (tons/yr)	1,317
Contaminants[b]: (tons/yr)	64
SO testing and start-up:	
Process air emissions: (tons/yr)	0.156
Fossil fuel (steam use): (tons/yr)	37,189
Effluents	
Sanitary wastewater (construction): (L)	25,633,913
Sanitary wastewater (SO testing): (L/yr)	4,144,575
Process wastewater (SO testing): (L/yr)	507,744

Construction Information (continued)	
Water usage	
Dust control (construction): (L)	605,600
Domestic (construction): (L)	25,633,913
Domestic (SO testing): (L)	8,289,150
Process water (SO testing): (L)	846,029
Energy requirements	
Electrical (construction): (MWh/yr)	2,160
Fossil fuel:	
Heavy equipment (construction): (L)	1,710,085
Steam generation (SO testing): (L/yr)	13,034,054
Operational Information	
Schedule start/end:	January 2015 – December 2035
Treatment of SBW:	January 2015 – December 2016
Number of workers	
Operations/Maintenance/Support:	60/10/50 per yr
Number of radiation workers:	30/yr (included in above totals)
Avg. annual worker rad. dose: (rem/yr)	0.19 per worker
Heavy equipment	Mobile cranes, forklifts, trucks
Trips:	1,100 (total)
Air emissions: (None/Reference)	See Appendix C.2 for details
Building ventilation: (Ci/yr)	4.83E-07
Process radioactive emissions: (Ci/yr)	4.83E-05
Process chemical emissions: (tons/yr)	0.156
Fossil fuel emissions: (tons/yr)	37,189
Effluents	
Sanitary wastewater: (L/yr)	4,144,575
Solid wastes:	
Sanitary/Industrial trash: (m^3/yr)	665
Radioactive wastes	
HEPA filters (LLW): (m^3)	245
Hazardous/toxic chemicals & wastes	
Solvents, rags, etc: (m^3)	231
Mixed wastes (LLW)	
PPEs & misc. rad. wastes (m^3)	945
Amalgamated Hg: (m^3)	21
Mixed rad. liquid waste: (L)	2,590,875

Table C.6.2-12. Continued (P9A).

Construction Information (continued)		**Operational Information (continued)**	
Solid wastes		Water usage	
Construction trash: (m^3)	14,274	Process water: (L/yr)	705,024
Sanitary/industrial trash (SO test.) (m^3/yr)	665	Domestic: (L/yr)	4,144,575
Radioactive wastes		Energy requirements	
Contaminated soil (LLW): (m^3)	133	Electrical: (MWh/yr)	10,834
Hazardous/toxic chemicals & wastes		Energy requirements (continued)	
Lube oil: (L)	10,466 (total)	Fossil fuel	
Solid hazardous waste: (m^3)	217	Vehicle fuel: (L/yr)	91,597
		Steam generation: (L/yr)	13,034,054

a. Sources: EDF-PDS-E-001; EDF-PDS-L-002.

b. CO, particulates, NO_x, SO_2, hydrocarbons.

Table C.6.2-13. Decontamination and decommissioning project data for Full Separations (P9A).[a]

Decontamination and Decommissioning (D&D) Information			
Schedule start/end:	January 2036 – December 2038	Solid wastes	
Number of D&D workers:	224 per yr	Non-radioactive (industrial) (m^3)	23,615
Number of radiation workers (D&D):	102 workers/yr	Radioactive wastes	
Avg. annual worker rad dose: (rem/yr)	0.25 per worker	Misc. solid rad. waste (LLW): (m^3)	31,407
Heavy equipment		Hazardous/toxic chemicals & wastes	
Equipment used:	Mobile cranes, roll-off trucks, Dozers, loaders	Solid hazardous wastes: (m^3)	11
		Lube oil (used): (L)	21,308
Trips (roll-off trucks):	30 per day	Mixed wastes (LLW)	
Hours of operation		Decon solution: (L)	71,158
(all heavy equipment): (hrs)	112,590	Solid wastes: (m^3)	281
Acres disturbed		Water usage	
New/Previous/Revegetated: (acres)	None/4.5/None	Process water: (L)	6,854,625
Air emissions		Domestic water: (L)	14,334,956
Fuel combustion (diesel exhaust):		Energy requirements	
Gases (CO_2): (tons/yr)	2,625	Electrical: (MWh/yr)	156
Contaminants[b]: (tons/yr)	127 (total)	Fossil fuel: (L)	2,556,919
Effluents			
Sanitary wastewater: (L)	14,334,956		

a. Sources: EDF-PDS-E-001; EDF-PDS-L-002.
b. CO, particulates, NO_x, SO_2, hydrocarbons.

Table C.6.2-14. Construction and operations project data for Full Separations (P23A).[a]

Generic Information	
Description/function and EIS project number:	Separations and storage facilities (P23A)
EIS alternatives/options:	Planning Basis Option
Project type or waste stream:	LAW and HAW
Action type:	New
Structure type:	Concrete and metal structures
Size: (m^2)	17,466
Other features: (pits, ponds, power/water/sewer lines)	Storage tanks
Location	
Inside/outside of fence:	Inside INTEC fence
Inside/outside of building:	Inside new buildings
Construction Information	
Schedule start/end	
Pre-construction:	January 2005 – December 2012
Construction:	January 2013 – December 2017
SO test and start-up:	January 2017 – December 2019
Number of workers:	301
Number of radiation workers:	None
Heavy equipment	
Equipment used:	Excavator, grader, crane, trucks
Trips:	4,760 (total)
Hours of operation: (hrs)	53,907 (total)
Acres disturbed	
New/Previous/Revegetated: (acres)	None/4.5/None
Air emissions: (None/Reference)	See Appendix C.2 for details.
Dust: (tons/yr)	64
Fuel combustion (diesel exhasut):	
Major gas (CO_2): (tons/yr)	1,285
Contaminants[b]: (tons/yr)	63
SO testing and start-up:	
Process air emissions: (tons/yr)	0.156
Fossil fuel (steam use): (tons/yr)	37,188.6
Effluents	
Construction:	
Sanitary wastewater: (L)	25,633,913

Construction Information (continued)	
Water usage	
Dust control (construction): (L)	605,600
Domestic (construction): (L)	25,633,913
Domestic (SO testing): (L)	8,081,921
Process (SO testing): (L)	846,029
Energy requirements	
Electrical: (MWh/yr)	2,160
Fossil fuel:	
Heavy equipment (construction): (L)	1,668,627
Steam generation (SO testing): (L/yr)	13,750,054
Operational Information	
Schedule start/end:	January 2020 – December 2035
Number of workers:	
Operations/Maintenance/Support:	57/10/50 per yr
Number of radiation workers:	30 per yr (incl. in above totals)
Avg. annual worker rad. dose: (rem/yr)	0.19 per worker
Heavy equipment	
Equipment used:	Mobile cranes, forklifts, trucks
Trips:	1,100 (total)
Air emissions: (None/Reference)	See Appendix C.2 for details.
Building ventilation: (Ci/yr)	6.44E-07
Process radioactive emissions: (Ci/yr)	6.44E-05
Process chemical emissions: (tons/yr)	0.156
Fossil fuel emissions: (tons/yr)	37,188.6
Effluents	
Sanitary wastewater: (L/yr)	4,040,961
Solid wastes	
Sanitary/Industrial trash: (m^3/yr)	649
Radioactive wastes	
HEPA filters (LLW): (m^3)	98
Hazardous/toxic chemicals & wastes	
Solid hazardous wastes: (m^3)	176
Mixed wastes (LLW)	
Solid mixed wastes: (m^3)	16
PPEs & misc. mixed rad. waste: (m^3)	720
Mixed rad. liquid waste: (L)	1,033,200

Table C.6.2-14. Continued (P23A).

Construction Information (continued)		Operational Information (continued)	
SO testing and start-up:		Water usage	
Sanitary wastewater: (L/yr)	4,040,961	Process: (L/yr)	940,032
Process wastewater: (L/yr)	507,744	Domestic: (L/yr)	4,040,961
Solid wastes		Energy requirements	
Construction trash: (m^3)	14,274	Electrical: (MWh/yr)	10,589
Sanitary/indus. trash (SO test): (m^3/yr)	649	Fossil fuel:	
Radioactive waste		Steam generation: (L/yr)	13,750,054
Contaminated soil (LLW): (m^3)	64	Equipment/vehicle fuel: (L/yr)	91,597
Hazardous/toxic chemicals & wastes			
Lube oil: (L)	10,466		
Solid hazardous waste: (m^3)	288		

a. Sources: EDF-PDS-E-001; EDF-PDS-L-002.

b. CO, particulates, NO_x, SO_2, hydrocarbons.

Table C.6.2-15. Decontamination and decommissioning project data for Full Separations (P23A).[a]

Decontamination and Decommissioning (D&D) Information			
Schedule start/end:	January 2035 – December 2037	Effluents	
Number of D&D workers:	224 per yr	Sanitary wastewater: (L)	14,334,956
Number of radiation workers (D&D):	102 new workers/yr	Solid wastes	
Avg. annual worker rad dose: (rem/yr)	0.25 per worker	Non-radioactive (industrial) (m^3)	23,176
Heavy equipment		Radioactive wastes	
Equipment used:	Mobile cranes, roll-off trucks, dozers, loaders	Solid LLW: (m^3)	30,824
		Mixed waste (LLW)	
Trips (roll-off trucks):	30 per day	Solid mixed waste: (m^3)	281
Hours of operation (all heavy equipment): (hrs)	112,590	Decon solution: (L)	34,065
		Hazardous/toxic chemicals & wastes	
Acres disturbed		Solid hazardous waste: (m^3)	15
New/Previous/Revegetated: (acres)	None/4.5/None	Lube oil: (used) (L)	21,308
Air emissions: (None/Reference)	See Appendix C.2 for details.	Water usage	
Non-radioactive:		Process water: (L)	6,854,625
Fuel combustion (diesel exhaust):		Domestic water: (L)	14,334,956
Gases (CO_2): (tons/yr)	2,625	Energy requirements	
Contaminants[b]: (tons/yr)	127 (total)	Electrical: (MWh/yr)	156
HEPA filtered offgas: (Ci/yr)	5.81×10^{-8}	Fossil fuel: (L)	2,556,919

a. Sources: EDF-PDS-E-001; EDF-PDS-L-002.

b. CO, particulates, NO_x, SO_2, hydrocarbons.

Table C.6.2-16. Construction and operations project data for the Vitrification Plant (P9B).[a]

Generic Information		**Construction Information (continued)**	
Description/function and EIS project number:	Houses equipment/operations for vitrifying HAW (P9B)	Water usage	
EIS alternatives/options:	Separations/Full Separations	Dust control (construction): (L)	454,200
Project type or waste stream:	Vitrify the HAW	Domestic (construction): (L)	17,756,381
Action type:	New	Process (SO testing): (L)	869
		Domestic (SO testing): (L)	9,325,294
Structure type:	Reinforced concrete	Energy requirements	
Size: (m^2)	10,205	Electrical: (MWh/yr)	180
Other features: (pits, ponds, power/water/sewer lines)	None	Fossil fuel	
		Heavy equipment: (L)	409,134
Location		Steam generation (SO testing): (L/yr)	845,142
Inside/outside of fence:	Inside INTEC fence	**Operational Information**	
Inside/outside of building:	New building	Schedule start/end:	January 2016 – December 2035
Construction Information		Number of workers	
Schedule start/end		Operations/Maintenance/Support:	40/4/46 per yr
Preconstruction:	January 2003 – December 2008	Number of radiation workers:	40 per yr (incl. in above totals)
Construction:	January 2009 – December 2013	Avg. annual worker rad. dose: (rem/yr)	0.19 per worker
SO test and start-up:	January 2013 – December 2015	Heavy equipment	
Number of workers:	278 per yr	Equipment used:	Mobile cranes, forklifts, trucks
Number of radiation workers:	None	Trips:	220 trips per yr
Heavy equipment		Air emissions: (None/Reference)	See Appendix C.2 for details.
Equipment used:	Excavator, grader, crane, trucks	Building ventilation: (Ci/yr)	1.52E-07
Hours of operation: (hrs)	15,641 (total)	Process radioactive emissions[c]: (Ci/yr)	1.31E-07
Trips:	578	Process tritium emissions: (Ci/yr)	None
Acres disturbed		Process chemical emissions:	See Fluor Daniel, 1997 (DOE/ID 13206)
New/Previous/Revegetated: (acres)	None/1.1/None		
Air emissions: (None/Reference)	See Appendix C.2 for details.	Fossil fuel emissions: (tons/yr)	2,411
Dust: (tons/yr)	15	Effluents	
Fuel combustion (diesel exhaust):		Sanitary wastewater: (L/yr)	3,108,431
Major gas (CO_2): (tons/yr)	420	Solid wastes	
Contaminants[b]: (tons/yr)	20	Sanitary/Industrial trash: (m^3/yr)	499
SO testing and start-up:		Radioactive wastes	
Process air emissions: (tons/yr)	0.15	Process output: HLW glass: (m^3)/(Ci)	470/41,200,000
Fossil fuel (steam use): (tons/yr)	2,411	HEPA filters (LLW): (m^3)	209
Hazardous/toxic chemicals & wastes		Mixed wastes (LLW)	
Solid hazardous waste: (m^3)	162	PPEs & misc. rad. wastes: (m^3)	1,200
Lube oil: (L)	2,960	Liquid mixed waste: (L)	2,211,997

Table C.6.2-16. Continued (P9B).

Construction Information (continued)		Operational Information (continued)	
Radioactive wastes		Hazardous/toxic chemicals & wastes	
Contaminated soil: (m^3)	78	Solid hazardous wastes: (m^3)	585
Solid wastes		Water usage	
Construction trash: (m^3)	9,888	Process water: (L/yr)	6,227
SO testing:		Domestic water: (L/yr)	3,108,431
Sanitary/industrial trash: (m^3/yr)	499	Energy requirements	
Effluents		Electrical: (MWh/yr)	7,962
Sanitary ww (construction): (L)	17,756,381	Fossil fuel:	
SO testing and start-up		Steam generation: (L/yr)	845,142
Sanitary wastewater: (L/yr)	3,108,431	Equipment/vehicle fuel: (L/yr)	18,319
Process wastewater: (L/yr)	1,136		

a. Sources: EDF-PDS-F-003; EDF-PDS-L-002.

b. CO, particulates, NO_x, SO_2, hydrocarbons.

c. Source: EDF-PDS-C-046.

Table C.6.2-17. Decontamination and decommissioning project data for the Vitrification Plant (P9B).[a]

Decontamination and Decommissioning (D&D) Information			
Schedule start/end:	January 2036 – December 2038	Effluents	
Number of D&D workers:	72 per yr	Sanitary wastewater: (L)	4,599,781
Number of radiation workers (D&D):	45 new workers per yr	Solid wastes	
Avg. annual worker rad. dose: (rem/yr)	0.25 per worker	Non-radioactive (industrial): (m^3)	13,817
Heavy equipment		Radioactive wastes	
Equipment used:	Mobile cranes, roll-of trucks, dozers, loaders	Building debris (LLW): (m^3)/(Ci)	18,376/184
		Hazardous/toxic chemicals & wastes	
Trips (roll-off trucks):	10 per day	Lube oil: (L)	11,420
Hours of operation		Solid hazardous waste: (m^3)	6
(all heavy equipment): (hrs)	60,345	Mixed wastes (LLW)	
Acres disturbed		Decon solution: (L)	41,578
New/Previous/Revegetated: (acres)	None/1.1/None	Water usage	
Air emissions: (None/Reference)	See Appendix C.2 for details	Process water: (L)	2,284,875
Fuel combustion (diesel exhasut):		Domestic water: (L)	4,599,781
Gases (CO_2): (tons/yr)	1,407	Energy requirements	
Contaminants[b]: (tons/yr)	69 (total)	Electrical: (MWh/yr)	156
HEPA filtered offgas: (Ci/yr)	5.81E-08	Fossil fuel (equipment/vehicles): (L)	1,370,435

a. Sources: EDF-PDS-F-003; EDF-PDS-L-002.

b. CO, particulates, NO_x, SO_2, hydrocarbons.

Table C.6.2-18. Construction and operations project data for the Vitrification Plant (P23B).[a]

Generic Information	
Description/function and EIS project number:	Houses equipment and operations for vitrifying the HAW (P23B)
EIS alternatives/options:	Planning Basis Option
Project type or waste stream:	Vitrify the HAW
Action type:	New
Structure type:	Reinforced concrete
Size: (m^2)	10,205
Other features: (pits, ponds, power/water/sewer lines)	None
Location	
Inside/outside of fence:	Inside INTEC fence
Inside/outside of building:	New building
Construction Information	
Schedule start/end:	
Preconstruction:	January 2008 – December 2013
Construction:	January 2014 – December 2018
SO testing and start-up:	January 2018 – December 2020
Number of workers:	278 per yr
Number of radiation workers:	None
Heavy equipment	
Equipment used:	Excavator, grader, crane, trucks
Trips:	578
Hours of operation: (hrs)	15,641 (total)
Acres disturbed	
New/Previous/Revegetated: (acres)	None/1.1/None
Air emissions: (None/Reference)	See Appendix C.2 for details.
Dust: (tons/yr)	15
Fuel combustion (diesel exhaust):	
Major gas (CO_2): (tons/yr)	341
Contaminants[b]: (tons/yr)	17
SO testing and start-up:	
Process air emissions: (tons/yr)	0.15
Fossil fuel (steam use): (tons/yr)	2,411
Effluents	
Construction	
Sanitary wastewater: (L)	21,899,537

Construction Information (continued)	
Water usage	
Dust control (construction): (L)	560,180
Domestic water (construction): (L)	21,899,537
Process water (SO testing): (L)	1,672
Domestic water (SO testing): (L/yr)	3,108,431
Energy requirements	
Electrical: (MWh/yr)	180
Fossil fuel:	
Heavy equipment (construction): (L)	409,134
Steam generation (SO testing): (L/yr)	845,142
Operational Information	
Schedule start/end:	January 2021 – December 2035
Number of workers	
Operations:	40 per yr
Maintenance:	4 per yr
Support:	46 per yr
Number of radiation workers:	40/yr (included in above totals)
Avg. annual worker rad. dose: (rem/yr)	0.19 per worker
Heavy equipment	
Equipment used:	Mobile cranes, forklifts, trucks
Trips:	220 trips per yr
Air emissions: (None/Reference)	See Appendix C.2 for details.
Building ventilation: (Ci/yr)	1.52E-07
Process radioactive emissions[c]: (Ci/yr)	1.31E-07
Process chemical emissions:	See Fluor Daniel, 1997 (DOE/ID 13206)
Fossil fuel emissions: (tons/yr)	2,411
Effluents	
Sanitary wastewater: (L/yr)	3,108,431
Solid wastes	
Sanitary/Industrial trash: (m^3/yr)	499
Radioactive wastes	
Process output:	
HLW glass: (m^3)	470
HEPA filters (LLW): (m^3)	86
Hazardous/toxic chemicals & wastes	

Table C.6.2-18. Continued (P23B).

Construction Information (continued)		**Operational Information (continued)**	
SO Testing & start-up		Solid hazardous wastes: (m^3)	504
Sanitary wastewater: (L/yr)	3,108,481		
Process wastewater: (L/yr)	921		
Solid wastes		Mixed wastes (LLW)	
Construction trash: (m^3)	12,195	PPEs & misc. rad. wastes: (m^3)	900
Sanitary/ind. trash (SO test.): (m^3/yr)	499	Mixed rad. liquid wastes: (L)	910,647
Hazardous/toxic chemicals & wastes		Water usage	
Solid hazardous waste: (m^3)	128	Process water: (L/yr)	8,637
Lube oil: (L)	2,960	Domestic water: (L/yr)	3,108,431
Radioactive wastes		Energy requirements	
Contaminated soil: (m^3)	16	Electrical: (MWh/yr)	7,962
		Fossil fuel	
		Steam generation: (L/yr)	845,142
		Equipment/vehicle fuel: (L/yr)	18,319

a. Sources: EDF-PDS-F-003; EDF-PDS-L-002.

b. CO, particulates, NO_x, SO_2, hydrocarbons.

c. Source: EDF-PDS-C-046.

Table C.6.2-19. Decontamination and decommissioning project data for the Vitrification Plant (P23B).[a]

Decontamination and Decommissioning (D&D) Information			
Schedule start/end:	January 2036 – December 2037	Effluents	
Number of D&D workers:	78 per yr	Sanitary wastewater: (L)	4,599,781
Number of radiation workers (D&D):	49 new workers per yr	Solid wastes	
Avg. annual worker radiation dose:	0.25 rem/yr per worker	Non-radioactive (industrial): (m^3)	13,817
Heavy equipment		Radioactive wastes:	
Equipment used:	Mobile cranes, roll-of trucks, dozers, loaders	Building debris (LLW): (m^3)/(Ci)	18,376/184
		Hazardous/toxic chemicals & wastes	
Trips (roll-off trucks):	10 per day	Lube oil: (L)	10,507
Hours of operation (all heavy equipment): (hrs)	55,517	Solid hazardous waste: (m^3)	6
Acres disturbed		Mixed wastes (LLW)	
New/Previous/Revegetated: (acres)	None/1.1/None	Decon solution: (L)	8,327
Air emissions: (None/Reference)	See Appendix C.2 for details.	Water usage	
Fuel combustion (diesel exhasut):		Process water: (L)	6,306,255
		Domestic water: (L)	4,599,781
Gases (CO_2): (tons/yr)	1,407	Energy requirements	
Contaminants[b]: (tons/yr)	69 (total)	Electrical: (MWh/yr)	156
HEPA filtered offgas: (Ci/yr)	5.81E-08	Fossil fuel: (L)	1,260,800

a. Sources: EDF-PDS-F-003; EDF-PDS-L-002.

b. CO, particulates, NO_x, SO_2, hydrocarbons.

Table C.6.2-20. Construction and operations project data for the Class A Grout Plant (P9C).[a]

Generic Information	
Description/function and EIS project number:	Denitrate the LAW and mix it with grout materials (P9C)
EIS alternatives/options:	Separations/Full Separations
Project type or waste stream:	Denitrated LAW
Action type:	New
Structure type:	Reinforced concrete
Size: (m^2)	4,413
Other features: (pits, ponds, lines)	None
Location	
Inside/outside of fence:	Inside INTEC fence
Inside/outside of building:	Inside new building
Construction Information	
Schedule start/end	
Preconstruction:	January 2006 – December 2010
Construction:	January 2011 – December 2012
SO test and start-up:	January 2013 – December 2014
Number of workers:	155 per yr
Number of radiation workers:	None
Heavy equipment	
Equipment used:	Excavator, grader, crane, trucks
Trips:	1,946
Hours of operation: (hrs)	17,756
Acres disturbed	
New/Previous/Revegetated (acres)	None/1.0/None
Air emissions: (None/Reference)	See Appendix C.2 for details.
Dust: (tons/yr)	15
Fuel combustion (diesel exhaust):	
Major gas (CO_2): (tons/yr)	901
Contaminants[b]: (tons/yr)	44
SO testing and start-up:	
Process air emissions: (tons/yr)	0.15
Fossil fuel (steam use): (tons/yr)	2,304.51
Effluents	
Sanitary wastewater (constr.): (L)	6,600,094
SO testing:	
Sanitary wastewater: (L/yr)	1,312,449
Construction Information (continued)	
Water usage	
Dust control (construction): (L)	302,800
Domestic (construction): (L)	6,600,094
Domestic (SO testing): (L/yr)	1,312,449
Process (SO testing): (L)	35,618,551
Energy requirements	
Electrical: (MWh/yr)	180
Fossil fuel:	
Heavy equipment (construction): (L)	584,922.5
Steam generation (SO testing): (L/yr)	807,650
Operational Information	
Schedule start/end:	January 2015 – December 2035
Number of workers	
Operations:	20
Maintenance:	4
Support:	14
Number of radiation workers per year:	16 (included in above totals)
Avg. annual worker rad. dose: (rem/yr)	0.19 per worker
Heavy equipment	
Equipment used:	Mobile cranes, forklifts, trucks
Trips:	220 per yr
Air emissions: (None/Reference)	See Appendix C.2 for details.
Building ventilation: (Ci/yr)	1.44E-07
Process radioactive emissions[c]: (Ci/yr)	1.49E-03
Process tritium emissions[d]: (Ci/yr)	45
Process chemical emissions[e]: (lb/hr)	11.0
Fossil fuel emissions: (tons/yr)	2,304.51
Effluents	
Sanitary wastewater: (L/yr)	1,312,449
Solid wastes	
Sanitary/industrial trash: (m^3/yr)	211
Radioactive wastes	
LLW grout: (m^3)/(Ci)	27,000/35,500
HEPA filters (LLW): (m^3)	313
Mixed wastes (LLW)	
PPEs & misc. rad. wastes: (m^3)	504
Liquid mixed wastes: (L)	3,313,586

Table C.6.2-20. Continued (P9C).

Construction Information (continued)		Operational Information	
Solid wastes		Hazardous/toxic chemicals & wastes	
Construction trash: (m^3)	3,675	Solid hazardous wastes: (m^3)	682
SO testing:		Water usage	
Sanitary/industrial trash: (m^3/yr)	211	Process: (L/yr)	17,809,275
Hazardous/toxic chemicals & wastes		Domestic: (L/yr)	1,312,449
Solid hazardous waste: (m^3)	97	Energy requirements	
Lube oil: (L)	3,380	Electrical: (MWh/yr)	6,158
Radioactive wastes		Fossil fuel:	
Contaminated soil (LLW): (m^3)	34	Steam generation: (L/yr)	807,650
		Equipment/vehicle fuel: (L/yr)	18,319

a. Sources: EDF-PDS-G-001; EDF-PDS-L-002.
b. CO, particulates, NO_x, SO_2, hydrocarbons
c. Source: EDF-PDS-C-046.
d. Released for 2 years via denitrations process. Source: EDF-PDS-C-046.
e. Source: EDF-PDS-C-043.

Table C.6.2-21. Decontamination and decommissioning project data for the Class A Grout Plant (P9C).[a]

Decontamination and Decommissioning (D&D) Information			
Schedule start/end:	January 2036 – June 2038	Solid wastes	
Number of D&D workers:	119 per yr	Non-radioactive (industrial): (m^3)	5,974
Number of radiation workers (D&D):	74 per yr	Radioactive wastes	
Avg. annual worker rad. dose: (rem/yr)	0.25 per worker	Building debris (LLW): (m^3)/(Ci)	7,945/79
Heavy equipment	Mobile cranes, roll-off trucks, dozers, loaders	Hazardous/toxic chemicals & wastes	
		Lube oil: (L)	9,517
Trips (roll-off trucks):	10 per day	Solid hazardous waste: (m^3)	3
Hours of operation (all heavy equipment): (hrs)	50,288	Mixed wastes (LLW)	
		Decon solution: (L)	17,979
Acres disturbed		Water usage	
New/Previous/Revegetated: (acres)	None/1.0/None	Process water: (L)	5,712,188
Air emissions: (None/Reference)	See Appendix C.2 for details.	Domestic water: (L)	6,315,245
Fuel combustion:		Energy requirements	
Major gases (CO_2): (tons/yr)	1,407	Electrical: (MWh/yr)	156
Contaminants[b]: (tons/yr)	69 (total)	Fossil fuel: (L)	1,142,029
HEPA filtered offgas: (Ci/yr)	5.81E-08		
Effluents			
Sanitary wastewater: (L)	6,315,245 (total)		

a. Sources: EDF-PDS-G-001; EDF-PDS-L-002.

b. CO, particulates, NO_x, SO_2, hydrocarbons.

Table C.6.2-22. Construction and operations project data for the Class A Grout Plant (P23C).[a]

Generic Information	
Description/function and EIS project number:	Denitrate the LAW and mix with grout materials (P9C)
EIS alternatives/options:	Full Separations Option
Project type or waste stream:	Denitrated LAW
Action type:	New
Structure type:	Reinforced concrete
Size: (m^2)	4,413
Other features: (pits, ponds, lines)	None
Location	
Inside/outside of fence:	Inside INTEC fence
Inside/outside of building:	Inside new building
Construction Information	
Schedule start/end	
Preconstruction:	January 2009 – March 2014
Construction:	April 2014 – December 2017
SO testing and start-up:	January 2018 – December 2019
Number of workers:	155 per yr
Number of radiation workers:	None
Heavy equipment:	
Equipment used:	Excavator, grader, crane, trucks
Trips:	1,946
Hours of operation: (hrs)	17,756 (total)
Acres disturbed	
New/Previous/Revegetated: (acres)	None/1.0/None
Air emissions: (None/Reference)	See Appendix C.2 for details.
Dust: (tons/yr)	15
Fuel combustion (diesel exhaust):	
Major gas (CO_2): (tons/yr)	487
Contaminants[b]: (tons/yr)	24
SO testing and start-up:	
Process air emissions: (tons/yr)	0.15
Fossil fuel (steam use): (tons/yr)	2,304.51
Effluents	
Sanitary wastewater (construct.): (L)	12,210,173
SO testing & start-up:	
Sanitary wastewater: (L/yr)	1,312,449
Process wastewater: (L/yr)	2,406,659

Construction Information (continued)	
Water usage	
Dust control (construction): (L)	560,180
Domestic (construction): (L)	12,210,173
Process (SO testing): (L)	12,851,403
Domestic (SO testing): (L)	2,296,785
Energy requirements	
Electrical: (MWh/yr)	180
Fossil fuel:	
Heavy equipment: (L)	584,923
Steam generation (SO testing): (L/yr)	807,650
Operational Information	
Schedule start/end:	January 2020 – December 2035
Number of workers	
Operations:	20
Maintenance:	4
Support:	14
Number of radiation workers:	16 (included in above totals)
Avg. annual worker rad. dose: (rem/yr)	0.19 per worker
Heavy equipment	
Equipment used:	Mobile cranes, forklifts, trucks
Trips:	220
Air emissions: (None/Reference)	See Appendix C.2 for details.
Building ventilation: (Ci/yr)	1.44E-07
Process radioactive emissions[c]: (Ci/yr)	1.49E-03
Process tritium emissions[d]: (Ci/yr)	45
Process chemical emissions[e]: (lb/hr)	11.0
Fossil fuel emissions: (tons/yr)	2,304.51
Effluents	
Sanitary wastewater: (L/yr)	1,312,449
Solid wastes	
Sanitary/industrial trash: (m^3/yr)	211
Radioactive wastes	
LLW grout: (m^3)/(Ci)	30,000/35,500
HEPA filters (LLW): (m^3)	224
Hazardous/toxic chemicals & wastes	
Solid hazardous wastes: (m^3)	504
Mixed wastes (LLW)	

Table C.6.2-22. Continued. (P23C)

Construction Information (continued)		Operational Information (continued)	
Solid wastes		PPEs & misc. mixed rad. wastes: (m^3)	384
Construction trash: (m^3)	6,799	Mixed rad. liquid wastes: (L)	2,366,237
SO testing:		Water usage	
Sanitary/industrial trash: (m^3/yr)	211	Process: (L/yr)	25,702,806
		Domestic: (L/yr)	1,312,449
Hazardous/toxic chemicals & wastes		Energy requirements	
Solid hazardous wastes: (m^3)	120	Electrical: (MWh/yr)	6,158
Lube oil: (L)	3,360	Fossil fuel:	
Radioactive wastes		Steam generation: (L/yr)	807,650
Contaminated soil: (m^3)	22	Equipment/vehicle fuel: (L/yr)	18,319.4

a. Sources: EDF-PDS-G-001; EDF-PDS-L-002.
b. CO, particulates, NO_x, SO_2, hydrocarbons.
c. Source: EDF-PDS-C-046.
d. Released for 2 years via denitrations process. Source: EDF-PDS-C-046.
e. Source: EDF-PDS-C-043.

Table C.6.2-23. Decontamination and decommissioning project data for the Class A Grout Plant (P23C).[a]

Decontamination and Decommissioning (D&D) Information			
Schedule start/end:	December 2036 – September 2037	Effluents	
Number of D&D workers:	107 per yr	Sanitary wastewater: (L)	6,315,245
Number of radiation workers (D&D):	67 per yr	Solid wastes	
Avg. annual worker rad. dose: (rem/yr)	0.25 per worker	Non-radioactive (industrial): (m^3)	5,974
Heavy equipment		Radioactive wastes	
Equipment used:	Mobile cranes, roll-off trucks, dozers, loaders	Building debris (LLW): (m^3)	7,945
		Hazardous/toxic chemicals & wastes	
Trips (roll-off trucks):	10 per day	Non-radioactive lube oil: (L)	10,507
Hours of operation (all heavy equipment): (hrs)	55,517	Solid hazardous wastes: (m^3)	3
Acres disturbed		Mixed wastes	
New/Previous/Revegetated: (acres)	None/1.0/none	Decon solution: (L)	11,734
Air emissions: (None/Reference)	See Appendix C.2 for details.	Water usage	
Fuel combustion:		Process water: (L)	6,306,255
Major gases (CO_2): (tons/yr)	1,407	Domestic water: (L)	6,315,245
Contaminants[b]: (tons/yr)	69 (total)	Energy requirements	
		Electrical: (MWh/yr)	156
HEPA filtered offgas: (Ci/yr)	5.81E-08	Fossil fuel: (L)	1,260,800

a. Sources: EDF-PDS-G-001; EDF-PDS-L-002.

b. CO, particulates, NO_x, SO_2, hydrocarbons.

Table C.6.2-24. Construction and operations project data for the HAW Denitration, Packaging and Cask Loading Facility (P9J).[a]

Generic Information	
Description/function and EIS project number:	Proposed new facilities for processing HAW for shipment to a permanent repository (P9J)
EIS alternatives/options:	Stand-alone project
Project type or waste stream:	TRUEX strip effluent, SREX, Cs Ion Exchange Effluent
Action type:	New
Structure type:	New facility
Size: (m^2)	3,395
Other features: (pits, ponds, power/water/sewer lines)	Power, water, and sewer
Location:	
Inside/outside of fence:	Inside INTEC fence
Inside/outside of building:	Inside new building
Construction Information	
Schedule start/end	
Preconstruction:	January 2002 – December 2007
Construction:	January 2008 – December 2011
SO test and start-up:	January 2012 – December 2014
Number of workers:	121 per yr
Number of radiation workers:	None
Heavy equipment:	
Equipment used:	Excavator, crane, material delivery Trucks
Trips (construction/SO testing):	6,501/189
Hours of operation: (hrs)	35,886 (total)
Acres disturbed:	
New/Previous/Revegetated: (acres)	None/3.0/None
Air emissions: (None/Reference)	See Appendix C.2 for details.
Dust: (tons/yr)	43
Diesel exhaust:	
Major gas (CO_2): (tons/yr)	836
Contaminants[b]: (tons/yr)	38.1
SO testing & start-up:	
Steam generation: (tons/yr)	6,532
Diesel/Kerosine exhaust: (tons/yr)	312.6
Construction Information (continued)	
Water usage	
Dust control (construction): (L)	1,234,000
Domestic (construction): (L)	10,305,000
Domestic (SO testing): (L)	1,533,000
Process (SO testing): (L)	68,550,000
Energy requirements	
Electrical: (MWh/yr)	180
Fossil fuel	
Heavy equipment/trips (const.): (L)	1,086,000
Steam generation (SO testing): (L)	6,867,000
Equip./vehicle fuel (SO testing): (L)	15,000
Kerosine (SO testing): (L)	276,000
Operational Information	
Schedule start/end:	January 2015 – December 2035
Number of workers	
Operations/Maintenance/Support:	8/5/35 per year
Number of radiation workers:	41 (inc. in above total)
Avg. annual worker rad. dose: (rem/yr)	0.19 per worker
Heavy equipment	
Trips:	189
Air emissions: (None/Reference)	See Appendix C.2 for details
Diesel exhaust:	
Major gas (CO_2): (tons/yr)	589
Contaminants[b]: (tons/yr)	26.8
Steam generation: (tons/yr)	8,835.5
Offgas from MACT: (tons/yr)	1.22
Building ventilation: (Ci/yr)	4.4E-08
Effluents:	
Sanitary wastewater: (L/yr)	1,022,000
Service wastewater: (L/yr)	65,300,000
Solid wastes:	
Sanitary/industrial trash: (m^3/yr)	0.08 (ash)
Radioactive wastes	
Process output: (m^3/yr)/(Ci/yr)	12/1,530,680
PPE (MLLW): (m^3/yr)/(Ci/yr)	0.041/0.030
Mixed hazardous wastes (LLW)	

Table C.6.2-24. Continued (P9J).

Construction Information (continued)		**Operational Information (continued)**	
Effluents		Hazardous/toxic chemicals & wastes	
Construction:		Activated carbon: (m^3/yr)/(Ci/yr)	1.048/1.05E-06
Sanitary wastewater: (L)	10,305,000	Kiln brick replacement: (m^3/yr)/(Ci/yr)	0.476/0.216
SO Testing & start-up:		Paint, solvents, etc: (m^3/yr)	2.8
Sanitary wastewater: (L)	1,533,000	Water usage	
Service wastewater: (L)	97,950,000	Process water: (L/yr)	45,700,000
Solid wastes		Domestic water: (L/yr)	1,022,000
Sanitary/industrial trash		Energy requirements:	
Construction: (m^3)	5,736	Electrical: (MWh/yr)	4,520
SO Testing: (m^3)	0.12 (ash after cubing/combustion)	Fossil fuel: (L/yr)	
Hazardous/toxic chemicals & wastes		Steam generation:	3,100,000
Used lube oil: (m^3)	Incinerated at WERF	Kerosine for denitrator & MACT:	184,000
Other hazardous waste: (m^3)	10.8	Equipment/vehicle fuel:	7,218
Hazardous waste (SO testing): (m^3)	2.8		

a. Sources: EDF-PDS-I-025; EDF-PDS-L-002.

b. CO, particulates, NO_x, SO_2, hydrocarbons.

Table C.6.2-25. Decontamination and decommissioning project data for the HAW Denitration, Packaging and Cask Loading Facility (P9J).[a]

Decontamination and Decommissioning (D&D) Information			
Schedule start/end:	January 2036 – December 2038	Effluents	
Number of D&D workers:	83 per yr	Sanitary wastewater: (L)	5,290,000
Number of radiation workers (D&D):	40 new workers per yr	Solid wastes	
Avg. annual worker rad. dose: (rem/yr)	0.25 per worker	Metal recycle: (m^3)	45.5
Heavy equipment:		Building debris: (m^3)	9,192
Equipment used:	Mobile cranes, roll-off trucks, Dozers, loaders	Radioactive wastes	
		LLW building debris: (m^3)/(Ci)	11,879/118.79
Trips:	3 per day	PPEs: (m^3)/(Ci)	2.8/1.99
Total hours of operation: (hrs)	56,970	Hazardous/toxic chemicals and wastes	
Acres disturbed		Misc. for building demolition: (m^3)	4.1
New: (acres)	None	Used lube oil:	Incinerated at WERF
Previous: (acres)	3.0	Water usage	
Revegetated: (acres)	None	Domestic water: (L)	5,290,000
Air emissions: (None/Reference)	See Appendix C.2 for details.	Process water: (L)	511,000
Dust: (tons/yr)	43	Energy requirements	
Fuel combustion:		Electrical: (MWh/yr)	156
Major gas (CO_2): (tons/yr)	3,986	Fossil fuel: (L)	1,294,000
Contaminants[b]: (tons/yr)	60.4 (total)		

a. Sources: EDF-PDS-I-025; EDF-PDS-L-002.
b. CO, particulates, NO_x, SO_2, hydrocarbons.

Table C.6.2-26. Construction and operations project data for the New Analytical Laboratory (P18).[a]

Generic Information	
Description/function and EIS project number:	Provide the capability to perform analyses on samples from facilities processing high level waste (P18)
EIS alternatives/options:	Full & TRU Seps. & PB Options, HIP, DC, EV Options, & Minimum INEEL Processing Alt.
Project type or waste stream:	Waste management program
Action type:	New and existing
Structure type:	Concrete and steel laboratory
Size: (m^2)	1,709
Other features: (pits, ponds, lines)	Pneumatic transfer lines
Location:	
Inside/outside of fence:	Inside INTEC fence
Inside/outside of building:	Inside new and existing buildings
Construction Information (Environmental Analytical Laboratory only)	
Schedule start/end:	
Preconstruction:	July 2006 – December 2010
Construction:	January 2011 – December 2012
SO test and start-up:	January 2013 – December 2014
Planning Basis Option only:	
Preconstruction:	October 2011 – December 2015
Construction:	January 2016 – December 2017
SO test and start-up:	January 2018 – December 2019
Number of workers:	59 per yr
Number of radiation workers:	None
Heavy equipment	Excavator, grader, crane, trucks
Trips	147
Hours of operation: (hrs)	11,913 (total)
Acres disturbed	
New/Previous/Revegetated: (acres)	None/0.6/none
Air emissions: (None/Reference)	See Appendix C.2 for details.
Dust: (tons/yr)	9
Fuel combustion (diesel exhaust):	
Major gas (CO_2): (tons/yr)	439
Contaminants[b]: (tons/yr)	21

Construction Information (continued)	
Hazardous/toxic chemicals & wastes	
Lube oil: (L)	1,991
Acid/caustic liquid waste: (m^3)	65
Water usage	
Dust control (construction): (L)	302,800
Domestic (construction): (L)	2,512,294
Domestic (SO testing): (L)	14,506,013
Energy requirements	
Electrical: (MWh/yr)	180
Fuel oil:	
Heavy equipment: (L)	285,031
Steam generation (SO testing): (L/yr)	165,508
Process use (SO testing): (L)	8,660
Operational Information (Environmental Analytical Laboratory)	
Schedule start/end:	January 2015 – December 2040
Planning Basis Option only:	January 2020 – December 2040
Number of workers	
Operations/Maintenance/Support:	80/10/15 per yr
Number of radiation workers per year:	30 (included in above totals)
Avg. annual worker rad. dose: (rem/yr)	0.19 per worker
Heavy equipment	
Equipment used:	Delivery truck
Trips:	26
Air emissions: (None/Reference)	See Appendix C.2 for details.
Building ventilation: (Ci/yr)	4.99E-07
Process chemical emissions: (tons/yr)	0.5
Fossil fuel emissions: (tons/yr)	472.15
Effluents	
Sanitary wastewater: (L/yr)	3,626,503
Solid wastes	
Sanitary/industrial trash: (m^3/yr)	582
Radioactive wastes	
HEPA filters (LLW): (m^3)	27
Hazardous/toxic chemicals & wastes	None

Table C.6.2-26. Continued (P18).

Construction Information (continued)		**Operational Information (continued)**	
SO testing and start-up:		Mixed wastes (LLW)	
Process air emissions: (tons/yr)	1	Liquid mixed waste: (L)	599,040
Fossil fuel (steam use): (tons/yr)	472.15	PPEs: (m^3)	1,170
Effluents		Water usage	
Sanitary wastewater:		Domestic: (L/yr)	3,626,503
Construction: (L)	2,512,294	Energy requirements	
SO testing & start-up: (L/yr)	3,626,503	Electrical: (MWh/yr)	7,541
Solid wastes		Fossil fuel	
Construction trash: (m^3)	1,399	Equipment/vehicle fuel: (L/yr)	2,165
Sanitary/industrial trash: (m^3/yr)	582	Steam generation: (L/yr)	165,508
Radioactive wastes			
Contaminated soil (LLW): (m^3)	13		

a. Sources: EDF-PDS-C-008; EDF-PDS-L-002.

b. CO, particulates, NO_x, SO_2, hydrocarbons.

Table C.6.2-27. Decontamination and decommissioning project data for the New Analytical Laboratory (P18).[a]

Decontamination and Decommissioning (D&D) Information			
Schedule start/end:	January 2041 – December 2042	Effluents	
Number of D&D workers:	88 per yr	Sanitary wastewater: (L)	7,487,169
Number of radiation workers (D&D):	30 new workers per yr (included in total above)	Radioactive wastes Demolition material (LLW)[c]: (m^3)	3,050
Avg. annual worker rad. dose: (rem/yr)	0.25 per worker	Solid wastes	
Heavy equipment		Non-radioactive (industrial): (m^3)	4,621 (EAL+RAL)
Equipment used:	Mobile cranes, roll-off trucks, Dozers, loaders	Non-radioactive waste description:	Material from demolition[c]
		Hazardous/toxic chemicals & wastes	
Trips (roll-off trucks):	6 per day	Lube oil: (L)	4,940
Hours of operation (all heavy equipment): (hrs)	52,200	Mixed solid waste Mixed solid waste: (m^3)	90
Acres disturbed		Decon solution: (L)	6,964
New/Previous/Revegetated: (acres)	None/0.6 acres for each of the 2 D&D exercises/ None	Water usage Process water: (L)	1,703,250
Air emissions: (None/Reference)	See Appendix C.2 for details.	Domestic water: (L)	7,487,169
Fuel combustion (diesel exhaust):		Energy requirements	
Gases (CO_2): (tons/yr)	913	Electrical: (MWh/yr)	156
Contaminants[b]: (tons/yr)	44 (total)	Fossil fuel: (L)	1,185,462
HEPA filtered offgas: (Ci/yr)	5.81E-08		

a. Sources: EDF-PDS-C-008; EDF-PDS-L-002.

b. CO, particulates, NO_x, SO_2, hydrocarbons.

c. The total for both labs (as shown above) is assumed to be twice that for environmental lab alone.

Table C.6.2-28 Construction and operations project data for the Remote Analytical Laboratory Operations (P18MC).[a]

Generic Information	
Description/function and EIS project number:	Provide the capability to perform analyses on samples from facilities processing high level waste (P18MC)
EIS alternatives/options:	No Action & Continued Current Operations
Project type or waste stream:	Waste management program
Action type:	D&D of existing facility, LLW Disposal
Structure type:	Laboratory
Size: (m^2)	1,115
Other features: (pits, ponds, lines)	Pneumatic transfer lines
Location:	
Inside/outside of fence:	Inside INTEC fence
Inside/outside of building:	Inside new and existing buildings
Construction Information	
Schedule start/end:	No construction activities associated with this project.
Number of workers:	
Heavy equipment:	
Acres disturbed:	
New/Previous/Revegetated: (acres)	
Air emissions: (None/Reference)	
Effluents:	
Solid wastes:	
Hazardous/toxic chemicals & wastes	
Water usage: (L)	
Energy requirements	
Electrical: (MWh/yr)	
Fossil fuel: (L)	

Operational Information	
Schedule start/end: (for RAL)	January 2007 – December 2035
Number of workers	
Operations:	40 per yr
Maintenance:	5 per yr
Support:	7 per yr
Number of radiation workers	
No Action:	5/yr (included in above totals)
Continued Current Operations:	10/yr (included in above totals)
Avg. annual worker rad. dose: (rem/yr)	0.19 per worker
Heavy equipment	
Equipment used:	Delivery truck
Trips:	13 per yr
Air emissions: (None/Reference)	See Appendix C.2 for details.
Building ventilation: (Ci/yr)	2.50E-07
Process chemical emissions: (tons/yr)	0.3
Fossil fuel emissions[b]: (tons/yr)	392.8
Effluents	
Sanitary wastewater: (L/yr)	1,795,983
Solid wastes	
Sanitary/Industrial trash: (m^3/yr)	172
Radioactive wastes	
HEPA filters (LLW): (m^3)	20
Misc. solid wastes (LLW): (m^3)	87
Mixed wastes (LLW)	
PPEs (No action/Cont. current ops): (m^3)	218/435
Rad. liquids (HEPA wash, lab pack): (L)	382,800
Hazardous/toxic chemicals & wastes:	None
Water usage (domestic): (L/yr)	1,795,983
Energy requirements	
Electrical: (MWh/yr)	3,770
Fossil fuel	
Steam generation: (L/yr)	137,638
Equipment/vehicle fuel: (L/yr)	1,083

a. Sources: EDF-PDS-C-023; EDF-PDS-L-002.
b. CO_2, CO, particulates, NO_x, SO_2, hydrocarbons.

Table C.6.2-29. Construction and operations project data for the Vitrified Product Interim Storage (P24).[a]

Generic Information	
Description/function and EIS project number:	Interim storage of vitrified product (P24)
EIS alternatives/options:	Full Separations, Planning Basis & Minimum INEEL Processing
Project type or waste stream:	Vitrified high-activity waste
Action type:	New building – Interim Storage Facility
Structure type	
Size: (m^2)	2,973
Other features: (pits, ponds, lines)	None
Location:	
Inside/outside of fence:	Inside INTEC fence
Inside/outside of building:	Inside new building
Construction Information	
Schedule start/end[b]	
Full Separations Option:	
Preconstruction:	October 2005 – September 2010
Construction:	October 2010 – June 2014
SO test and start-up:	July 2014 – December 2015
Number of workers:	111 per yr
Number of radiation workers:	None
Heavy equipment	
Equipment used:	Excavator, trucks, grader, cranes
Trips:	1,349
Hours of operation: (hrs)	12,058 (total)
Acres disturbed	
New/Previous/Revegetated: (acres)	None/3.0/None
Air emissions: (None/Reference)	See Appendix C.2 for details.
Dust: (tons/yr)	43
Fuel combustion (diesel exhaust):	
Major gas (CO_2): (tons/yr)	333
Contaminants[c]: (tons/yr)	16
Effluents	
Sanitary wastewater (constr.): (L)	8,744,060
Sanitary wastewater (SO testing): (L)	381,646
Radioactive wastes	
Contaminated soil (LLW): (m^3)	23

Construction Information (continued)	
Solid wastes	
Construction trash: (m^3)	4,869
Sanitary/Industrial trash (SO test.): (m^3/yr)	61
Hazardous/toxic chemicals & wastes	
Lube oil: (L)	2,282
Solid hazardous wastes: (m^3)	221
Water usage	
Dust control (construction): (L)	950,906
Domestic (construction): (L)	8,744,060
Domestic (SO testing): (L)	381,646
Energy requirements	
Electrical (constr./SO testing): (MWh/yr)	180/290
Fossil fuel	
Heavy equipment (construction): (L)	273,828
Other use (construction): (L)	125,945
Operational Information	
Schedule start/end:	
Full Separations Option:	January 2016 – indefinite
Planning Basis Option:	January 2021 – indefinite
Minimum INEEL Processing:	Unknown
Number of workers	
Operations/Maintenance/Support:	1.5/1/4 per yr
Number of radiation workers:	5 (included in above totals)
Avg. annual worker rad. dose: (rem/yr)	0.19 per worker
Heavy equipment:	None
Air emissions: (None/Reference)	None
Effluents	
Sanitary wastewater: (L/yr)	224,498
Solid wastes	
Sanitary/industrial trash: (m^3/yr)	36
Hazardous/toxic chemicals and wastes	
Solid hazardous waste: (m^3)	36
Radioactive wastes:	None
Water usage (domestic): (L/yr)	224,498
Energy requirements	
Electrical: (MWh /yr)	290
Fossil fuel: (L)	None

a. Sources: EDF-PDS-H-001; EDF-PDS-L-002.
b. Planning Basis Option: Preconstruction - October 2010 – September 2015; Construction – October 2015 – June 2019; SO testing and start-up – July 2019 – December 2020. Minimum INEEL Processing Alternative: Unknown.
c. CO, particulates, NO_x, SO_2, hydrocarbons.

Table C.6.2-30. Decontamination and decommissioning project data for the Vitrified Product Interim Storage (P24).[a]

Decontamination and Decommissioning (D&D) Information			
Schedule start/end:	Unknown	Effluents	
Number of D&D workers :	31 per yr	Sanitary wastewater: (L)	1,831,745
Number of radiation workers: (D&D)	3 per year	Solid wastes	
Avg. annual worker rad. dose: (rem/yr)	None expected (0.25 per worker if found)	Building rubble: (m^3) Metals: (m^3)	9,405 20
Heavy equipment Equipment used: Trips (roll-off trucks): Hours of operation: (all heavy equipment): (hrs)	 Mobile cranes, roll-off trucks, Dozers, loaders 2 per day 15,120 hours	Hazardous/toxic chemicals & wastes Haz. waste from demolition: (m^3) Lube oil: (L) Water usage Domestic water: (L)	 2 2,861 1,831,745
Acres disturbed New/Previous/Revegetated: (acres)	 None/3.0/None	Energy requirements Electrical: (MWh/yr) Fossil fuel: (L)	 156 343,375
Air emissions: (None/Reference) Fuel combustion: Gases (CO_2): (tons/yr) Contaminants[b]: (tons/yr)	See Appendix C.2 for details. 378 18		

a. Sources: EDF-PDS-H-001; EDF-PDS-L-002.

b. CO, particulates, NO_x, SO_2, hydrocarbons.

Table C.6.2-31. Construction and operations project data for the Packaging and Loading Vitrified HLW at INTEC for Shipment to a Geologic Repository (P25A).[a]

Generic Information	
Description/function and EIS project number:	Load & ship glass canisters for shipment to a NGR (P25A)
EIS alternatives/options:	Full Separations, Planning Basis, & Minimum INEEL Processing
Project type or waste stream:	Glass canisters of HAW
Action type:	New
Structure type:	Existing HAW Interim Storage Facil.
Size: (m^2)	0
Other features: (pits, ponds, power/water/sewer lines)	None
Location:	
Inside/outside of fence:	Inside INTEC fence
Inside/outside of building:	Inside Interim Storage Facility
Construction Information (procurement only)	
Schedule start/end	
Procurement:	Unknown
Number of workers:	No construction data is required because the facilities exist as part of P24 and could continue to operate after this project has been completed.
Heavy equipment:	
Acres disturbed:	
New/Previous/Revegetated: (acres)	
Air emissions: (None/Ref.)	
Effluents:	
Solid wastes:	
Hazardous/toxic chemicals & wastes	
Water usage:	
Energy requirements:	

Operational Information	
Schedule start/end:	Unknown
Number of workers	
Operations:	3
Maintenance:	1
Support:	3
Number of radiation workers:	6 (included in above totals)
Avg. annual worker rad. dose: (rem/yr)	0.19 per worker
Heavy equipment:	None
Air emissions: (None/Reference)	None
Effluents	
Sanitary wastewater: (L/yr)	241,767
Solid wastes	
Sanitary/industrial trash: (m^3/yr)	39
Radioactive wastes:	None
Hazardous/toxic chemicals & wastes:	None
Water usage	
Domestic: (L/yr)	241,767
Process: (L/yr)	18,925
Energy requirements	
Electrical: (MWh/yr)	2,535
Fossil fuel: (L/yr)	None

a. Sources: EDF-PDS-I-001; EDF-PDS-L-002.

Table C.6.2-32. Decontamination and decommissioning project data for the Packaging and Loading Vitrified HLW at INTEC for Shipment to a Geologic Repository (P25A).[a]

Decontamination and Decommissioning (D&D) Information			
Schedule start/end:	Unknown	Solid wastes	
Number of D&D workers	2.1 per yr	Non-radioactive:	
Number of radiation workers (D&D):	None	Neutron shielding: (m^3)	2.8
Avg. annual worker rad. dose: (rem/yr)	None expected (0.25 per worker if found)	Foam: (m^3)	3.6
		Metal: (m^3)	5.4
Heavy equipment:	None	Hazardous/toxic chemicals & wastes	
Acres disturbed:	None	Non-radioactive lead: (m^3)	3
Air emissions:	None	Water usage	
Effluents		Domestic water: (L)	11,359
Sanitary wastewater: (L)	11,359	Energy requirements	
		Electrical: (MWh)	39
		Fossil fuel: (L)	None

a. Sources: EDF-PDS-I-001; EDF-PDS-L-002.

Table C.6.2-33. Decontamination and decommissioning project data for Performance-Based Clean Closure of Bin Sets for the Class A Grout Disposal in Tank Farm and Bin Sets (P26 & P51).[a]

Generic Information	
Description/function and EIS project number:	Performance-Based Closure of Bin sets (P26 & P51)
EIS alternatives/options:	Separations/Full Separations & Facility Disposition
Project type or waste stream:	HLW
Action type:	New
Structure type:	Calcine solids storage units, weather enclosure
Size: (m^2)	1,347
Other features: (pits, ponds, power/water/sewer lines)	Electrical, firewater, sewer, & water required
Location	
Inside/outside of fence:	Inside INTEC fence
Inside/outside of building:	Inside & around the calciner Bins
Decontamination and Decommissioning (D&D) Information	
Schedule start/end	
Pre – D&D:	March 2014 – June 2019
D&D:	January 2019 – January 2034
Number of D&D workers	49 per yr
Number of radiation workers (D&D):	49 per yr (included in above total)
Avg. annual worker rad. dose: (rem/hr)	0.87 per worker
Heavy equipment	
Equipment used:	Cement trucks
Trips :	2,147
Hours of operation (all heavy equipment): (hrs)	4,295

Decontamination and Decommissioning (D&D) Information (continued)	
Acres disturbed:	
New/Previous/Revegetated: (acres)	None/4.6/None
Air emissions: (None/Reference)	See Appendix C.2 for details.
Fuel combustion (diesel exhaust)	
Gases (CO_2): (tons/yr)	24.6
Contaminants[b]: (tons/yr)	1.2
Radioactive	
Calcine (cleaning): (Ci/yr)	6.08E-09
Effluents	
Sanitary wastewater: (L)	20,865,000
Grout truck wash: (L)	406,000
Solid wastes	
Construction/D&D trash: (m^3)	11,618
Hazardous/toxic chemicals & wastes:	None
Radioactive wastes:	None
Water usage	
Domestic water: (L)	20,865,000
Process water: (L)	481,700
Energy requirements	
Electrical: (MWh/yr)	1,146
Fossil fuel: (L)	159,700

a. Sources: EDF-PDS-B-001; EDF-PDS-L-002.

b. CO, particulates, NO_x, SO_2, hydrocarbons.

Table C.6.2-34. Decontamination and decommissioning project data for Performance-Based Clean Closure of Tank Farm for the Class A Grout Disposal in Tank Farm and Bin Sets (P26 & P51).[a]

Generic Information	
Description/function and EIS project number:	Performance-Based Closure of Tank Farm Facility (P26 & P51)
EIS alternatives/options:	Separations/Full Separations & Facility Disposition
Project type or waste stream:	HLW
Action type:	New
Structure type:	D&D of existing facility, LLW Disposal
Size: (m^2)	10,400
Other features: (pits, ponds, power/water/sewer lines)	Electrical, firewater, sewer, & water required
Location:	
Inside/outside of fence:	Inside INTEC fence
Inside/outside of building:	Outside buildings
Decontamination and Decommissioning (D&D) Information	
Schedule start/end	
D&D:	January 2000 – December 2021
Number of D&D workers:	11 per yr
Number of radiation workers (D&D):	11 per yr (included in above total)
Avg. annual worker rad. dose: (rem/yr)	1.1 per worker
Heavy equipment	
Equipment used:	Earthmoving equipment, cement trucks, crane
Trips (roll-off trucks):	2,188
Hours of operation (all heavy equipment): (hrs)	4,375

Decontamination and Decommissioning (D&D) Information (continued)	
Acres disturbed	
New/Previous/Revegetated: (acres)	None/2.6/None
Air emissions: (None/Reference)	See Appendix C.2 for details
Non-radioactive	
Excavation dust: (tons/yr)	0.1
Fuel combustion	
Gases (CO_2): (tons/yr)	89.9
Contaminants[b]: (tons/yr)	4.4
Radioactive	
Enclosure emissions: (Ci/yr)	1.1E-07
Effluents	
Sanitary wastewater: (L)	5,148,000
Service waste: (L)	716,000
Solid wastes	
Sanitary/industrial trash: (m^3)	1,342
Radioactive wastes:	None
Hazardous/toxic chemicals & wastes:	None
Water usage	
Domestic water: (L)	5,148,000
Process water: (L)	3,089,865
Energy requirements	
Electrical: (MWh/yr)	4,372
Fossil fuel: (L)	641,844

a. Sources: EDF-PDS-B-001; EDF-PDS-L-002.
b. CO, particulates, NO_x, SO_2, hydrocarbons.

Table C.6.2-35. Construction and operations project data for Bin Set Closure for the Class A Grout Disposal in Tank Farm and Bin Sets (P26).[a]

Generic Information	
Description/function and EIS project number:	Fill Bin Sets with Class A Grout P26
EIS alternatives/options:	Separations/Full Separations & Facility Disposition
Project type or waste stream:	Waste Management Program
Action type:	New
Structure type:	Calcine storage units, enclosure
Size: (m^2)	1,347
Other features: (pits, ponds, power/water/sewer lines)	Electrical, firewater, sewer, and water will be required
Location	
Inside/outside of fence:	Inside INTEC fence
Inside/outside of building:	Inside and around calciner bins
Construction Information	
	No construction activities
Operational Information	
Schedule start/end	
Grouting operations:	January 2027 – December 2035
Number of workers:	
Operations:	4 per yr
Maintenance:	1 per yr
Support:	2 per yr
Number of radiation workers:	7 per yr
Avg. annual worker rad. dose: (rem/yr)	1.0 per worker
Heavy equipment	
Equipment used:	Cement trucks
Trips:	None
Hours of operation (all heavy equipment): (hrs/yr)	127

Operational Information (continued)	
Acres disturbed	
New/Previous/Revegetated: (acres)	None/4.6/None
Air emissions: (None/Reference)	See Appendix C.2 for details
Radioactive emiss. from grouting: (Ci/yr)	1.21E-10
Fuel combustion (diesel exhaust):	
Gases (CO_2): (tons/yr)	9.0
Contaminants[b]: (tons/yr)	0.4
Effluents	
Sanitary wastewater: (L/yr)	12,400
Solid wastes	
Sanitary/industrial trash: (m^3/yr)	39
Radioactive wastes:	None
Hazardous/toxic chemicals & wastes	
Lube oil (L)	18
Mixed wastes (LLW)	
PPEs & misc. mixed rad. wastes: (m^3)	95
Mixed rad. liquid wastes: (L)	94,500
Water usage	
Domestic water: (L/yr)	12,400
Process water: (L/yr)	10,500
Energy requirements	
Electrical: (MWh/yr)	244
Equipment/vehicle fuel: (L/yr)	2,917

a. Sources: EDF-PDS-B-001; EDF-PDS-L-002.

b. CO, particulates, NO_x, SO_2, hydrocarbons.

Table C.6.2-36. Construction and operations project data for Tank Farm Closure with Class A Fill for the Class A Grout Disposal in Tank Farm and Bin Sets (P26).[a]

Generic Information	
Description/function and EIS project number:	Tank Farm Fill with Class A Grout (P26)
EIS alternatives/options:	Separations/Full Separations & Facility Disposition
Project type or waste stream:	Waste Management Pgm. - HLW
Action type:	New
Structure type:	Tank Farm Vaults and Tanks
Size: (m^2)	10,400
Other features: (pits, ponds, power/water/sewer lines)	Electrical, firewater, sewer, and water will be required
Location:	
Inside/outside of fence:	Inside INTEC fence
Inside/outside of building:	Around the Tank Farm
Construction Information	
	No construction activities
Operational Information	
Schedule start/end	
Grouting operations:	January 2015 – December 2026
Number of workers:	
Operations:	2 per yr
Maintenance:	0.5 per yr
Support:	0.5 per yr
Number of radiation workers:	3 per yr
Avg. annual worker rad. dose: (rem/yr)	0.7 per worker
Heavy equipment	
Equipment used:	Crane
Trips:	None
Hours of operation (all heavy equipment): (hrs/yr)	257

Operational Information (continued)	
Acres disturbed:	
New/Previous/Revegetated: (acres)	None/2.6/None
Air emissions: (None/Reference)	See Appendix C.2 for details.
Fuel combustion (diesel exhaust):	
Gases (CO_2): (tons/yr)	17.9
Contaminants[b]: (tons/yr)	0.9
Effluents:	
Sanitary wastewater: (L/yr)	4,000
Solid wastes	
Sanitary/industrial trash: (m^3/yr)	17
Radioactive wastes:	None
Hazardous/toxic chemicals and wastes	
Used lube oil: (L)	36
Mixed wastes (LLW)	
PPEs & misc. mixed rad. wastes: (m^3)	54
Liquid mixed rad. wastes: (L)	85,200
Water usage	
Domestic water: (L/yr)	4,000
Process water: (L/yr)	7,100
Energy requirements	
Electrical: (MWh/yr)	108
Fossil fuel:	
Equipment/vehicle fuel: (L/yr)	5,813

a. Sources: EDF-PDS-B-001; EDF-PDS-L-002.
b. CO, particulates, NO_x, SO_2, hydrocarbons.

Table C.6.2-37. Decontamination and decommissioning project data for Tank Farm Closure with Class A Fill for the Class A Grout Disposal in Tank Farm and Bin Sets (P26).[a]

Decontamination and Decommissioning (D&D) Information			
Schedule start/end:	January 2026 – December 2027	Solid wastes	
Number of D&D workers:	8 per yr	Building rubble: (m^3)	115
Number of radiation workers (D&D):	8 per yr (included in above totals)	Radioactive wastes:	None
Avg. annual worker rad. dose: (rem/yr)	0.25 per worker	Hazardous/toxic chemicals & wastes	
Heavy equipment		Solid hazardous wastes: (m^3)	9
Equipment used:	Flatbed trucks	Used lube oil: (L)	382
Trips:	22 trips	Mixed wastes (LLW)	
Hours of operation		Solid mixed wastes: (m^3)	7
(all heavy equipment): (hrs)	66	Decon solution: (L)	17,033
Acres disturbed		Water usage	
New/Previous/Revegetated: (acres)	None/2.6/ None	Process water: (L)	17,033
Air emissions: (None/Reference)	See Appendix C.2 for details	Domestic water: (L)	338,000
Fuel combustion (diesel exhaust)		Energy requirements	
Gases (CO_2): (tons/yr)	3.1	Electrical: (MWh/yr)	156
Contaminants[b]: (tons/yr)	0.2 (total)	Fossil fuel: (L)	2,017
Effluents			
Sanitary wastewater: (L)	338,000 (total)		

a. Sources: EDF-PDS-B-001; EDF-PDS-L-002.
b. CO, particulates, NO_x, SO_2, hydrocarbons

Table C.6.2-38. Decontamination and decommissioning project data for Bin Sets Closure with Class A Fill for the Class A Grout Disposal in Tank Farm and Bin Sets (P26).[a]

Decontamination and Decommissioning (D&D) Information			
Schedule Start/end:	January 2036 – December 2037	Solid wastes	
Number of D&D workers:	36 per yr	Building rubble: (m^3)	3,569
Number of radiation workers (D&D):	36 per yr (included in above totals)	Metals: (m^3)	20
Avg. annual worker rad. dose: (rem/yr)	0.25 per worker	Radioactive wastes	None
Heavy equipment		Hazardous/toxic chemicals & wastes	
Equipment used:	Flatbed trucks	Solid hazardous wastes: (m^3)	11
Trips:	194	Use lube oil: (L)	3,370
Hours of operation		Mixed wastes	
(all heavy equipment): (hrs)	583	Solid mixed wastes: (m^3)	177
Acres disturbed		Decon solution: (L)	170,000
New/Previous/Revegetated: (acres)	None/4.6/None	Water usage	
Air emissions: (None/Reference)	See Appendix C.2 for details.	Domestic water: (L)	1,533,000
Fuel combustion (diesel exhaust):		Process water: (L)	170,000
Gases (CO_2): (tons/yr)	54.9	Energy requirements	
Contaminants[b]: (tons/yr)	2.7 (total)	Electrical: (MWh/yr)	156
Effluents		Fossil fuel: (L)	17,809
Sanitary wastewater: (L)	1,533,000 (total)		

a. Sources: EDF-PDS-B-001; EDF-PDS-L-002.
b. CO, particulates, NO_x, SO_2, hydrocarbons.

Table C.6.2-39. Construction and operations project data for the Class A/C Grout Disposal in a New Low-Activity Waste Disposal Facility (P27).[a]

Generic Information	
Description/function and EIS Project number:	INEEL Class A/C near surface Land disposal facility (P27)
EIS alternatives/options:	Separations/Full & TRU Seps.; Minimum INEEL Processing
Project type or waste stream:	LAW disposal
Action type:	New
Structure type	Near Surface Land Disposal Unit
Size: (m^2)	93
Other features: (pits, ponds, power/water/sewer lines)	Revegetated cap, secondary Containment
Location:	
Inside/outside of fence:	Outside INTEC fence
Inside/outside of building:	Outside
Construction Information	
Schedule start/end:[b]	
Preconstruction:	October 2004 – September 2009
Construction:	October 2009 – June 2034
Number of workers:	7 per yr
Number of radiation workers:	6 per yr (included in above totals)
Avg. annual worker rad. dose: (rem/hr)	<0.19 per worker
Heavy equipment:	
Equipment used:	Excavator, grader, crane,trucks
Trips:	5,919
Hours of operation: (hrs)	34,203 (total)
Acres disturbed:	
New/Previous/Revegetated: (acres)	None/21.6/None
Air emissions: (None/Reference)	See Appendix C.2 for details.
Dust: (tons/yr)	311
Fuel combustion (diesel exhaust):	
Major gas (CO_2): (tons/yr)	585
Contaminants[c]: (tons/yr)	28
Effluents	
Sanitary wastewater: (L)	11,624,681
Solid wastes	
Construction trash: (m^3)	6,473

Construction Information (continued)	
Hazardous/toxic chemicals & wastes	
Lube oil: (L)	5,973
Solid hazardous wastes: (m^3)	6
Water usage	
Dust control (construction): (L)	1,059,800
Domestic (construction): (L)	11,624,681
Energy requirements	
Electrical: (MWh/yr)	1
Fossil fuel (heavy equipment): (L)	1,329,338
Operational Information	
Schedule start/end:[b]	
Disposal operations:	January 2015 – December 2035
Number of workers	
Operations/Maintenance/Support:	7/2/8 per yr
Number of radiation workers:	2.5 per yr (included in above totals)
Avg. annual worker rad. dose: (rem/hr)	0.19 per worker
Heavy equipment	
Equipment used:	Mobile cranes, trucks
Trips:	6,800
Air emissions: (None/Reference)	See Appendix C.2 for details.
Fossil fuel emissions: (tons/yr)	180
Effluents	
Sanitary wastewater: (L/yr)	587,148
Solid wastes	
Sanitary/Industrial trash: (m^3/yr)	94
Radioactive wastes:	None
Hazardous/toxic chemicals & wastes:	None
Water usage	
Domestic water: (L/yr)	587,148
Energy requirements	
Electrical: (MWh/yr)	1
Fossil fuel: (L/yr)	33,308

a. Sources: EDF-PDS-J-001; EDF-PDS-L-002.
b. For Minimum INEEL Processing Alternative schedule unknown, however, durations are as follows: Preconstruction - 6.0 years, Construction – 10.5 years, and Operations – 21.0 years.
c. CO, particulates, NO_x, SO_2, hydrocarbons.

Table C.6.2-40. Decontamination and decommissioning project data for the Class A/C Grout Disposal in a New Low-Activity Waste Disposal Facility (P27).[a]

Decontamination and Decommissioning (D&D) Information			
Schedule start/end:	January 2036 – December 2037	Effluents	
Number of D&D workers:	136 per yr	Sanitary wastewater: (L)	5,790,104
Number of radiation workers (D&D):	88 per yr	Solid wastes	
Avg. annual worker rad. dose: (rem/yr)	0.25 per worker	Non-radioactive (industrial): (m^3)	126
Heavy equipment:		Hazardous/toxic chemicals & wastes	
Equipment used:	Excavator, grader, crane, material delivery trucks	Lube oil: (L)	3,781
		Water usage	
Hours of operation (all heavy equipment): (hrs)	19,980	Domestic: (L)	5,790,104
Acres disturbed:		Energy requirements	
New/Previous/Revegetated: (acres)	None/21.6/None	Electrical: (MWh/yr)	1
		Fossil fuel: (L)	453,746
Air emissions: (None/Reference)	See Appendix C.2 for details.		
Fuel combustion (diesel exhaust):			
Gases (CO_2): (tons/yr)	699		
Contaminants[c]: (tons/yr)	34 (total)		

a. Sources: EDF-PDS-J-001; EDF-PDS-L-002.

b. For Minimum INEEL Processing Alternative schedule unknown, however, D&D duration of 21 years anticipated.

c. CO, particulates, NO_x, SO_2, hydrocarbons

Table C.6.2-41. Construction and operations project data for the Class A Grout Packaging and Shipping to a New Low-Activity Waste Disposal Facility (P35D).[a]

Generic Information	
Description/function and EIS project number:	Pack and ship Class A grout to INEEL landfill (P35D)
EIS alternatives/options:	Full Separations Option
Project type or waste stream:	LAW
Action type:	New
Structure type:	Contact handled LLW handling Facility
Size: (m^2)	491
Other features: (pits, ponds, power/water/sewer lines)	Power/water/sewer/LLW decon Collection tank
Location:	
Inside/outside of fence:	Inside INTEC fence
Inside/outside of building:	Inside building
Construction Information	
Schedule start/end	
Pre-construction:	January 2007 – December 2010
Construction:	January 2011 – December 2012
SO test and start-up:	January 2013 – December 2014
Number of workers:	21.7 per yr
Heavy equipment:	Excavator, grader, crane, trucks
Trips/Hours of operation: (hrs)	564/9,869 (total)
Acres disturbed:	
New/Previous/Revegetated: (acres)	None/0.2/None
Air emissions: (None/Reference)	See Appendix C.2 for details.
Dust: (tons/yr)	2
Fuel combustion (diesel exhaust):	
Gases (CO_2): (tons/yr)	426
Contaminants[b]: (tons/yr)	21
SO testing and start-up:	
Process air emissions: (tons/yr)	8
Effluents	
Sanitary ww (constr./SO testing): (L)	(923,332)/(656,224)
Process wastewater (SO testing): (L)	9,841
Solid wastes	
Construction trash: (m^3)	514
Sanitary/industrial (SO testing): (m^3)	105
Hazardous/toxic chemicals & wastes	
Lube oil: (L)	1,868
Solid hazardous wastes: (m^3)	4

Construction Information (continued)	
Radioactive wastes	
Contaminated soil (LLW): (m^3)	4
Water usage	
Dust control (construction): (L)	302,800
Domestic (construction): (L)	923,332
Domestic (SO testing): (L)	656,224
Process (SO testing): (L)	9,841
Energy requirements	
Electrical (Construction): (MWh/yr)	55
Electrical (SO testing): (MWh/yr)	2,000
Fossil fuel:	
Heavy equipment fuel: (L)	224,133
Other (construction): (L)	52,644
Operational Information	
Schedule start/end:	January 2015 – December 2035
Number of workers :	
Operations/Maintenance/Support:	7.5/1/1 per yr
Number of radiation workers:	8/yr (included in above totals)
Avg. annual worker rad. dose: (rem/yr)	0.19 per worker
Heavy equipment:	Mobile cranes, forklifts, trucks
Trips:	260 per yr
Air emissions: (None/Reference)	See Appendix C.2 for details.
Building ventilation: (Ci/yr)	4.36E-08
Fuel combustion (diesel exhaust):	
Major gas (CO_2): (tons/yr)	2.43
Contaminants[b]: (tons/yr)	0.12
Effluents	
Sanitary wastewater: (L/yr)	328,112
Solid wastes	
Sanitary/industrial trash: (m^3/yr)	53
Radioactive wastes:	None
Hazardous/toxic chemicals & wastes	
Lube oil: (L)	525
Water usage	
Process (L/yr)	19,682
Domestic (L/yr):	328,112
Energy requirements	
Electrical: (MWh/yr)	2,000
Fuel oil: (L/yr)	787

a. Sources: EDF-PDS-J-001; EDF-PDS-L-002.

b. CO, particulates, NO_x, SO_2, hydrocarbons.

Table C.6.2-42 Decontamination and decommissioning project data for the Class A Grout Packaging and Shipping to a New Low-Activity Waste Disposal Facility (P35D).[a]

Decontamination and Decommissioning (D&D) Information			
Schedule start/end:	January 2036 – December 2037	Effluents	
Number of D&D workers:	30 per yr	Sanitary wastewater: (L)	1,292,360
Number of radiation workers (D&D):	20 new workers/yr	Solid wastes	
Avg. annual worker rad. dose: (rem/yr)	0.25 per worker	Building rubble: (m^3)	664
Heavy equipment		Metals: (m^3)	3
Equipment used:	Mobile cranes, roll-off trucks, dozers, loaders	Radioactive wastes:	None
		Hazardous/toxic chemicals and wastes	
Trips (roll-off trucks):	0.5 per day	Used lube oil: (L)	1,346
Hours of operation (all heavy equipment): (hrs)	7,110	Mixed wastes:	None
		Water usage	
Acres disturbed:		Process water: (L)	380,813
New/Previous/Revegetated: (acres)	None/0.2/None	Domestic water: (L)	1,292,360
Air emissions: (None/Reference)	See Appendix C.2 for details.	Energy requirements	
Fuel combustion (diesel exhaust):		Electrical: (MWh/yr)	156
Gases (CO_2): (tons/yr)	249	Fossil fuel: (L)	161,468
Contaminants[b]: (tons/yr)	12		
HEPA filtered offgas: (Ci/yr)	5.81E-08		

a. Sources: EDF-PDS-J-001; EDF-PDS-L-002.
b. CO, particulates, NO_x, SO_2, hydrocarbons.

Table C.6.2-43. Construction and operations project data for the Class A Grout Packaging and Loading for Offsite Disposal (P35E).[a]

Generic Information	
Description/function and EIS project number:	Package Class A grout for offsite shipment and disposal (P35E)
EIS alternatives/options:	Full Separations, Planning Basis
Project type or waste stream:	LAW grout
Action type:	New
Structure type:	Contact handled LLW handling Facility
Size: (m^2)	491
Other features: (pits, ponds,power/water/sewer lines)	Power/water/sewer/LLW decon Collection tank
Location:	
Inside/outside of fence:	Inside INTEC fence
Inside/outside of building:	Inside LAWTF
Construction Information	
Schedule start/end	
Full Separtions Option:[b]	
Pre-construction:	January 2007 – December 2010
Construction:	January 2011 – December 2012
SO test and start-up:	January 2013 – December 2014
Number of workers:	21.7 per yr
Heavy equipment	
Equipment used:	Excavator, grader, crane, trucks
Trips:	564
Hours of operation: (hrs)	9,869 (total)
Acres disturbed & duration	
New/Previous/Revegetated: (acres)	None/0.2/None
Air emissions: (None/Reference)	See Appendix C.2 for details.
Dust: (tons/yr)	2
Fuel combustion (diesel exhaust)	
Gases (CO_2): (tons/yr)	426
Contaminants[c]: (tons/yr)	21
SO testing and start-up	
Process air emissions: (tons/yr)	8
Effluents	
Sanitary wastewater (constr.): (L)	923,332
Sanitary wastewater (SO testing): (L)	587,148
Process wastewater: (L)	9,841
Solid wastes	
Construction trash: (m^3)	514
Sanitary/industrial trash (SO test.): (m^3)	94

Construction Information (continued)	
Hazardous/toxic chemicals and wastes	
Lube oil: (L)	1,868
Misc. (solvents, etc.): (m^3)	3
Radioactive wastes	
Contaminated soil (LLW): (m^3)	4
Water usage	
Dust control (construction): (L)	302,800
Domestic (construction)/(SO testing): (L)	(923,332)/(587,148)
Process (SO testing): (L)	9,841
Energy requirements	
Electrical (constr.)/(SO Test): (MWh/yr)	(55)/(2,000)
Fossil fuel:	
Heavy equipment (construction): (L)	224,133
Other fossil fuel (construction): (L)	52,644
Operational Information	
Schedule start/end: Full Separations Option[b]	January 2015 – December 2035
Number of workers :	
Operations/Maintenance/Support:	6.5/1/1 per yr
Number of radiation workers:	8/yr (included in above total)
Avg. annual worker rad. dose: (rem/yr)	0.19 per worker
Heavy equipment:	Mobile cranes, forklifts, trucks
Trips:	260 per yr
Air emissions: (None/Reference)	See Appendix C.2 for details.
Building ventilation: (Ci/yr)	4.36E-08
Fuel combustion (diesel exhaust):	
Major gas (CO_2): (tons/yr)	2.43
Contaminants[b]: (tons/yr)	0.12
Effluents	
Sanitary wastewater: (L/yr)	293,574
Solid wastes	
Sanitary/Industrial trash: (m^3/yr)	47
Radioactive wastes:	None
Hazardous/toxic chemicals and wastes	
Lube oil: (L)	525
Water usage	
Process: (L/yr)	19,682
Domestic: (L/yr)	293,574
Energy requirements	
Electrical: (MWh/yr)	2,000
Fossil fuel: (L/yr)	787

a. Sources: EDF-PDS-J-003; EDF-PDS-L-002.
b. Schedule for Planning Basis Option: Preconstruction: January 2012 – December 2015; Construction: January 2016 – December 2017; SO testing & start-up: January 2018 – December 2019; Operations – January 2020 – December 2035.
c. CO, particulates, NO_x, SO_2, hydrocarbons.

Table C.6.2-44. Decontamination and decommissioning project data for the Class A Grout Packaging and Loading for Offsite Disposal (P35E).[a]

Decontamination and Decommissioning (D&D) Information			
Schedule start/end:	January 2036 – December 2037	Effluents	
Number of D&D workers:	30 per yr	Sanitary wastewater: (L)	1,289,555
Number of radiation workers (D&D):	20 new workers per yr	Solid wastes	
Avg. annual worker rad. dose: (rem/yr)	0.25 per worker	Building rubble: (m^3)	664
Heavy equipment		Metals: (m^3)	3
Equipment used:	Mobile cranes, roll-off trucks, dozers, loaders	Radioactive wastes	None
		Hazardous/toxic chemicals & wastes	
Trips (roll-off trucks):	0.5 per day	Lube oil: (L)	1,346
Hours of operation		Mixed wastes:	None
(all heavy equipment): (hrs)	7,110	Water usage	
Acres disturbed:		Process water: (L)	380,813
New/Previous/Revegetated: (acres)	None/0.2/None	Domestic water: (L)	1,289,555
Air emissions: (None/Reference)	See Appendix C.2 for details.	Energy requirements	
Fuel combustion (diesel exhaust):		Electrical: (MWh/yr)	156
Gases (CO_2): (tons/yr)	249	Fossil fuel: (L)	161,468
Contaminants[b]: (tons/yr)	12		
HEPA filtered offgas: (Ci/yr)	5.81E-08		

a. Sources: EDF-PDS-J-003; EDF-PDS-L-002.

b. CO, particulates, NO_x, SO_2, hydrocarbons.

Table C.6.2-45. Construction and operations project data for the Packaging and Loading of Transuranic Waste at INTEC for Shipment to the Waste Isolation Pilot Plant (P39A).[a]

Generic Information		**Operational Information**	
Description/function and EIS project number:	Pack and load TRU canisters into trailer mounted casks via the Waste Separations Facility (P39A)	Schedule start/end:	January 2015 – December 2035
		Number of workers	
		Operations:	3 per yr
EIS alternatives/options:	Transuranic Separations Option	Maintenance:	0.5 per yr
Project type or waste stream:	TRU disposal	Support:	3 per yr
Action type:	New	Number of radiation workers:	2.5/yr (included in above totals)
Structure type	None	Avg. annual worker rad. dose: (rem/yr)	0.19 per worker
Size: (m^2)	0	Heavy equipment:	None
Other features: (pits, ponds, power/water/sewer lines)	None	Air emissions: (None/Reference)	None
		Effluents	
Location		Sanitary wastewater: (L/yr)	224,498
Inside/outside of fence:	Inside INTEC fence	Solid wastes	
Inside/outside of building:	Inside Waste Separations Facility	Sanitary/Industrial trash: (m^3/yr)	37
Construction Information (procurement only)		Radioactive waste:	None
Schedule start/end:		Hazardous/toxic chemicals & wastes:	None
Design and procurement:	January 2010 – December 2011	Water usage - Domestic: (L/yr)	224,498
Cask construction:	January 2012 – December 2014	Energy requirements	
Number of workers:	No construction data is required because the facilities for this project have been completed.	Electrical: (MWh/yr)	86
Acres disturbed:		Fossil fuel: (L)	None
New/Previous/Revegetated: (acres)			
Air emissions: (None/Reference)			
Effluents:			
Solid wastes:			
Hazardous/toxic chemicals & wastes			
Water usage:			
Energy requirements:			

a. Sources: EDF-PDS-E-004; EDF-PDS-L-002.

Table C.6.2-46. Decontamination and decommissioning project data for the Packaging and Loading of Transuranic Waste at INTEC for Shipment to the Waste Isolation Pilot Plant (P39A).[a]

Decontamination and Decommissioning (D&D) Information			
Schedule start/end:	January 2036 – June 2037	Solid wastes	
Number of D&D workers:	7 per yr	Non-radioactive:	
Number of radiation workers (D&D):	None	Foam: (m^3)	69
Avg. annual worker rad. dose: (rem/yr)	None expected	Metals: (m^3)	27
	(if found 0.25 per worker)	Industrial: (m^3)	76
Heavy equipment:		Hazardous/toxic chemicals & wastes	
Equipment used:	Mobile cranes, roll-off trucks,	Lead: (m^3)	15
Trips (roll-off trucks):	9 per day	Used lube oil: (L)	2,555
Hours of operation		Water usage	
(all heavy equipment): (hrs)	13,500	Process water: (L)	228,488
Acres disturbed:	None	Domestic water: (L)	223,552
Air emissions: (None/Reference)	See Appendix C.2 for details.	Energy requirements	
Fuel combustion (diesel exhaust):		Electrical: (MWh/yr)	135
Gases (CO_2) (tons/yr)	630	Fossil fuel: (L)	306,585
Contaminants[b]: (tons/yr)	31 (total)		
Effluents			
Sanitary wastewater: (L)	223,552		

a. Sources: EDF-PDS-E-004; EDF-PDS-L-002.

b. CO, particulates, NO_x, SO_2, hydrocarbons.

Table C.6.2-47. Construction and operations project data for the Transuranic/Class C Separations (P49A).[a]

Generic Information	
Description/function and EIS project number:	Waste Separations Facility (P49A)
EIS alternatives/options:	Transuranic Separations Option
Project type or waste stream:	Transuranic and Class C waste
Action type:	New
Structure type:	Concrete and metal structures
Size: (m^2)	14,864
Other features: (pits, ponds, power/water/sewer lines)	Existing utilities will be extended
Location:	
Inside/outside of fence:	Inside INTEC fence
Inside/outside of building:	Inside new buildings
Construction Information	
Schedule start/end:	
Pre-construction:	June 2000 – December 2007
Construction:	January 2008 – December 2012
SO test and start-up:	January 2013 – December 2014
Number of workers:	298 per yr
Heavy equipment:	
Equipment used:	Excavator, grader, crane, trucks
Trips:	3,669 (total)
Hours of operation: (hrs)	64,110 (total)
Acres disturbed:	
New/Previous/Revegetated: (acres)	None/4.5/None
Air emissions: (None/Reference)	See Appendix C.2 for details.
Dust: (tons/yr)	64
Fuel combustion (diesel exhaust):	
Major gas (CO_2): (tons/yr)	1,385
Contaminants[b]: (tons/yr)	67
SO testing and start-up	
Process air emissions: (tons/yr)	0.156
Fossil fuel (steam use): (tons/yr)	17,396.34
Effluents	
Sanitary wastewater (constr.): (L)	25,378,425
SO testing:	
Sanitary wastewater: (L/yr)	2,901,203
Process wastewater: (L/yr)	1,015,489

Construction Information (continued)	
Water usage	
Dust control (construction): (L)	605,600
Domestic water (construction): (L)	25,378,425
Process (SO testing): (L)	846,029
Domestic (SO testing): (L)	11,604,810
Energy requirements	
Electrical: (MWh/yr)	2,160
Fossil fuel	
Heavy equipment (construction): (L)	1,798,460
Steam generation (SO testing): (L/yr)	6,097,291
Operational Information	
Schedule start/end:	January 2015 – December 2035
Treament of sodium bearing waste:	January 2015 – December 2016
Number of workers	
Operations/Maintenance/Support:	(38)/(12)/(34) per yr
Number of radiation workers:	50/yr (included in above totals)
Avg. annual worker rad. dose: (rem/yr)	0.19 per worker
Heavy equipment:	
Equipment used:	Mobile cranes, forklifts, trucks
Trips:	780
Air emissions: (None/Reference)	See Appendix C.2 for details.
Building ventilation: (Ci/yr)	4.83E-07
Process rad. emissions: (Ci/yr)	4.83E-05
Process chemical emissions: (tons/yr)	1.56E-01
Fossil fuel emissions: (tons/yr)	17,396.34
Effluents	
Sanitary wastewater: (L/yr)	2,901,203
Solid wastes	
Sanitary/Industrial trash: (m^3/yr)	677
Radioactive wastes	
Process output:	
RH-TRU waste (HLW): (m^3)/(Ci)	220/330,000
HEPA filters (LLW): (m^3)	212
Hazardous/toxic chemicals & wastes	
Solid hazardous waste: (m^3)	231
Mixed waste (LLW)	
PPEs & misc. mixed rad. waste: (m^3)	1,575

Table C.6.2-47. Continued (P49A).

Construction Information (continued)		**Operational Information (continued)**	
Solid wastes:		Mixed rad. liquid waste: (L)	2,238,075
Construction trash: (m^3)	14,132	Water usage	
Sanitary/industrial trash: (m^3/yr)	677	Domestic: (L/yr)	2,901,203
		Process: (L/yr)	183,168,000
Radioactive waste		Energy requirements	
Contaminated soil (LLW): (m^3)	113	Electrical: (MWh/yr)	10,600[c]
Hazardous/toxic chemicals & wastes		Fossil fuel	
Solid hazardous waste: (m^3)	25	Steam generation: (L/yr)	6,097,291
Used lube oil: (L)	12,133	Equipment/vehicle fuel: (L/yr)	64,951

a. Sources: EDF-PDS-E-004; EDF-PDS-L-002.

b. CO, particulates, NO_x, SO_2, hydrocarbons.

c. Source: EDF-PDS-C-051.

Table C.6.2-48. Decontamination and decommissioning project data for the Transuranic/Class C Separations (P49A).[a]

Decontamination and Decommissioning (D&D) Information			
Schedule start/end:	January 2036 – December 2038	Solid wastes	
Number of D&D workers:	147 per yr	Non-radioactive (industrial): (m^3)	20,079
Number of radiation workers (D&D):	81 new workers/yr	Metal: (m^3)	99
Avg. annual worker rad. dose: (rem/yr)	0.25 per worker	Radioactive wastes	
Heavy equipment:		Contaminated equipment, piping,	
Equipment used:	Mobile cranes, roll-of trucks, dozers, loaders	bldg. material, & trash (LLW): (m^3)	26,704
		Hazardous/toxic chemicals & wastes	
Trips (roll-off trucks):	21 per day	Solid hazardous waste: (m^3)	9
Hours of operation		Lube oil: (L)	16,811
(all heavy equipment): (hrs)	88,830	Mixed waste	
Acres disturbed:		Solid mixed waste: (m^3)	141
New/Previous/Revegetated: (acres)	None/4.5/None	Decon solution: (L)	60,560
Air emissions: (None/Reference)	See Appendix C.2 for details.	Water usage	
Fuel combustion:		Process water: (L)	6,854,625
Gases (CO_2): (tons/yr)	2,071	Domestic water: (L)	9,412,767
Contaminants[b]: (tons/yr)	100 (total)	Energy requirements	
HEPA filtered offgas: (Ci/yr)	5.81E-08	Electrical: (MWh/yr)	156
Effluents		Fossil fuel: (L)	2,017,329
Sanitary wastewater: (L)	9,412,767		

a. Sources: EDF-PDS-E-004; EDF-PDS-L-002.
b. CO, particulates, NO_x, SO_2, hydrocarbons.

Table C.6.2-49. Construction and operations project data for the Class C Grout Plant (P49C).[a]

Generic Information	
Description/function and EIS project number:	Denitrate the LAW and mix it with grout materials (P49C)
EIS alternatives/options:	Transuranic Separations Option
Project type or waste stream:	Denitrate the LAW
Action type:	New
Structure type:	Reinforced concrete
Size: (m^2)	4,413
Other features: (pits, ponds, power/water/sewer lines)	None
Location:	
Inside/outside of fence:	Inside the INTEC fence
Inside/outside of building:	Inside new building
Construction Information	
Schedule start/end	
Preconstruction:	January 2007 – December 2010
Construction:	January 2011 – December 2012
SO test and start-up:	January 2013 – December 2014
Number of workers:	200 per yr
Number of radiation workers:	None
Heavy equipment	
Equipment used:	Excavator, grader, crane, trucks
Trips:	1,997
Hours of operations: (hrs)	24,649 (total)
Acres disturbed:	
New/Previous/Revegetated: (acres)	None/1.0/None
Air emissions: (None/Reference)	See Appendix C.2 for details.
Dust: (tons/yr)	15
Fuel combustion (diesel exhaust):	
Major gas (CO_2): (tons/yr)	1,149
Contaminants[b]: (tons/yr)	56
SO testing and start-up:	
Process air emissions: (tons/yr)	0.15
Fossil fuel (steam use): (tons/yr)	2,304.51
Effluents	
Sanitary wastewater (constr.): (L)	8,516,250
Construction Information (continued)	
Water usage	
Dust control (construction): (L)	302,800
Domestic water (construction): (L)	8,516,250
Process (SO testing): (L)	36,217,590
Domestic (SO testing): (L)	2,763,050
Energy requirements	
Electrical: (MWh/yr)	180
Fuel oil	
Heavy equipment (construction): (L)	746,180.9
Steam generation (SO test.): (L/yr)	807,650.9
Operational Information	
Schedule start/end:	January 2015 – December 2035
Number of workers	
Operations/Maintenance/ Support:	25/4/11 per yr
Number of radiation workers:	16/yr (included in above totals)
Avg. annual worker rad. dose: (rem/yr)	0.19 per worker
Heavy equipment	
Equipment used:	Mobile cranes, forklifts, trucks
Trips:	220 per yr
Air emissions: (None/Reference)	See Appendix C.2 for details.
Building ventilation:	Included in values below
Process rad. emissions[c]: (Ci/yr)	4.44E-04
Process tritium emissions[d]: (Ci/yr)	45
Process chemical emissions[e]: (lb/hr)	11.0
Fossil fuel emissions: (tons/yr)	2,304.51
Effluents	
Sanitary wastewater: (L/yr)	1,381,525
Solid wastes	
Sanitary/industrial trash: (m^3/yr)	222
Radioactive wastes	
Process output:	
LLW grout: (m^3)/(Ci)	22,700/40,900,000
HEPA filters (LLW): (m^3)	313
Hazardous/toxic chemicals & wastes	
Solid hazardous waste: (m^3)	683

Table C.6.2-49. Continued (P49C).

Construction Information (continued)		**Operational Information (continued)**	
SO testing:		Mixed waste (LLW)	
Process wastewater: (L/yr)	18,108,795	PPEs & misc. rad waste: (m^3)	504
Sanitary wastewater: (L/yr)	1,381,525	Mixed liquid rad. waste: (L)	3,313,586
Solid wastes		Water usage	
Construction trash: (m^3)	4,742	Process: (L/yr)	18,108,795
Sanitary/industrial trash: (m^3/yr)	222	Domestic: (L/yr)	1,381,525
Hazardous/toxic chemicals & wastes		Energy requirements	
Solid hazardous wastes: (m^3)	163	Electrical: (MWh/yr)	6,158
Lube oil: (L)	4,665	Fuel oil:	
Radioactive waste		Steam generation: (L/yr)	807,650.9
Contaminated soil (LLW): (m^3)	34	Equipment/vehicle fuel: (L/yr)	18,319.4

a. Sources: EDF-PDS-G-002; EDF-PDS-L-002.
b. CO, particulates, NO_x, SO_2, hydrocarbons.
c. Source: EDF-PDS-C-046.
d. Released for 2 years via denitration process. Source: EDF-PDS-C-046.
e. Source: EDF-PDS-C-043.

Table C.6.2-50. Decontamination and decommissioning project data for the Class C Grout Plant (P49C).[a]

Decontamination and Decommissioning (D&D) Information			
Schedule start/end:	January 2036 – December 2037	Solid wastes	
Number of D&D workers:	93 per yr	Non-radioactive (industrial): (m^3)	5,974
Number of radiation workers (D&D):	64 per yr (included in above total)	Radioactive wastes	
Avg. annual worker rad. dose: (rem/yr)	0.25 per worker	Building debris (LLW): (m^3)/(Ci)	7,945/79
Heavy equipment		Hazardous/toxic chemicals & wastes	
Equipment used:	Mobile cranes, roll-off trucks, dozers, loaders	Lube oil: (L)	7,614
		Solid hazardous waste: (m^3)	3
Trips (roll-off trucks):	10 per day	Mixed waste (LLW)	
Hours of operation (all heavy equipment): (hrs)	40,230 (total)	Decon solution: (L)	17,979
		Water usage	
Acres disturbed:		Process water: (L)	4,569,750
New/Previous/Revegetated: (acres)	None/1.0/None	Domestic water: (L)	3,942,574
Air emissions: (None/Reference)	See Appendix C.2 for details.	Energy requirements	
Fuel combustion (diesel exhaust):		Electrical: (MWh/yr)	156
Gases (CO_2): (tons/yr)	1,407	Fossil fuel: (L)	913,623
Contaminants[b]: (tons/yr)	69 (total)		
Effluents			
Sanitary wastewater: (L)	3,942,574		

a. Sources: EDF-PDS-G-002; EDF-PDS-L-002.

b. CO, particulates, NO_x, SO_2, hydrocarbons.

Table C.6.2-51. Construction and operations project data for the Class C Grout Packaging and Shipping to a New Low-Activity Waste Disposal Facility (P49D).[a]

Generic Information	
Description/function and EIS project number:	Package and ship Class C grout to INEEL LLW landfill (P49D)
EIS alternatives/options:	Transuranic Separations Option
Project type or waste stream:	LAW
Action type:	New
Structure type:	Remote handled LLW handling fac.
Size: (m^2)	491
Other features: (pits, ponds, power/water/sewer lines)	Power/water/sewer/LLW decontamination collection tank
Location:	
Inside/outside of fence:	Inside INTEC fence
Inside/outside of building:	Inside LAWTF
Construction Information	
Schedule start/end	
Preconstruction:	January 2007 – December 2010
Construction:	January 2011 – December 2012
SO test and start-up:	January 2013 – December 2014
Number of workers:	21.7 per yr
Heavy equipment	Excavator, grader, crane, trucks
Trips:	745
Hours of operation: (hrs)	10,515 (total)
Acres disturbed:	
New/Previous/Revegetated: (acres)	None/0.2/None
Air emissions: (None/Reference)	See Appendix C.2 for details.
Dust: (tons/yr)	2
Fuel combustion (diesel exhaust)	
Major gas (CO_2): (tons/yr)	475
Contaminants[b]: (tons/yr)	23
Effluents	
Sanitary wastewater (constr.): (L)	923,332
Process wastewater (SO test.): (L)	587,148
Sanitary wastewater (SO test): (L)	13,777
Solid wastes	
Construction trash: (m^3)	514
Sanitary/Industrial trash: (m^3)	94
Hazardous/toxic chemicals & wastes	
Used lube oil: (L)	1,990
Solid hazardous waste: (m^3)	3

Construction Information (continued)	
Radioactive waste	
Contaminated soil (LLW): (m^3)	4
Water usage	
Dust control (construction): (L)	1,990
Domestic water (construction): (L)	923,332
Process (SO testing): (L)	13,777
Domestic (SO testing): (L)	587,148
Energy requirements	
Electrical (Const./SO Test): (MWh/yr)	55/2,000
Fuel oil:	
Heavy equipment (construction): (L)	238,791
Other use (construction): (L)	69,513
Operational Information	
Schedule start/end:	January 2015 – December 2035
Number of workers	
Operations/Maintenance/Support:	(7)/(0.5)/(1) per yr
Number of radiation workers:	8.5/yr (included in above totals)
Avg. annual worker rad. dose: (rem/yr)	0.19 per worker
Heavy equipment	
Equipment used:	Mobile cranes, forklifts, trucks
Trips:	260 per yr
Air emissions: (None/Reference)	See Appendix C.2 for details.
Building ventilation: (Ci/yr)	4.36E-08
Fuel combustion (diesel exhaust):	
Major gas (CO_2): (tons/yr)	2.43
Contaminants[a]: (tons/yr)	0.12
Effluents - Sanitary wastewater: (L/yr)	293,574
Solid wastes	
Sanitary/Industrial trash: (m^3/yr)	47
Radioactive wastes	None
Hazardous/toxic chemicals & wastes	
Solid hazardous waste: (m^3)	21
Used lube oil: (L)	525
Water usage	
Process: (L/yr)	27,555
Domestic: (L/yr)	293,574
Energy requirements	
Electrical: (MWh/yr)	2,000
Fossil fuel: (L/yr)	787

a. Sources: EDF-PDS-J-002; EDF-PDS-L-002.
b. CO, particulates, NO_x, SO_2, hydrocarbons.

Table C.6.2-52. Decontamination and decommissioning project data for the Class C Grout Packaging and Shipping to a New Low-Activity Waste Disposal Facility (P49D).[a]

Decontamination and Decommissioning (D&D) Information			
Schedule start/end:	January 2036 – December 2037	Radioactive waste	
Number of D&D workers:	57 per yr	Building rubble (LLW): (m^3)/(Ci)	883/9
Number of radiation workers (D&D):	41 new workers per yr	Solid wastes	
Avg. annual worker rad. dose: (rem/yr)	0.25 per worker	Non-radioactive:	
Heavy equipment:		Building rubble: (m^3)	664
Equipment used:	Mobile cranes, roll-off trucks, dozers, loaders	Metals: (m^3)	3
		Cask disposal: (m^3)	33
Trips (roll-off trucks):	0.5 per day	Hazardous/toxic chemicals & wastes	
Hours of operation (all heavy equipment): (hrs)	7,110	Used lube oil: (L)	1,346
		Building demolition[c]: (m^3)	0.3
Acres disturbed:		Water usage	
New/Previous/Revegetated: (acres)	None/0.2/None	Process water: (L)	418,894
Air emissions: (None/Reference)	See Appendix C.2 for details.	Domestic water: (L)	2,427,036
Fuel combustion (diesel exhaust)		Energy requirements	
Gases (CO_2): (tons/yr)	249	Electrical: (MWh/yr)	156
Contaminants[b]: (tons/yr)	12	Fossil fuel: (L)	161,468
HEPA filtered offgas: (Ci/yr)	5.81E-08		
Effluents			
Sanitary wastewater: (L)	2,427,036		

a. Sources: EDF-PDS-J-002; EDF-PDS-L-002.

b. CO, particulates, NO_x, SO_2, hydrocarbons.

c. Hg, PCBs, etc.

Table C.6.2-53. Decontamination and decommissioning project data for Performance-Based Clean Closure of the Bin Sets for the Class C Grout Disposal in Tank Farm and Bin Sets (P51& P26).[a]

Generic Information	
Description/function and EIS project number:	Performance-Based Closure of Bin sets (P51&26)
EIS alternatives/options:	Separations/TRU Separations & Facility Disposition
Project type or waste stream:	HLW
Action type:	New
Structure type:	Calcine solids storage units, weather enclosure
Size: (m^2)	1,347
Other features: (pits, ponds, power/water/sewer lines)	Electrical, firewater, sewer, & water required
Location:	
Inside/outside of fence:	Inside INTEC fence
Inside/outside of building:	Inside & around the calciner bins
Decontamination and Decommissioning (D&D) Information	
Schedule start/end	
Pre–D&D:	March 2014 – June 2019
D&D:	January 2019 – January 2034
Number of D&D workers:	49 per yr
Number of radiation workers (D&D):	49 per yr (included in above total)
Avg. annual worker rad. dose: (rem/yr)	1.0 per worker
Heavy equipment	
Equipment used:	Cement trucks
Trips :	2,147 trips
Hours of operation (all heavy equipment): (hrs)	4,295

Decontamination and Decommissioning (D&D) Information (continued)	
Acres disturbed:	
New Previous Revegetated: (acres)	None/4.6/None
Air emissions: (None/Reference)	See Appendix C.2 for details.
Fuel combustion (diesel exhaust)	
Gases (CO_2): (tons/yr)	24.6
Contaminants[b]: (tons/yr)	1.2
Radioactive:	
Calcine (cleaning): (Ci/yr)	6.08E-09
Effluents	
Sanitary wastewater: (L)	20,865,000
Grout truck wash: (L)	406,000
Solid wastes	
Construction/D&D trash: (m^3)	11,618
Radioactive wastes:	None
Hazardous/toxic chemicals & wastes:	None
Mixed wastes:	None
Water usage	
Domestic water: (L)	20,865,000
Process water: (L)	481,700
Energy requirements	
Electrical: (MWh/yr)	1,146
Fossil fuel: (L)	159,700

a. Sources: EDF-PDS-B-002; EDF-PDS-L-002.
b. CO, particulates, NO_x, SO_2, hydrocarbons.

Table C.6.2-54. Decontamination and decommissioning project data for the Performance-Based Clean Closure of the Tank Farm for the Class C Grout Disposal in Tank Farm and Bin Sets (P51& P26).[a]

Generic Information	
Description/function and EIS project number:	Performance-Based Closure of Tank Farm Facility (P51&26)
EIS alternatives:	Separations/TRU Separations & Facility Disposition
Project type or waste stream:	HLW
Action type:	New
Structure type:	D&D of existing facility, LLW disposal
Size: (m^2)	10,400
Other features: (pits, ponds, power/water/sewer lines)	Electrical, firewater, sewer, & water required
Location:	
Inside/outside of fence:	Inside INTEC fence
Inside/outside of building:	Outside buildings
Decontamination and Decommissioning (D&D) Information	
Schedule start/end:	January 2000 – December 2021
Number of D&D workers:	11 per yr
Number of radiation workers (D&D):	11 per yr (included in above total)
Avg. annual worker rad. dose: (rem/yr)	1.1 per worker
Heavy equipment	
Equipment used:	Earthmoving equipment, cement trucks, crane
Trips (roll-off trucks):	2,188 trips
Hours of operation (all heavy equipment): (hrs)	4,375
Acres disturbed	
New/Previous/Revegetated: (acres)	None/2.6/None

Decontamination and Decommissioning (D&D) Information (continued)	
Air emissions: (None/Reference)	See Appendix C.2 for details.
Excavation dust: (tons/yr)	0.1
Fuel combustion	
Gases (CO_2): (tons/yr)	89.9
Contaminants[b]: (tons/yr)	4.4
Radioactive	
Enclosure emissions: (Ci/yr)	1.1E-07
Effluents	
Sanitary wastewater: (L)	5,148,000
Service waste: (L)	716,000
Solid wastes	
Sanitary/industrial trash: (m^3)	1,342
Radioactive wastes:	None
Hazardous/toxic chemicals & wastes :	None
Mixed wastes:	None
Water usage	
Domestic water: (L)	5,148,000
Process water: (L)	3,089,865
Energy requirements	
Electrical: (MWh/yr)	4,372
Fossil fuel: (L)	641,844

a. Sources: EDF-PDS-B-002; EDF-PDS-L-002.

b. CO, particulates, NO_x, SO_2, hydrocarbons.

Table C.6.2-55. Construction and operations project data for Bin Set Closure for the Class C Grout Disposal in Tank Farm and Bin Sets (P51).[a]

Generic Information		**Operational Information (continued)**	
Description/function and EIS project number:	Fill bin sets with Class C grout (P51)	Acres disturbed: New/Previous/Revegetated: (acres)	None/4.6/None
EIS alternatives/options:	Separations/TRU Separations & Facility Disposition	Air emissions: (None/Reference) Fuel combustion (diesel exhasut): Gases (CO_2): (tons/yr) Contaminants[b]: (tons/yr) Radioactive: Emissions from grouting: (Ci/yr)	See Appendix C.2 for details. 9.5 0.5 (total) 1.21E-10
Project type or waste stream:	HLW		
Action type:	New		
Structure type: Size: (m^2) Other features: (pits, ponds, power/water/sewer lines)	Calcine soild storage units, Weather enclosure 1,347 Electrical, firewater, sewer, & Water required	Effluents: Sanitary wastewater: (L/yr)	23,100
		Solid wastes Sanitary industrial trash: (m^3/yr)	44
Location: Inside/outside of fence: Inside/outside of building:	 Inside INTEC fence Inside and around the Calciner bins	Radioactive wastes	None
		Hazardous/toxic chemicals and wastes Lube oil (L)	18
Construction Information		Mixed wastes (LLW) PPEs & misc. rad. wastes: (m^3) Mixed rad. liquid wastes: (L)	 95 94,500
	No construction activities		
Operational Information			
Schedule start/end Grouting operations:	January 2027 – December 2035	Water usage Domestic water: (L/yr) Process water: (L/yr)	 23,100 10,500
Number of workers: Operations/Maintenance/Support:	8/2/3 per yr	Energy requirements Electrical: (MWh/yr) Fossil fuel: Equipment/vehicle fuel: (L/yr)	 244 3,083
Number of radiation workers:	7 per yr (included in above totals)		
Avg. annual worker rad. dose: (rem/yr)	1.8 per worker		
Heavy equipment Equipment used: Trips: Hours of operation (all heavy equipment): (hrs/yr)	 Cement trucks None 136		

a. Sources: EDF-PDS-B-002; EDF-PDS-L-002.
b. CO, particulates, NO_x, SO_2, hydrocarbons.

Table C.6.2-56. Decontamination and decommissioning project data for Bin Set Closure for the Class C Grout Disposal in Tank Farm and Bin Sets (P51).[a]

Decontamination and Decommissioning (D&D) Information			
Schedule start/end:	January 2036 – December 2037	Solid wastes	
Number of D&D workers:	36 workers per yr	Building rubble: (m^3)	3,569
Number of radiation workers (D&D):	36 per yr (included in above totals)	Metals: (m^3)	20
Avg. annual worker rad. dose: (rem/yr)	0.25 per worker	Radioactive wastes:	None
Heavy equipment		Hazardous/toxic chemicals & wastes	
Equipment used:	Flatbed trucks	Solid hazardous wastes: (m^3)	11
Trips:	194 trips	Use lube oil: (L)	3,370
Hours of operation		Mixed wastes (LLW)	
(all heavy equipment): (hrs)	583	Solid mixed wastes: (m^3)	177
Acres disturbed		Decon solution: (L)	170,000
New/Previous/Revegetated: (acres)	None/4.6/None	Water usage	
Air emissions: (None/Reference)	See Appendix C.2 for details.	Domestic water: (L)	1,533,000
Fuel combustion (diesel exhaust):		Process water: (L)	170,000
Gases (CO_2): (tons/yr)	54.9	Energy requirements	
Contaminants[b]: (tons/yr)	2.7 (total)	Electrical: (MWh/yr)	156
Effluents		Fossil fuel: (L)	17,809
Sanitary wastewater: (L)	1,533,000		

a. Sources: EDF-PDS-B-002; EDF-PDS-L-002.

b. CO, particulates, NO_x, SO_2, hydrocarbons.

Table C.6.2-57. Construction and operations project data for for Tank Farm Closure for the Class C Grout Disposal in Tank Farm and Bin Sets (P51).[a]

Generic Information	
Description/function and EIS project number:	Tank Farm fill with Class C grout (P51)
EIS alternatives/options:	Separations/TRU Separations & Facility Disposition
Project type or waste stream:	HLW
Action type:	New
Structure type:	Tank Farm vaults and tanks
Size: (m^2)	10,400
Other features: (pits, ponds, power/water/sewer lines)	Electrical, firewater, sewer, & Water required
Location:	
Inside/outside of fence:	Inside INTEC fence
Inside/outside of building:	Around the Tank Farm
Construction Information	
	No construction activities
Operational Information	
Schedule start/end	
Grouting operations:	January 2015 – December 2026
Number of workers:	
Operations/Maintenance/Support:	2/0.5/0.5 per yr
Number of radiation workers:	3 per yr (included in above totals)
Avg. annual worker rad. dose: (rem/yr)	4.5 per worker
Heavy equipment	
Equipment used:	Crane
Trips:	None
Hours of operation (all heavy equipment): (hrs/yr)	257

Operational Information (continued)	
Acres disturbed:	
New/Previous/Revegetated: (acres)	None/2.6/None
Air emissions: (None/Reference)	See Appendix C.2 for details.
Fuel combustion (diesel exhaust):	
Gases (CO_2): (tons/yr)	17.9
Contaminants[b]: (tons/yr)	0.9
Effluents	
Sanitary wastewater: (L/yr)	4,000
Solid wastes	
Sanitary industrial trash: (m^3/yr)	17
Radioactive wastes:	None
Hazardous/toxic chemicals and wastes	
Lube oil: (L)	36
Mixed wasstes (LLW)	
PPEs & misc. mixed rad. wastes: (m^3)	54
Decon solution: (L)	85,200
Water usage	
Domestic water: (L/yr)	4,000
Process water: (L/yr)	7,100
Energy requirements	
Electrical: (MWh/yr)	108
Fossil fuel:	
Equipment/vehicle fuel: (L/yr)	5,813

a. Sources: EDF-PDS-B-002; EDF-PDS-L-002.

b. CO, particulates, NO_x, SO_2, hydrocarbons.

Table C.6.2-58. Decontamination and decommissioning project data for Tank Farm Closure for the Class C Grout Disposal in Tank Farm and Bin Sets (P51).[a]

Decontamination and Decommissioning (D&D) Information			
Schedule start/end:	January 2026 – December 2027	Effluents	
Number of D&D workers:	9 per yr	Sanitary wastewater: (L)	402,000
Number of radiation workers (D&D):	9 per yr (included in above total)	Solid wastes	
Avg. annual worker rad. dose: (rem/yr)	0.25 per worker	Building rubble: (m^3)	115
Heavy equipment:		Radioactive wastes:	None
Equipment used:	Flatbed trucks	Hazardous/toxic chemicals & wastes	
Trips:	22 trips	Solid hazardous wastes (m^3)	9
Hours of operation		Lube oil: (L)	382
(all heavy equipment): (hrs)	66	Mixed wastes (LLW)	
Acres disturbed:		Solid mixed wastes: (m^3)	7
New/Previous/Revegetated: (acres)	None/2.6/None	Decon solution: (L)	17,033
Air emissions: (None/Reference)	See Appendix C.2 for details.	Water usage	
Non-radioactive		Domestic water: (L)	402,000
Fuel combustion (diesel exhaust)		Process water: (L)	17,033
Gases (CO_2): (tons/yr)	3.1	Energy requirements	
Contaminants[b]: (tons/yr)	0.2 (total)	Electrical: (MWh/yr)	156
		Fossil fuel: (L)	2,017

a. Sources: EDF-PDS-B-002; EDF-PDS-L-002.
b. CO, particulates, NO_x, SO_2, hydrocarbons.

Table C.6.2-59. Construction and operations project data for the Calcine Retrieval and Transport (P59A).[a]

Generic Information	
Description/function and EIS project number:	Retrieve calcine from bin sets and transport to WTF (P59A)
EIS alternatives/options:	Separations/(Full Sep. & TRU Sep. Options); Non-Separations/(HIP, Direct Cement, Early Vit. Options) & Minimum INEEL Processing
Project type or waste stream:	HLW calcine
Action type:	New
Structure type:	New and modified existing facilities
Size: (m^2)	2,657
Other features: (pits, ponds, lines)	None
Location:	
Inside/outside of fence:	Inside INTEC fence
Inside/outside of building:	Outside of building
Construction Information	
Schedule start/end	
Full Separations Option:[b]	
Preconstruction:	January 2004 – December 2009
Construction:	January 2010 – December 2014
SO testing and start-up:	January 2015 – December 2015
Number of workers:	100 per yr
Number of radiation workers:	90 per yr
Avg. annual rad. dose: (rem/yr)	0.25
Heavy equipment:	
Equipment used:	Excavator, grader, cranes, trucks
Trips/Hours of operations (hrs):	250/33,807 (total)
Acres disturbed	
New/Previous/Revegetated: (acres)	None/0.5/None
Air emissions: (None/Reference)	See Appendix C.2 for details.
Construction:	
Dust: (tons/yr)	7
Fuel combustion (diesel gas):	
Major gas (CO_2): (tons/yr)	609
Contaminants[c]: (tons/yr)	30
Effluents	
Sanitary wastewater:	
Construction: (L):	8,516,250
SO testing: (L/yr)	388,554

Construction Information (continued)	
Hazardous/toxic chemicals & wastes	
Solid hazardous wastes: (m^3)	6
Lube oil: (L)	5,973
Radioactive wastes	
Contaminated soil (LLW): (m^3)	1,300
Mixed wastes (LLW)	
Misc. solid wastes (PPEs, debris): (m^3)	1,070
Decon solution: (L)	30,000
Water usage	
Dust control (Construction): (L)	605,600
Domestic (Construction): (L)	8,516,250
Domestic (SO testing): (L)	388,554
Energy requirements	
Electrical: (MWh/yr)	180
Fuel oil:	
Heavy equipment & trips: (L)	791,056
Operational Information	
Schedule start/end:	
Full Separations Option[d]	January 2016 – December 2035
Number of workers	
Operations/Maintenance/Support:	6/1/4.25 per yr
Number of radiation workers:	10 (included in above totals)
Avg. annual rad. dose: (rem/yr)	0.19 per worker
Heavy equipment:	None
Air emissions: (None/Reference)	See Appendix C.2 for details.
Fossil fuel emission: (tons/yr)	1,300.93
Building ventilation: (Ci/yr)	5.65E-08
Process radioactive emissions: (Ci/yr)	8.06E-03
Effluents	
Sanitary wastewater: (L/yr)	388,554
Solid wastes	
Sanitary/Industrial trash: (m^3/yr)	62
Radioactive wastes	
HEPA filters (LLW): (m^3)	231
Mixed wastes (LLW)	
Mixed solids: (m^3)	21
PPEs & misc. rad. waste: (m^3)	315
Mixed radioactive liquid wastes: (L)	2,442,825

Table C.6.2-59. Continued (P59A).[a]

Construction Information		Operational Information (continued)	
Solid wastes		Water usage - Domestic: (L/yr)	388,554
Construction trash: (m^3)	4,742	Energy requirements	
SO testing:		Electrical: (MWh/yr)	89
Sanitary/Industrial trash: (m^3/yr)	62	Fossil fuel (steam generation): (L/yr)	455,920

a. Sources: EDF-PDS-C-007; EDF-PDS-L-002.

b. Schedule for other alternatives/options:

Planning Basis Option: Preconstruction: January 2009 – December 2013/Construction: January 2014 – December 2018/SO test and start-up: January 2019 – December 2019.

TRU Separations Option & Non-Separations Alternative (HIP Waste, Direct Cement, & Early Vitrification Options): Preconstruction: January 2004 – December 2008/Construction: January 2009 – December 2013/ SO test and start-up: January 2014 – December 2014.

Minimum INEEL Processing Alternative: Preconstruction: January 2002 – December 2006/Construction: January 2007 – December 2010/ SO test and start-up: January 2010 – December 2010.

c. CO, particulates, NO_x, SO_2, hydrocarbons.

d. Operations schedule for other alternatives/options:

Planning Basis Option: January 2020 – December 2035.

TRU Separations Option & Non-Separations Alternative (HIP Waste, Direct Cement, & Early Vitrification Options): January 2015 – December 2035.

Minimum INEEL Processing: January 2011 – December 2025.

Table C.6.2-60. Decontamination and decommissioning project data for the Calcine Retrieval and Transport (P59A).[a]

Decontamination and Decommissioning (D&D) Information			
Schedule start/end: Separations Alt./Full Separations Opt.:[b]	Unknown	Air emissions: (None/Reference) Fuel combustion (diesel exhaust)	See Appendix C.2 for details.
Number of D&D workers:	160 per yr	Gases (CO_2): (tons/yr)	1,250
Number of radiation workers (D&D):	102 new workers/yr	Contaminants[c]: (tons/yr)	61 (total)
Avg. annual worker rad. dose: (rem/yr)	0.25 per worker	Effluents Sanitary wastewater: (L)	3,412,304
Heavy equipment Equipment used:	Mobile cranes, roll-off trucks, dozers, loaders	Solid wastes Non-radioactive (industrial): (m^3)	3,597
Trips (roll-off trucks):	9 per day	Radioactive wastes:	None
Hours of operation (all heavy equipment): (hrs)	17,865	Hazardous/toxic chemicals & wastes:	None
		Water usage Process water: (L) Domestic water: (L)	761,625 3,412,304
Acres disturbed New/Previous/Revegetated: (acres)	None/0.5/None	Energy requirements Electrical: (MWh/yr) Fossil fuel: (L)	156 405,714

a. Sources: EDF-PDS-C-007; EDF-PDS-L-002.

b. Schedule for other alternatives/options:
Separations Alternative (Planning Basis Option): January 2036 – December 2037.
Separations Alternative (TRU Separations Option) & Non-Separations Alternative (Direct Cement, HIP Waste, & Early Vitrification Options): January 2036 – December 2036.
Minimum INEEL Processing Alternative: January 2026 – December 2026.

c. CO, particulates, NO_x, SO_2, hydrocarbons.

Table C.6.2-61. Construction and operations project data for the Calcine Retrieval and Transport Just-in-Time (P59B).[a]

Generic Information	
Description/function and EIS Project number:	Retrieve calcine from bin sets and transport to Waste Treatment Facility for transport to Hanford JIT (P59B)
EIS alternatives/options:	Minimum INEEL Processing Alt.
Project type or waste stream:	HLW calcine
Action type:	New
Structure type:	New facility
Size: (m^2)	2,657
Other features: (pits, ponds, power/water/sewer lines)	None
Location:	
Inside/outside of fence:	Inside INTEC fence
Inside/outside of building:	New building
Construction Information	
Schedule start/end	
Preconstruction:	January 1, 2019 – December 1, 2022
Construction:	January 1, 2023 – December 1, 2026
SO test and start-up:	January 1, 2027 – December 1, 2027
Number of workers:	224 per yr
Number of radiation workers:	202
Avg. annual worker rad. dose: (rem/yr)	0.25
Heavy equipment:	
Equipment used:	Excavator, grader, cranes, trucks
Trips:	250
Hours of operation: (hrs)	23,830 (total)
Acres disturbed:	
New/Previous/Revegetated: (acres)	None/0.5/None
Air emissions: (None/Reference)	See Appendix C.2 for details.
Dust: (tons/yr)	7
Fuel combustion (diesel gas)	
Contaminants[b]: (tons/yr)	22
Effluents	
Sanitary wastewater (constr.): (L)	18,690,774
Sanitary wastewater (SO test.): (L/yr)	293,574
Process wastewater (SO test.): (L/yr)	2,068
Solid wastes:	
Construction trash: (m^3)	10,408
Sanitary/ind. trash (SO test.): (m^3/yr)	47
Radioactive wastes: (m^3)	85

Construction Information (continued)	
Hazardous/toxic chemicals & wastes	
Solid hazardous wastes: (m^3)	9.8
Water usage	
Dust control (construction): (L)	593,156
Domestic (construction): (L)	18,690,774
Domestic (SO testing): (L)	268,640
Energy requirements	
Electrical: (MWh/yr)	180
Fossil fuel:	
Equipment/vehicle fuel: (L)	564,482
Operational Information	
Schedule start/end:	January 2028 – March 2030
Number of workers	
Operations/Maintenance/Support:	4/1/3.5
Number of radiation workers:	5 (included in above totals)
Avg. annual worker rad. dose:	0.19 rem/yr
Heavy equipment:	None
Air emissions: (None/Reference)	See Appendix C.2 for details.
Building ventilation: (Ci/yr)	1.19E-07
Process rad. emissions: (Ci/yr)	1.52E-05
Effluents	
Sanitary wastewater: (L/yr)	293,574
Solid wastes	
Sanitary/industrial trash: (m^3/yr)	47
Radioactive wastes	
HEPA filters: (m^3/yr)	6
Misc. rad. wastes (mixed): (m^3/yr)/(Ci/yr)	0.07/7
Hazardous/toxic chemicals & wastes	
Paints, solvents, etc. (LLW): (m^3/yr)/(Ci/yr)	1/<1
Water usage	
Process: (L/yr)	1,935,210
Domestic: (L/yr)	293,574
Energy requirements	
Electrical: (MWh/yr)	187
Fossil fuel: (L)	None

a. Sources: EDF-PDS-C-044; EDF-PDS-L-002.

b. CO, particulates, NO_x, SO_2, hydrocarbons.

Table C.6.2-62. Decontamination and decommissioning project data for the Calcine Retrieval and Transport Just-in-Time (P59B).[a]

Decontamination and Decommissioning (D&D) Information			
Schedule start/end:	March 15, 2030 – March 14, 2032	Effluents Sanitary wastewater: (L)	 3,310,883
Number of D&D workers:	78 per yr		
Number of radiation workers (D&D):	53 new workers/yr	Solid wastes Non-radioactive (industrial): (m^3)	 3,597
Avg. annual worker radiation dose:	0.25 rem/yr per worker		
Heavy equipment Equipment used: Trips (roll-off trucks): Hours of operation (all heavy equipment): (hrs)	 Mobile cranes, roll-off trucks, dozers, loaders 9 per day 30,130	Hazardous/toxic chemicals & wastes Solid hazardous wastes: (m^3)	 2
		Radioactive wastes Rad. waste (LLW): (m^3)/(Ci)	 4,442/47.8
		Radioactive (mixed waste): (m^3)/(Ci)	94/1
Acres disturbed: New/Previous/Revegetated: (acres)	 None/0.5/None	Water usage Process water: (L) Domestic water: (L)	 1,523,250 3,310,883
Air emissions: (None/Reference) Fuel combustion contaminants[b]: (tons/yr) HEPA filtered offgas: (Ci/yr)	See Appendix C.2 for details. 51 (total) 5.81E-08	Energy requirements Electrical: (MWh/yr) Fossil fuel: (L)	 156 684,252

a. Sources: EDF-PDS-C-044; EDF-PDS-L-002.
b. CO, particulates, NO_x, SO_2, hydrocarbons.

Table C.6.2-63. Construction and operations project data for Vitrified HLW Interim Storage (P61).[a]

Generic Information	
Description/function and EIS project number:	Long-term storage for contain awaiting shipment to NGR (P61)
EIS alternatives/options:	Non-Separations/Early Vitrification Option
Project type or waste stream:	Treated HLW calcine
Action type:	New
Structure type:	
Size: (m^2)	13,493
Other features: (pits, ponds, power/water/sewer lines)	None
Location:	
Inside/outside of fence:	Inside INTEC fence
Inside/outside of building:	New building
Construction Information	
Schedule start/end:	
Preconstruction:	July 2005 – December 2009
Construction:	January 2010 – December 2013
SO test and start-up:	January 2014 – December 2014
Number of workers:	114 per yr
Number of radiation workers:	None
Heavy equipment	
Equipment used:	Excavator, grader, crane, trucks
Trips:	2,191 trips
Hours of operations: (hrs)	50,548 (total)
Acres disturbed	
New/Previous/Revegetated: (acres)	None/5.0/None
Air emissions (None/Reference)	See Appendix C.2 for details.
Dust: (tons/yr)	
Fuel combustion (diesel exhaust):	72
Major gas (CO_2): (tons/yr)	1,042
Contaminants[b]: (tons/yr)	51
Effluents	
Sanitary wastewater (constr.): (L)	9,708,525
Sanitary wastewater (SO test.): (L)	224,498
Solid wastes	
Construction trash: (m^3)	5,406
Sanitary/ind. trash (SO test.): (m^3/yr)	36

Construction Information (continued)	
Hazardous/toxic chemicals & wastes	
Solid hazardous waste: (m^3)	220
Used lube oil: (L)	31,888
Radioactive wastes	
Contaminated soil (LLW): (m^3)	103
Water usage	
Dust control (construction): (L)	2,056,032
Domestic (construction): (L)	9,708,525
Domestic (SO testing): (L)	224,498
Energy requirements	
Electrical	
Construction: (MWh/yr)	156
SO testing: (MWh/yr)	4,368
Fossil fuel	
Heavy equipment (construction): (L)	1,147,953
Other use (construction): (L)	204,561
Operational Information	
Schedule start/end:	January 2015 – indefinite
Number of workers	
Operations:	4
Maintenance:	1
Support:	1.5
Number of radiation workers:	4.5 (included in above totals)
Avg. annual worker rad. dose: (rem/yr)	0.19 per worker
Heavy equipment:	None
Air emissions: (None/Reference)	None
Effluents	
Sanitary wastewater: (L/yr)	224,498
Solid wastes:	
Sanitary/industrial trash: (m^3/yr)	36
Hazardous/toxic chemicals & wastes:	None
Radioactive wastes:	None
Water usage - Domestic: (L/yr)	224,498
Energy requirements	
Electrical: (MWh/yr)	4,368
Fossil fuel: (L)	None

a. Sources: EDF-PDS-H-004; EDF-PDS-L-002.
b. CO, particulates, NO_x, SO_2, hydrocarbons.

Table C.6.2-64. Decontamination and decommissioning project data for Vitrified HLW Interim Storage (P61).[a]

Decontamination and Decommissioning (D&D) Information			
Schedule start/end:	Unknown	Effluents	
Number of D&D workers:	249 per yr	Sanitary wastewater: (L)	15,901,630
Number of radiation workers (D&D):	25.3 new workers/yr	Solid wastes	
Avg. annual worker rad. dose: (rem/yr)	None expected (0.25 per worker if found)	Non-radioactive:	
		Building rubble: (m^3)	42,946
Heavy equipment		Metals: (m^3)	91
Equipment used:	Mobile cranes, roll-off trucks, dozers, loaders	Hazardous/toxic chemicals & wastes	
		Used lube oil: (L)	9,504
Trips:	9 per day	Solid hazardous wastes: (m^3)	22
Total hours of operation: (hrs)	50,220	Water usage	
Acres disturbed:		Domestic water: (L)	15,901,630
New/Previous/ Revegetated: (acres)	None/5.0/None	Energy requirements	
Air emissions: (None/Reference)	See Appendix C.2 for details.	Electrical: (MWh/yr)	156
Fuel combustion (diesel exhaust)		Fossil fuel: (L)	1,140,496
Gases (CO_2): (tons/yr)	1,171		
Contaminants[b]: (tons/yr)	57		

a. Sources: EDF-PDS-H-004; EDF-PDS-L-002.

b. CO, particulates, NO_x, SO_2, hydrocarbons.

Table C.6.2-65. Construction and operations project data for the Packaging and Loading of Vitrified HLW at INTEC for Shipment to a Geologic Repository (P62A).[a]

Generic Information	
Description/function and EIS project number:	Package and load vitrified HLW canister into RMC via ISF (P62A)
EIS alternatives/options:	Non-Separations/Early Vitrification Option
Project type or waste stream:	Waste mgt. pgm., HAW disposal
Action type:	New
Structure type	None
Size: (m^2)	0
Other features: (pits, ponds, power/water/sewer lines)	None
Location	
Inside/outside of fence:	Inside INTEC fence
Inside/outside of building:	Inside Interim Storage Facility (ISF)
Construction Information (procurement only)	
Schedule start/end:	
Design & procurement spec.:	Unknown
Cask construction:	Unknown
Number of workers:	No construction data is required - procurement only (fabricate 32 casks with internal support and railcars).
Number of radiation workers:	
Avg. annual worker rad. dose: (rem/yr)	
Heavy equipment:	
Equipment used:	
Acres disturbed:	
Air emissions: (None/Reference)	
Effluents:	
Solid wastes:	
Hazardous/toxic chemicals & wastes:	
Water usage:	
Energy requirements:	

Operational Information	
Schedule start/end:	Unknown
Number of workers	
Operations:	3 per yr
Maintenance:	0.5 per yr
Support:	3 per yr
Number of radiation workers:	2.5 (included in above totals)
Avg. annual worker rad. dose: (rem/yr)	0.19 per worker
Heavy equipment:	None
Air emissions: (None/Reference)	None
Effluents	
Sanitary wastewater: (L/yr)	224,498
Solid wastes	
Sanitary/industrial trash (m^3/yr):	36
Hazardous/toxic chemicals & wastes:	None
Radioactive wastes:	None
Water usage - Domestic: (L/yr)	224,498
Energy requirements	
Electrical: (MWh/yr)	4,368
Fossil fuel: (L)	None

a. Sources: EDF-PDS-I-003; EDF-PDS-L-002.

Table C.6.2-66. Decontamination and decommissioning project data for the Pacakaging and Loading of Vitrified HLW at INTEC for Shipment to a Geologic Repository (P62A).[a]

Decontamination and Decommissioning (D&D) Information			
Schedule start/end:	Unknown	Effluents	
Number of D&D workers:	10 per yr	Sanitary wastewater: (L)	586,141
Number of radiation workers (D&D):	0 new workers per yr	Solid wastes	
Avg. annual worker rad. dose: (rem/yr)	None expected, if found 0.25 per worker	Non-radioactive:	
		Neutron shielding: (m^3)	91
Heavy equipment		Metals: (m^3)	172
Equipment used:	Mobile cranes, roll-off trucks, Loaders	Industrial: (m^3)	165
		Hazardous/toxic chemicals & wastes	
Trips:	9 per day	Lead: (m^3)	109
Total hours of operation: (hrs)	27,000	Lube oil: (L)	5,110
Acres disturbed:	None	Radioactive wastes:	None
Air emissions: (None/Reference)	See Appendix C.2 for details.	Water usage	
Fuel combustion (diesel exhaust):		Domestic water: (L)	586,141
Gases (CO_2): (tons/yr)	630	Process water: (L)	913,950
Contaminants[b]: (tons/yr)	31 (total)	Energy requirements	
		Electrical: (MWh/yr)	135
		Fossil fuel: (L)	613,170

a. Sources: EDF-PDS-I-003; EDF-PDS-L-002.
b. CO, particulates, NO_x, SO_2, hydrocarbons

Table C.6.2-67. Construction and operations project data for the Mixing and Hot Isostatic Pressing (P71).[a]

Generic Information	
Description/function and EIS project number:	Hot isostatically press HLW calcine for storage awaiting shipment (P71)
EIS alternatives/options:	HIP Waste Option
Project type or waste stream:	HIPed HLW calcine
Action type:	New
Structure type:	New Hot Isostatic Press Facility Bldg.
Size: (m^2)	16,722
Other features: (pits, ponds, power/water/sewer lines)	None
Location	
Inside/outside of fence:	Inside INTEC fence
Inside/outside of building:	Inside HIPing Facility
Construction Information	
Schedule start/end	
Preconstruction:	July 2000 – December 2007
Construction:	January 2008 – December 2011
SO test and start-up:	January 2012 – December 2014
Number of workers:	100 per yr
Number of radiation workers:	None
Heavy equipment	
Equipment used:	Excavator, grader, crane, trucks
Trips:	1,156 trips
Hours of operation: (hrs)	71,200 (total)
Acres disturbed	
New/Previous/Revegetated: (acres)	None/6.2/None
Air emissions: (None/Reference)	See Appendix C.2 for details.
Dust: (tons/yr)	89
Fuel combustion (diesel exhaust)	
Major gas (CO_2): (tons/yr)	276
Contaminants[b]: (tons/yr)	13
SO testing and start-up:	
Process air emissions: tons/yr	6
Fossil fuel (steam use): (tons/yr)	7,917.09

Construction Information (continued)	
Water usage	
Dust control (construction): (L)	605,600
Domestic (construction): (L)	8,516,250
Process (SO testing): (L)	308,000,000
Domestic (SO testing): (L)	4,605,588
Energy requirements	
Electrical: (MWh/yr)	156
Fuel oil:	
Heavy equipment & trips: (L)	1,719,894
Steam generation (SO testing): (L/yr)	2,774,749
Process use (SO testing): (L)	2,498
Operational Information	
Schedule start/end:	January 2015 – December 2035
Number of workers	
Operations:	29 per yr
Maintenance:	15 per yr
Support:	34 per yr
Number of radiation workers:	22 (included in above totals)
Avg. annual rad. dose: (rem/yr)	0.19 per worker
Heavy equipment:	None
Air emissions: (None/Reference)	See Appendix C.2 for details.
Building ventilation: (Ci/yr)	4.99E-07
Process rad. emissions: (Ci/yr)	9.10E-02
Fossil fuel emissions: (tons/yr)	7,917.09
Process chem. emissions[c]: (lb/hr)	12
Effluents	
Sanitary wastewater: (L/yr)	1,535,196
Solid wastes	
Sanitary/Industrial trash: (m^3/yr)	433
Radioactive wastes	
Process output:	
HLW (Hot Isostatic Press): (m^3)/(Ci)	3,400/40,700,000
HEPA filters (LLW): (m^3)	243
Hazardous/toxic chemicals & wastes:	None
Mixed waste (LLW)	

Table C.6.2-67. Continued (P71).

Construction Information (continued)		**Operational Information (continued)**	
Effluents		Solid mixed waste: (m^3)	63
Sanitary wastewater (constr.): (L)	8,516,250	PPEs & misc. rad. waste: (m^3)	693
Sanitary wastewater (SO test.): (L/yr)	1,535,196	Mixed rad. liquid waste: (L)	2,569,119
Process wastewater (SO test.): (L/yr)	1,142,425		
Solid wastes		Water usage	
Construction trash: (m^3)	4,742	Process: (L/yr)	102,649,200
Sanitary/Industrial trash: (m^3/yr)	433	Domestic: (L/yr)	1,535,196
Hazardous/toxic chemicals & wastes		Energy requirements	
Lube oil: (L)	12,941	Electrical: (MWh/yr)	8,472
Solid hazardous waste: (m^3)	456	Fuel oil:	
Radioactive waste		Steam generation: (L/yr)	2,774,749
Contaminated soil (LLW): (m^3)	128	Equipment/vehicle fuel: (L/yr)	833

a. Sources: EDF-PDS-C-006; EDF-PDS-L-002.

b. CO, particulates, NO_x, SO_2, hydrocarbons.

c. Source: EDF-PDS-C-043.

Table C.6.2-68. Decontamination and decommissioning project data for the Mixing and Hot Isostatic Pressing (P71).[a]

Decontamination and Decommissioning (D&D) Information			
Schedule start/end:	January 2036 – December 2040	Solid wastes	
Number of D&D workers:	198 per yr	Non-radioactive (industrial): (m^3)	26,193
Number of radiation workers (D&D):	146 new workers per yr	Radioactive waste	
Avg. annual worker rad. dose: (rem/yr)	0.19 per worker	Sand & frit (LLW): (m^3)	34,836
Heavy equipment		Hazardous/toxic chemicals & wastes	
Equipment used:	Mobile cranes, roll-off trucks, Dozers, loaders	Solid hazardous waste: (m^3)	12
		Used lube oil: (L)	24,272
Trips (roll-off trucks):	15 per day	Mixed waste (LLW)	
Total hours of operation:	76,950 hours	Solid mixed waste: (m^3)	141
Acres disturbed		Decon solution: (L)	68,130
New/Previous/ Revegetated: (acres)	None/6.2/None	Water usage	
Air emissions: (None/Reference)	See Appendix C.2 for details	Process water: (L)	6,854,625
Fuel combustion		Domestic water: (L)	12,619,592
Gases (CO_2): (tons/yr)	1,794	Energy requirements	
Contaminants[b]: (tons/yr)	87 (total)	Electrical: (MWh/yr)	156
Effluents		Fossil fuel: (L)	1,747,535
Sanitary wastewater: (L)	12,619,592		

a. Sources: EDF-PDS-C-006; EDF-PDS-L-002.

b. CO, particulates, NO_x, SO_2, hydrocarbons.

Table C.6.2-69. Construction and operations project data for Interim Storage of Hot Isostatic Pressed Waste (P72).[a]

Generic Information	
Description/function and EIS project number:	Long-term storage for containers awaiting shipment to NGR (P72)
EIS alternatives/options:	Non-Separations/HIP Waste Option
Project type or waste stream:	Treated HLW calcine
Action type:	New
Structure type	
Size: (m^2)	7,283
Other features: (pits, ponds, power/water/sewer lines)	None
Location	
Inside/outside of fence:	Inside INTEC fence
Inside/outside of building:	Inside Interim Storage Facility
Construction Information	
Schedule start/end:	
Preconstruction:	July 2006 – December 2010
Construction:	January 2011 – December 2013
SO test and start-up:	January 2014 – December 2014
Number of workers:	92 per yr
Number of radiation workers:	None
Heavy equipment	
Equipment used:	Excavator, trucks, grader, cranes
Trips:	1,349 trips
Hours of operation: (hrs)	33,332 (total)
Acres disturbed:	
New/Previous/Revegetated: (acres)	None/3.0/ None
Air emissions: (None/Reference)	See Appendix C.2 for details.
Dust: (tons/yr)	43
Fuel combustion (diesel exhaust)	
Major gas (CO_2): (tons/yr)	907
Contaminants[b]: (tons/yr)	44
Effluents:	
Sanitary wastewater (constr.): (L)	5,876,213
Sanitary wastewater (SO test.): (L)	224,498
Solid wastes:	
Construction trash: (m^3)	3,272
Sanit./ind. trash (SO test): (m^3/yr)	36

Construction Information (continued)	
Hazardous/toxic chemicals & wastes	
Solid hazardous waste: (m^3)	218
Lube oil: (L)	6,308
Radioactive waste	
Contaminated soil (LLW): (m^3)	56
Water usage	
Dust control (construction): (L)	771,005
Domestic (construction): (L)	5,876,213
Domestic (SO testing): (L)	224,498
Energy requirements	
Electrical (MWh/yr)	156
Fossil fuel	
Heavy equipment: (L)	756,964
Other fuel use: (L)	125,945
Operational Information	
Schedule start/end:	January 2015 – indefinite
Number of workers	
Operations/Maintenance/Support:	3/0.5/3
Number of radiation workers:	2.5 (included in above totals)
Avg. annual worker rad. dose: (rem/yr)	0.19 per worker
Heavy equipment:	None
Air emissions: (None/Reference)	None
Effluents	
Sanitary wastewater: (L/yr)	224,498
Solid wastes:	
Sanitary/Industrial trash: (m^3/yr)	36
Hazardous/toxic chemicals & wastes:	None
Radioactive waste:	None
Water usage - Domestic: (L/yr)	224,498
Energy requirements	
Electrical: (MWh/yr)	4,368
Fossil fuel: (L)	0

a. Sources: EDF-PDS-H-003; EDF-PDS-L-002.
b. CO, particulates, NO_x, SO_2, hydrocarbons.

Table C.6.2-70. Decontamination and decommissioning project data for the Interim Storage of Hot Isostatic Pressed Waste (P72).[a]

Decontamination and Decommissioning (D&D) Information			
Schedule start/end:	Unknown	Effluents	
Number of D&D workers:	154 per yr	Sanitary wastewater: (L)	9,818,799
Number of radiation workers (D&D):	16 new workers per yr	Solid wastes	
Avg. annual worker rad. dose: (rem/yr)	0.25 per worker	Non-radioactive (industrial): (m^3)	22,985
Heavy equipment		Hazardous/toxic chemicals & wastes	
Equipment used:	Mobile cranes, roll-off trucks, dozers, loaders	Solid hazardous waste: (m^3)	4
		Lube oil: (L)	6,745
Trips:	9 per day	Water usage	
Total hours of operation:	35,640 hours	Domestic water: (L)	9,818,799
Acres disturbed:		Energy requirements	
New/ Previous/Revegetated: (acres)	None/3.0/None	Electrical: (MWh/yr)	156
Air emissions: (None/Reference)	See Appendix C.2 for details.	Fossil fuel: (L)	809,384
Fuel combustion (diesel exhaust)			
Gases (CO_2): (tons/yr)	831		
Contaminants[b]: (tons/yr)	40 (total)		

a. Sources: EDF-PDS-H-003; EDF-PDS-L-002.
b. CO, particulates, NO_x, SO_2, hydrocarbons.

Table C.6.2-71. Construction and operations project data for Packaging and Loading of Hot Isostatic Pressed Waste for Shipment to a Geologic Repository for Waste Processing (P73A).[a]

Generic Information	
Description/function and EIS Project number:	Package and load HIPed waste canisisters into RMC via ISF (P73A)
EIS alternatives/options:	Non-Separations/HIPed Waste Option
Project type or waste stream:	Waste mgt program, HAW disposal
Action type:	New
Structure type	None
Size: (m^2)	NA
Other features: (pits, ponds, power/water/sewer lines)	None
Location	
Inside/outside of fence:	Inside INTEC fence
Inside/outside of building:	Inside Interim Storage Facility (ISF)
Construction Information	
Schedule start/end:	Unknown
Number of workers:	No construction data is required - procurement only (fabricate 24 casks with internal support and railcars).
Heavy equipment:	
Acres disturbed:	
Air emissions: (None/Reference)	
Effluents:	
Solid wastes:	
Hazardous/toxic chemicals & wastes:	
Water usage:	
Energy requirements:	

Operational Information	
Schedule start/end:	Unknown
Number of workers	
Operations:	3
Maintenance:	0.5
Support:	3
Number of radiation workers:	2.5 (included in above totals)
Avg. annual worker rad. dose (rem/yr):	0.19 per worker
Heavy equipment:	None
Air emissions: (None/Reference)	None
Effluents	
Sanitary wastewater: (L/yr)	224,498
Solid wastes	
Sanitary/Industrial trash: (m^3)	98
Hazardous/toxic chemicals & wastes:	None
Radioactive waste:	None
Water usage - Domestic: (L/yr)	224,498
Energy requirements	
Electrical: (MWh/yr)	135
Fuel oil: (L/yr)	None

a. Sources: EDF-PDS-I-004; EDF-PDS-L-002.

Table C.6.2-72. Decontamination and decommissioning project data for Packaging and Loading of Hot Isostatic Pressed Waste for Shipment to a Geologic Repository for Waste Processing (P73A).[a]

Decontamination and Decommissioning (D&D) Information			
Schedule start/end:	Unknown	Solid wastes	
Number of D&D workers	7 per yr	Non-radioactive:	
Number of radiation workers (D&D):	0 new workers per yr	Neutron shielding: (m^3)	48
Avg. annual worker radiation dose:	None expected, if found 0.25 rem/yr/worker	Foam: (m^3)	313
		Metals: (m^3)	122
Heavy equipment		Industrial: (m^3)	39
Equipment used:	Mobile cranes, roll-off trucks, loaders	Hazardous/toxic chemicals & wastes	
		Lead from casks: (m^3)	68
Trips:	9 per day	Used lube oil: (L)	4,258
Hours of operation: (hrs)	22,500	Water usage	
Acres disturbed:	None	Domestic water: (L)	372,586
Air emissions: (None/Reference)	See Appendix C.2 for details.	Process water: (L)	761,625
Fuel combustion (diesel exhaust)		Energy requirements	
Gases (CO_2): (tons/yr)	630	Electrical: (MWh/yr)	135
Contaminants[b]: (tons/yr)	31 (total)	Fossil fuel: (L)	510,975
Effluents			
Sanitary wastewater: (L)	372,586		

a. Sources: EDF-PDS-I-004; EDF-PDS-L-002.

b. CO, particulates, NO_x, SO_2, hydrocarbons.

Table C.6.2-73. Construction and operations project data for the Direct Cement Process (P80).[a]

Generic Information	
Description/function and EIS project number:	Directly grout HLW calcine (P80).
EIS alternatives/options:	Non-Separations/Direct Cement Option
Project type or waste stream:	Grouted HLW calcine
Action type:	New
Structure type	
Size: (m^2)	18,581
Other features: (pits, ponds, power/water/sewer lines)	None
Location	
Inside/outside of fence:	Inside INTEC fence
Inside/outside of building:	Inside Grouting Facility
Construction Information	
Schedule start/end	
Preconstruction:	July 2000 – December 2007
Construction:	January 2008 – December 2011
SO testing and start-up:	January 2012 – December 2014
Number of workers:	100 per yr
Number of radiation workers:	None
Heavy equipment	
Equip used:	Excavator, grader, crane, trucks
Trips:	3,567
Hours of operation: (hrs)	14,695 (total)
Acres disturbed	
New/Previous/Revegetated: (acres)	None/3.5/None
Air emissions: (None/Reference)	See Appendix C.2 for details.
Dust: (tons/yr)	51
Fuel combustion (diesel exhaust):	
Major gas (CO_2): (tons/yr)	1,498
Contaminants[b]: (tons/yr)	73
SO testing and start-up:	
Fossil fuel (steam use): (tons/yr)	4,877.25
Effluents	
Sanitary wastewater (constr.): (L)	8,516,250
Sanitary wastewater (SO test): (L/yr)	4,835,338

Construction Information (continued)	
Water usage	
Dust control: (L)	605,600
Domestic (construction): (L)	8,516,250
Process water (SO testing): (L)	583,831
Domestic (SO testing): (L)	9,670,675
Energy requirements	
Electrical: (MWh/yr)	156
Fossil fuel:	
Heavy equip./trips (const.): (L)	1,944,737
Steam generation (SO test.): (L/yr)	1,709,444
Operational Information	
Schedule start/end:	January 2015 – December 2035
Number of workers	
Operations/Maintenance/Support:	59/34/47 per yr
Number of radiation workers per yr:	93 (included in above totals)
Avg. annual worker rad. dose: (rem/yr)	0.19 per worker
Heavy equipment:	
Equipment used:	Trucks for deliver only
Trips:	10 per yr
Air emissions: (None/Reference)	See Appendix C.2 for details.
Building ventilation: (Ci/yr)	7.61E-07
Process chem. emissions[c]: (lb/hr)	0.0013
Fossil fuel emissions: (tons/yr)	4,877.25
Effluents	
Sanitary wastewater: (L/yr)	4,835,338
Solid wastes	
Sanitary/Industrial trash: (m^3/yr)	776
Radioactive wastes	
Process output:	
HLW cement: (m^3)/(Ci)	13,000/40,700,000
HEPA filters (LLW): (m^3)	267
Hazardous/toxic chemicals & wastes:	None
Mixed wastes (LLW)	
Solid mixed wastes: (m^3)	63
PPEs & misc. mixed wastes: (m^3)	2,930
Mixed rad. liquid wastes: (L)	2,819,801

Table C.6.2-73. Continued (P80).

Construction Information (continued)		**Operational Information (continued)**	
Solid wastes:		Water usage	
Construction trash: (m^3)	4,742	Process: (L/yr)	291,915
Sanit./Ind. trash (SO testing): (m^3/yr)	776	Domestic: (L/yr)	4,835,338
Hazardous/toxic chemicals & wastes		Energy requirements	
Used lube oil: (L)	12,941	Electrical: (MWh/yr)	3,767
Solid hazardous waste: (m^3)	222	Fuel oil:	
Radioactive wastes		Steam generation: (L/yr)	1,709,444
Contaminated soil: (m^3)	142	Equipment/vehicle fuel: (L/yr)	833

a. Sources: EDF-PDS-C-006; EDF-PDS-L-002.

b. CO, particulates, NO_x, SO_2, hydrocarbons.

c. Source: EDF-PDS-C-043.

Table C.6.2-74. Decontamination and decommissioning project data for the Direct Cement Process (P80).[a]

Decontamination and Decommissioning (D&D) Information			
Schedule start/end:	January 2036 – December 2038	Effluents	
Number of workers each year of D&D:	164 per yr	Sanitary wastewater: (L)	10,478,337
Number of radiation workers (D&D):	121 new workers/yr	Solid wastes	
Avg. annual worker rad. dose: (rem/yr)	0.25 per worker	Non-radioactive (industrial): (m^3)	25,156
Heavy equipment		Hazardous/toxic chemicals & wastes	
Equipment used:	Mobile cranes, roll-off trucks, dozers, loaders	Lube oil: (L)	12,902
		Solid hazardous waste: (m^3)	11
Trips:	15 per day	Radioactive wastes	
Hours of operation: (hrs)	68,175	Solid waste (LLW): (m^3)/(Ci)	33,456/330
Acres disturbed		Mixed wastes (LLW)	
New/Previous/Revegetated: (acres)	None/3.5/None	Solid mixed rad. wastes: (m^3)	141
Air emissions: (None/Reference)	See Appendix C.2 for details.	Decon solution: (L)	75,700
Fuel combustion		Water usage	
Gases (CO_2): (tons/yr)	1,590	Process water: (L)	6,854,625
Contaminants[b]: (tons/yr)	77 (total)	Domestic water: (L)	10,478,337
HEPA filtered offgas: (Ci/yr)	5.81E-08	Energy requirements	
		Electrical: (MWh/yr)	156
		Fossil fuel: (L)	1,548,254

a. Sources: EDF-PDS-C-006; EDF-PDS-L-002.

b. CO, particulates, NO_x, SO_2, hydrocarbons.

Table C.6.2-75. Construction and operations project data for Unseparated Cementitious HLW Interim Storage (P81).[a]

Generic Information	
Description/function and EIS project number:	Provide long-term storage for road-ready HLW containers (P81)
EIS alternatives/options:	Non-Separations/Direct Cement
Project type or waste stream:	Treated HLW calcine
Action type:	New
Structure type:	
Size: (m^2)	15,967
Other features: (pits, ponds, power/water/sewer lines)	None
Location:	
Inside/outside of fence:	Inside INTEC fence
Inside/outside of building:	Inside new building
Construction Information	
Schedule start/end	
Preconstruction:	January 2005 – December 2009
Construction:	January 2010 – December 2013
SO test and start-up:	January 2014 – December 2014
Number of workers:	134 per yr
Number of radiation workers:	None
Heavy equipment	
Equipment used:	Excavator, grader, crane, trucks
Trips:	2,482
Hours of operation: (hrs)	55,360 (total)
Acres disturbed	
New/Previous/Revegetated: (acres)	None/9.0/None
Air emissions: (None/Reference)	See Appendix C.2 for details.
Dust: (tons/yr)	130
Fuel combustion (diesel exhaust):	
Major gas (CO_2): (tons/yr)	1,147
Contaminants[b]: (tons/yr)	56
Effluents	
Sanitary wastewater (constr.): (L)	11,411,775
Sanitary wastewater (SO test.): (L)	224,498
Solid wastes	
Construction trash: (m^3)	6,355
Sanitary/ind. trash (SO test.): (m^3/yr)	36

Construction Information (continued)	
Hazardous/toxic chemicals & wastes	
Used lube oil: (L)	34,923
Solid hazardous waste: (m^3)	220
Radioactive wastes	
Contaminated soil: (m^3)	122
Water usage	
Dust control (construction): (L)	3,700,858
Domestic (construction): (L)	11,411,775
Domestic (SO testing): (L)	224,498
Energy requirements	
Electrical:	
Construction: (MWh/yr)	156
SO testing: (MWh/yr)	4,586
Fossil fuel:	
Heavy equipment (construction): (L)	1,257,231
Other use (construction): (L)	231,743
Operational Information	
Schedule start/end:	January 2015 – indefinite
Number of workers	
Operations/Maintenance/Support:	4/1/1.5 per yr
Number of radiation workers:	4.5 (included in above totals)
Avg. annual worker rad. dose: (rem/yr)	0.19 per worker
Heavy equipment:	None
Air emissions: (None/Reference)	None
Effluents	
Sanitary wastewater: (L/yr)	224,498
Solid wastes	
Sanitary/Industrial trash: (m^3/yr)	36
Hazardous/toxic chemicals & wastes:	None
Radioactive wastes:	None
Water usage - Domestic: (L/yr)	224,498
Energy requirements	
Electrical: (MWh/yr)	4,586
Fossil fuel: (L)	None

a. Sources: EDF-PDS-H-005; EDF-PDS-L-002.
b. CO, particulates, NO_x, SO_2, hydrocarbons.

Table C.6.2-76. Decontamination and decommissioning project data for Unseparated Cementitious HLW Interim Storage (P81).[a]

Decontamination and Decommissioning (D&D) Information			
Schedule start/end:	Unknown	Effluents	
Number of D&D workers :	287.2 new workers per yr	Sanitary wastewater: (L)	18,346,756
Number of radiation workers (D&D):	87.6 new workers per yr	Solid wastes	
Avg. annual worker rad. dose: (rem/yr)	None expected (0.25 per worker if found)	Building rubble: (m^3) Metals: (m^3)	50,817 108
Heavy equipment Equipment used:	Mobile cranes, roll-off trucks, dozers, loaders	Hazardous/toxic chemicals & wastes Solid hazardous wastes: (m^3) Used lube oil: (L)	24 11,752
Trips: Hours of operation: (all heavy equipment) (hrs)	12 per day 62,100	Water usage Domestic water: (L) Energy requirements	18,346,756
Acres disturbed New/Previous/Revegetated: (acres)	None/9.0/None	Electrical: (MWh/yr) Fossil fuel: (L)	156 1,410,291
Air emissions: (None/Reference) Fuel combustion: Gases (CO_2): (tons/yr) Contaminants[b]: (tons/yr)	See Appendix C.2 for details 1,448 70 (total)		

a. Sources: EDF-PDS-H-005; EDF-PDS-L-002.

b. CO, particulates, NO_x, SO_2, hydrocarbons.

Table C.6.2-77. Construction and operations project data for Packaging and Loading of Cementitious Waste at INTEC for Shipment to a Geologic Repository (P83A).[a]

Generic Information	
Description/function and EIS project number:	Package and load cementitious waste canisters into rail casks (P83A)
EIS alternatives/options:	Non-Separations./Direct Cement
Project type or waste stream:	HAW disposal
Action type:	New
Structure type	None
Size: (m^2)	NA
Other features: (pits, ponds, power/water/sewer lines)	NA
Location	
Inside/outside of fence:	Inside INTEC fence
Inside/outside of building:	Inside Interim Storage Facility

Construction Information	
Schedule start/end:	
Design & procurement specs:	Unknown
Cask construction:	Unknown
Number of workers:	No construction activities - procurement only.
Heavy equipment:	
Acres disturbed:	
Air emissions: (None/Reference)	
Effluents:	
Solid wastes:	
Hazardous/toxic chemicals & wastes:	
Water usage:	
Energy requirements:	

Operations Information	
Schedule start/end:	Unknown
Number of workers :	
Operations:	5 per yr
Maintenance:	1 per yr
Support:	5 per yr
Number of radiation workers per yr:	2.5 (included in above totals)
Avg. annual worker rad. dose: (rem/yr)	0.19 per worker
Heavy equipment:	None
Air emissions: (None/Reference)	None
Effluents	
Sanitary wastewater: (L/yr)	379,919
Solid wastes	
Sanitary/Industrial trash: (m^3/yr)	47
Hazardous/toxic chemicals & wastes:	None
Radioactive wastes:	None
Water usage	
Domestic: (L/yr)	379,919
Energy requirements	
Electrical: (MWh/yr)	135
Fossil fuel: (L)	None

a. Sources: EDF-PDS-I-008; EDF-PDS-L-002.

Table C.6.2-78. Decontamination and decommissioning project data for Packaging and Loading of Cementitious Waste at INTEC for Shipment to a Geologic Repository (P83A).[a]

Decontamination and Decommissioning (D&D) Information			
Schedule start/end:	Unknown	Solid wastes	
Number of D&D workers:	7 per yr	Non-radioactive:	
Number of radiation workers (D&D):	0 new workers per yr	Neutron shielding: (m^3)	79
Avg. annual worker rad. dose: (rem/yr)	None expected, if found 0.25 per worker	Foam: (m^3)	521
		Metals: (m^3)	204
Heavy equipment		Industrial: (m^3)	51
Equipment used:	Mobile cranes, roll-off trucks, loaders	Hazardous/toxic chemicals & wastes	
		Used lube oil: (L)	5,961
Trips:	9 per day	Lead from casks: (m^3)	113
Hours of operation (all heavy equipment): (hrs)	31,500	Water usage	
		Process water: (L)	1,066,275
Acres disturbed:	None	Domestic water: (L)	521,620
Air emissions: (None/Reference)	See Appendix C.2 for details	Energy requirements	
Fuel combustion (diesel exhaust):		Electrical: (MWh/yr)	135
Gases (CO_2): (tons/yr)	630	Fossil fuel: (L)	715,365
Contaminants[b]: (tons/yr)	31 (total)		
Effluents			
Sanitary wastewater: (L)	521,620		

a. Sources: EDF-PDS-I-008; EDF-PDS-L-002.

b. CO, particulates, NO_x, SO_2, hydrocarbons.

Table C.6.2-79. Construction and operations project data for the Early Vitrification Facility with Maximum Achievable Control Technology (P88). [a]

Generic Information	
Description/function and EIS project number:	Vitrify liquid waste, calcine, and grout evaporator bottoms (P88)
EIS alternatives/options:	Non-Separations/Early Vitrification
Project type or waste stream:	HLW treatment
Action type:	New
Structure type:	Treatment facility
Size: (m^2)	20,438
Other features: (pits, ponds, power/water/sewer lines)	None
Location:	
Inside/outside of fence:	Inside INTEC fence
Inside/outside of building:	Inside new building
Construction Information	
Schedule start/end:	
Pre-construction:	July 2000 – December 2007
Construction:	January 2008 – December 2012
SO test and start-up:	January 2013 – December 2014
Number of workers:	115 per yr
Number of radiation workers:	None
Heavy equipment	
Equipment used:	Excavator, grader, crane, trucks
Trips:	2,744
Hours of operation: (hrs)	56,402 (total)
Acres disturbed:	
New/Previous/Revegetated: (acres)	None/2.8/None
Air emissions: (None/Reference)	See Appendix C.2 for details.
Dust: (tons/yr)	40
Fuel combustion (diesel exhaust):	
Major gas (CO_2): (tons/yr)	986
Contaminants[b]: (tons/yr)	48
SO testing and start-up	
Fossil fuel emissions: (tons/yr)	5,879.8
Effluents	
Sanitary ww (construction): (L)	9,793,688
Sanitary ww (SO testing): (L/yr)	4,593,571
Process ww (SO testing): (L/yr)	359,870

Construction Information (continued)	
Water usage	
Dust control (construction): (L)	757,000
Domestic (construction): (L)	9,793,688
Process (SO testing): (L)	2,084,631
Domestic (SO testing): (L)	13,780,712
Energy requirements	
Electrical (construction): (MWh/yr)	198
Fuel oil:	
Heavy equipment (construction): (L)	1,280,894
Steam generation (SO testing): (L/yr)	2,060,727
Process use (SO testing): (L/yr)	545,040
Operational Information	
Schedule start/end:	
Vitrify SBW & calcine:	January 2015 – December 2035
Process sodium bearing waste:	January 2015 – December 2016
Number of workers:	
Operations/Maintenance/Support:	48/46/39 per yr
Number of radiation workers:	39 (included in above totals)
Avg. annual work rad. dose: (rem/yr)	0.19 per worker
Heavy equipment:	None
Air emissions: (None/Reference)	See Appendix C.2 for details.
Building ventilation: (Ci/yr)	6.48E-07
Process radioactive emissions[c]: (Ci/yr)	1.11E-03
Process tritium emissions[d]: (Ci/yr)	45
Process chemical emissions[e]: (lb/hr)	2.9
Fossil fuel emissions: (tons/yr)	5,879.8
Effluents	
Sanitary wastewater: (L/yr)	4,593,571
Solid wastes	
Sanitary/industrial trash: (m^3/yr)	738
Radioactive wastes	
HLW glass: (m^3)/(Ci)	8,860
LLW glass: (m^3)/(Ci)	30/28,000
RH TRU (TRU): (m^3)/(Ci)	360/510,000
HEPA filters (LLW): (m^3)	290
Mixed wastes (LLW)	

Table C.6.2-79. Continued (P88).

Construction Information (continued)		Operational Information (continued)	
Solid wastes		Solid mixed wastes.: (m^3)	441
Construction trash: (m^3)	5,454	PPEs & misc. rad. wastes: (m^3)	1,229
Sanitary/ind. trash (SO test): (m^3/yr)	738	Mixed liquid rad. waste: (L)	3,071,801
Hazardous/toxic chemicals & wastes		Hazardous/toxic chemicals & wastes:	None
Used lube oil: (L)	10,674	Water usage	
Solid hazardous wastes: (m^3)	336	Process: (L/yr)	694,877
Radioactive wastes		Domestic: (L/yr)	4,593,571
Contaminated soil (LLW): (m^3)	156	Energy requirements	
		Electrical: (MWh/yr)	16,831
		Fuel oil:	
		Steam generation: (L/yr)	2,060,727
		Process use: (L/yr)	545,040

a. Sources: EDF-PDS-F-006; EDF-PDS-L-002.

b. CO, particulates, NO_x, SO_2, hydrocarbons.

c. Source: EDF-PDS-C-046.

d. Released for 2 years via vitrification process. Source: EDF-PDS-C-046.

e. Source: EDF-PDS-C-043.

Table C.6.2-80. Decontamination and decommissioning project data for the Early Vitrification Facility with Maximum Achievable Control Technology (P88).[a]

Decontamination and Decommissioning (D&D) Information			
Schedule start/end:	January 2036 – December 2040	Radioactive wastes	
Number of D&D workers:	117 per yr	Solid rad. waste (LLW): (m^3)	31,104
Number of radiation workers (D&D):	78 new workers per yr	Solid wastes	
Avg. annual worker rad. dose: (rem/yr)	0.25 per worker	Non-radioactive (industrial): (m^3)	23,387
Heavy equipment:		Mixed wastes (LLW)	
Equipment used:	Mobile cranes, roll-off trucks, dozers, loaders	Solid mixed wastes: (m^3)	281
		Decon solution: (L)	83,270
Trips (roll-off trucks):	18 per day	Hazardous/toxic chemicals & wastes	
Hours of operation: (hrs)	166,950	Lube oil: (L)	31,595
Acres disturbed:		Solid hazardous waste[c]: (m^3)	11
New/Previous/Revegetated: (acres)	None/2.8/None	Water usage	
Air emissions: (None/Reference)	See Appendix C.2 for details.	Process water: (L)	13,328,438
Fuel combustion (diesel exhaust)		Domestic water: (L)	12,467,752
Gases (CO_2): (tons/yr)	2,336	Energy requirements	
Contaminants[b]: (tons/yr)	114 (total)	Electrical: (MWh/yr)	182
HEPA filted offgas: (Ci/yr)	7.26E-08	Fossil fuel: (L)	3,791,435
Effluents			
Sanitary wastewater: (L)	12,467,752		

a. Sources: EDF-PDS-F-006; EDF-PDS-L-002.
b. CO, particulates, NO_x, SO_2, hydrocarbons.
c. Hg and PCB contaminated equipment (after decon); PCBs from electrical equipment taken out of service.

Table C.6.2-81. Construction and operations project data for the Packaging and Loading of Vitrified SBW at INTEC for Shipment to the Waste Isolation Pilot Plant (P90A).[a]

Generic Information		**Operational Information**	
Description/function and EIS project number:	Load vitrified TRU canisters into trailer mounted casks (P90A)	Schedule start/end:	January 2015 - January 2035
EIS alternatives/options:	Non-Separations/Early Vitrification	Number of workers Operations: Maintenance: Support:	 3 per yr 0.5 per yr 3 per yr
Project type or waste stream:	TRU disposal		
Action type:	New		
Structure type: Size: (m^2) Other features: (pits, ponds, power/water/sewer lines)	None -- None	Number of radiation workers:	2.5 (included in above totals)
		Avg. annual worker rad. dose: (rem/yr)	0.19 per worker
		Heavy equipment:	None
		Air emissions: (None/Reference)	None
Location: Inside/outside of fence: Inside/outside of building:	 Inside INTEC fence Inside Interim Storage Facility	Effluents Sanitary wastewater: (L/yr)	 224,498
Construction Information		Solid wastes Sanitary/industrial trash: (m^3/yr)	 36
Schedule start/end Design & procurement specs.: Cask construction	 January 2010 - December 2011 January 2012 - December 2014	Radioactive wastes:	None
		Mixed wastes (LLW):	None
		Hazardous/toxic chemicals:	None
Number of workers:	No construction activities – procurement only.	Water usage Domestic: (L/yr)	 224,498
Heavy equipment:		Energy requirements Electrical: (MWh/yr) Fossil fuel: (L)	 86 None
Acres disturbed: New/Previous/Revegetated: (acres)			
Air emissions (None/Reference)			
Solid wastes:			
Hazardous/toxic chemicals & wastes:			
Water usage:			
Energy requirements:			

a. Sources: EDF-PDS-I-010; EDF-PDS-L-002.

Table C.6.2-82. Decontamination and decommissioning project data for the Packaging and Loading of Vitrified SBW at INTEC for Shipment to the Waste Isolation Pilot Plant (P90A).[a]

Decontamination and Decommissioning (D&D) Information			
Schedule start/end:	January 2036 – June 2037	Solid wastes	
Number of D&D workers :	7 per yr	Non-radioactive	
Number of radiation workers (D&D):	0 new workers/yr	Foam: (m^3)	69
Avg. annual worker rad. dose: (rem/yr)	None expected, if found 0.25 per worker	Metals: (m^3) Industrial: (m^3)	27 76
Heavy equipment		Hazardous/toxic chemicals & wastes	
Equipment used:	Mobile cranes, roll-off trucks, loaders	Used lube oil: (L) Lead: (m^3)	2,555 15
Trips (roll-off trucks):	9 per day	Water usage	
Hours of operation (all heavy equipment): (hrs)	13,500	Process water: (L) Domestic water: (L)	228,488 223,552
Acres disturbed:	None	Energy requirements	
Air emissions: (None/Reference)	See Appendix C.2 for details	Electrical: (MWh/yr)	135
Fuel combustion (diesel exhaust)		Fossil fuel: (L)	306,585
Gases (CO_2): (tons/yr)	630		
Contaminants[b]: (tons/yr)	31 (total)		
Effluents			
Sanitary wastewater: (L)	223,552		

a. Sources: EDF-PDS-I-010; EDF-PDS-L-002.
b. CO, particulates, NO_x, SO_2, hydrocarbons.

Table C.6.2-83. Construction and operations project data for the SBW and Newly Generated Liquid Waste Treatment with Cesium Ion Exchange Contact-Handled Transuranic Grout and Low-Level Waste Grout (P111).[a]

Generic Information	
Description/function and EIS project number:	Process SBW & NGLW into grout to ship to WIPP and Hanford (P111)
EIS alternatives/options:	Minimum INEEL Processing Alt.
Project type or waste stream:	Grouted TRU and Grouted LLW
Action type:	New
Structure type	Processing facility
Size: (m^2)	2,787
Other features (pits, ponds, lines):	None
Location	
Inside/outside of fence:	Inside INTEC fence
Inside/outside of building:	Inside processing facility
Construction Information	
Schedule start/end	
Pre-construction:	January 2001 – June 2005
Construction:	July 2005 - December 2007
SO test and start-up:	January 2007 - December 2008
Number of workers:	20 per yr
Heavy equipment	
Equipment used:	Excavator, grader, crane, trucks
Trips:	566
Hours of operation: (hrs)	1,921 (total)
Acres disturbed	
New/Previous/Revegetated (acres)	None/0.95/None
Air emissions (None/Reference)	See Appendix C.2 for details.
Construction:	
Dust: (tons/yr)	14
Fuel combust. (diesel exhaust):	
Major gas (CO_2): (tons/yr)	72
Contaminants[b]: (tons/yr)	3.5
SO testing and start-up:	
Process air emissions: (tons/yr)	0.00001
Fossil fuel (steam use): (tons/yr)	434.98
Effluents:	
Sanitary ww (const.): (L)	1,277,438
Sanitary ww (SO test.): (L/yr)	1,934,135
Construction Information (continued)	
Energy requirements	
Electrical: (MWh/yr)	180
Fuel oil:	
Heavy equipment (construction): (L)	70,046
Steam generation (SO testing): (L/yr)	152,314
Equip./vehicle fuel (SO testing) (L/yr)	666
Operational Information	
Schedule start/end:	
Cesium ion exchange:	January 2009 – December 2025
Treatment of sodium bearing waste:	January 2009 – December 2012
Number of workers	
Operations/Maintenance/Support:	23/17/16 per yr
Number of radiation workers	33 per yr (incl. in above total)
Avg. annual worker rad. dose: (rem/yr)	0.19 per worker
Heavy equipment	
Equipment used:	Trucks
Trips:	8 per yr
Air emissions: (None/Reference)	See Appendix C.2 for details.
Building ventilation: (Ci/yr)	3.25E-08
Process radioactive emissions: (Ci/yr)	0.600
Process tritium emissions[c]: (Ci/yr)	22.5
Process chemical emissions: (tons/yr)	2.80E-03
Fossil fuel emissions: (tons/yr)	434.98 (total)
Effluents	
Sanitary wastewater: (L/yr)	1,934,135
Solid wastes	
Sanitary/industrial trash: (m^3/yr)	311
Radioactive wastes	
Process output:	
CH-TRU Grout: (m^3)/(Ci)	7,500/340,000
LLW Grout: (m^3)/(Ci)	230/7,200
LLW GTCC (resin): (m^3)/(Ci)	9/250,000
HEPA filters (LLW): (m^3)	41
Hazardous/toxic chemicals & wastes:	None
Mixed wastes (LLW)	

Table C.6.2-83. Continued (P111).

Construction Information (continued)		**Operational Information (continued)**	
Solid wastes		Solid mixed wastes: (m^3)	10.2
Construction trash: (m^3)	711	PPEs & misc. mixed wastes: (m^3)	842
SO testing:		Mixed rad. liquid waste: (L)	431,843
Sanitary/industrial trash: (m^3/yr)	311		
Radioactive wastes		Water usage	
Contaminated soil (LLW): (m^3)	21	Process: (L/yr)	828,461
Hazardous/toxic chemicals & wastes		Domestic: (L/yr)	1,934,135
Used lube oil: (L)	143	Energy requirements	
Solid haz. wastes: (m^3)	6	Electrical: (MWh/yr)	1,484
Water usage		Fuel oil:	
Dust control (construction): (L)	454,200	Steam generation: (L/yr)	152,314
Domestic (construction): (L)	1,277,438	Equipment/vehicle fuel: (L/yr)	666
Process (SO testing): (L)	69,038		
Domestic (construction): (L)	1,934,135		

a. Sources: EDF-PDS-D-004; EDF-PDS-L-002.

b. CO, particulates, NO_x, SO_2, hydrocarbons.

c. For 4 years via evaporation and grouting processess. Source: EDF-PDS-C-046.

Table C.6.2-84. Decontamination and decommissioning project data for the SBW and Newly Generated Liquid Waste Treatment with Cesium Ion Exchange Contact-Handled Transuranic Grout and Low-Level Waste Grout (P111).[a]

Decontamination and Decommissioning (D&D) Information			
Schedule start/end:	January 2026 – December 2026	Effluents	
Number of D&D workers	104 per yr	Sanitary wastewater: (L)	2,224,291
Number of radiation workers (D&D):	59 new workers per yr (included in number above)	Solid wastes Industrial: (m^3)	3,742
Avg. annual worker rad. dose: (rem/yr)	0.25 per worker	Radioactive wastes Solid LLW: (m^3)	4,977
Heavy equipment Equipment used: Trips (roll-off trucks): Hours of operation (all heavy equipment): (hrs)	Mobile cranes, roll-off trucks, dozers, loaders 9 per day 11,925	Mixed waste (LLW) Decontamination solution: (L) Solid mixed wastes: (m^3)	11,355 4
		Hazardous/toxic chemicals & wastes Solid hazarsous waste: (m^3) Used lube oil: (L)	2 2,257
Acres disturbed New/Previous/Revegetated: (acres)	None/0.95/None	Water usage Process water: (L) Domestic water: (L)	761,625 2,224,291
Air emissions: (None/Reference) Fuel combustion (diesel exhaust): Major gases (CO_2): (tons/yr) Contaminants[b]: (tons/yr) HEPA filtered offgas: (Ci/yr)	See Appendix C.2 for details. 834 41 (total) 5.81E-08	Energy requirements Electrical: (MWh/yr) Fossil fuel: (L)	180 270,817

a. Sources: EDF-PDS-D-004; EDF-PDS-L-002.

b. CO, particulates, NO_x, SO_2, hydrocarbons.

Table C.6.2-85. Construction and operations project data for the Packaging and Loading Contact-Handled Transuranic Waste for Shipment to the Waste Isolation Pilot Plant (P112A).[a]

Generic Information	
Description/function and EIS project number:	Package/load drums into casks for ground transport (P112A)
EIS alternatives/options:	Minimum INEEL Processing Alt.
Project type or waste stream:	TRU disposal
Action type:	New
Structure type	None
Size: (m^2)	0
Other features: (pits, ponds, power/water/sewer lines)	None
Location	
Inside/outside of fence:	Inside INTEC fence
Inside/outside of building:	Inside NGLW Facility
Construction Information	
Schedule start/end:	
Design & procurement:	January 2002 – December 2005
Cask construction:	January 2006 – December 2008
Number of workers:	No construction – only procurement activities.
Heavy equipment:	
Acres disturbed:	
Air emissions: (None/Reference)	
Effluents:	
Solid wastes:	
Hazardous/toxic chemicals & wastes:	
Water usage:	
Energy requirements:	

Operational Information	
Schedule start/end:	January 2009 - December 2025
Number of workers per yr	
Operations:	8
Maintenance:	2
Support:	8
Number of radiation workers per yr:	2.5 (included in above total)
Avg. annual worker rad. dose: (rem/yr)	0.19 per worker
Heavy equipment:	None
Air emissions: (None/Reference)	None
Effluents	
Sanitary wastewater: (L/yr)	621,686
Solid wastes	
Sanitary/industrial trash: (m^3/yr)	100
Radioactive wastes:	None
Hazardous/toxic chemicals & wastes:	None
Water usage - Domestic: (L/yr)	621,686
Energy requirements	
Electrical: (MWh/yr)	86
Fuel oil: (L/yr)	None

a. Sources: EDF-PDS-I-011; EDF-PDS-L-002.

Table C.6.2-86. Decontamination and decommissioning project data for the Packaging and Loading Contact-Handled Transuranic Waste for Shipment to the Waste Isolation Pilot Plant (P112A).[a]

Decontamination and Decommissioning (D&D) Information			
Schedule start/end:	January 2026 – June 2030	Effluents	
Number of D&D workers:	7 per yr	Sanitary wastewater: (L)	670,655
Number of radiation workers (D&D):	None	Solid wastes	
Avg. annual worker rad. dose: (rem/yr)	None expected, if found 0.25 per worker	Non-radioactive:	
		Foam: (m^3)	468
Heavy equipment		Metals: (m^3)	184
Equipment used:	Mobile cranes, roll-of trucks, loaders	Industrial: (m^3)	228
		Hazardous/toxic chemicals & wastes	
Trips (roll-off trucks):	9 per day	Used lube oil: (L)	7,665
Hours of operation (all heavy equipment): (hrs)	40,500	Water usage	
		Process water: (L)	685,463
Acres disturbed: (acres)	None	Domestic water: (L)	670,655
Air emissions: (None/Reference)	See Appendix C.2 for details.	Energy requirements	
Fuel combustion:		Electrical: (MWh/yr)	135
Major gas (CO_2): (tons/yr)	630	Fossil fuel: (L)	919,755
Contaminant[b]: (tons/yr)	31 (total)		

a. Sources: EDF-PDS-I-011; EDF-PDS-L-002.

b. CO, particulates, NO_x, SO_2, hydrocarbons.

Table C.6.2-87. Construction and operations project data for Calcine Packaging and Loading to Hanford (P117A).[a]

Generic Information		**Construction Information (continued)**	
Description/function and EIS project number:	Fill & make ready to send containers of unprocessed calcine to Hanford (P117A)	Water usage Dust control (construction): (L) Domestic (construction): (L) Process (SO testing): (L) Domestic (SO testing): (L)	 238,000 3,321,000 7,000 2,044,000
EIS alternatives/options:	Minimum INEEL Processing Alt.		
Project type or waste stream:	Containers of unprocessed calcine		
Action type:	New	Energy requirements Electrical (construction): (MWh/yr) Fuel oil: Heavy equipment/trips (const.): (L) Steam generation (SO testing): (L/yr) Equipment/fuel oil (SO testing): (L)	 180 111,000 233,982 333
Structure type Size: (m^2) Other features: (pits, ponds, lines)	New facility 1,932 None		
Location Inside/outside of fence: Inside/outside of building:	 Inside INTEC fence New building	**Operational Information**	
Construction Information		Schedule start/end:	January 2011 – December 2025
Schedule start/end Preconstruction: Construction: SO test and start-up:	 January 2002 – December 2006 January 2007 – December 2010 January 2009 – December 2010	Number of workers Operations/Maintenance/Support:	 36/8/4 per yr
		Number of radiation worker:	44 (included in above total)
		Avg. annual worker rad. dose: (rem/yr)	0.19 per worker
Number of workers:	78 per yr	Heavy equipment Equipment used: Trips:	 Mobile cranes, forklifts, trucks 2
Number of radiation workers:	None		
Heavy equipment Equipment used: Trips: Hours of operation: (hrs)	 Excavator, grader, crane, trucks 817 1,909 (total)	Air emissions: (None/Reference) Building ventilation: (Ci/yr) Process radioactive emissions: (Ci/yr) Fossil fuel emissions: (tons/yr)	See Appendix C.2 for details. 2.35E-07 3.10E-05 668.04 (total)
Acres disturbed: New/Previous/Revegetated: (acres)	 None/1.16/None	Effluents Sanitary wastewater: (L/yr)	 1,022,000
Air emissions: (None/Reference) Dust: (tons/yr) Fuel combustion: Major gas (CO_2): (tons/yr) Contaminants[b]: (tons/yr) SO testing and start-up: Fossil fuel (steam use): (tons/yr)	See Appendix C.2 for details. 17 171 8.32 668.04	Solid wastes Sanitary/industrial trash: (m^3/yr)	 0.27
		Radioactive wastes Calcine & Cs resin (HLW): (m^3) HEPA filters (LLW): (m^3)	 4,324 18
Effluents Sanitary ww (construction): (L) Sanitary ww (SO testing): (L/yr)	 3,321,000 1,022,000	Mixed wastes (LLW) PPEs & misc. waste: (m^3) Mixed rad. liquid waste: (L)	 924 187,200
		Hazardous/toxic chemicals & wastes:	None

Table C.6.2-87. Continued (P117A)

Construction Information (continued)		Operational Information (continued)	
Solid wastes		Water usage	
Sanitary/industrial trash:		Process: (L/yr)	125,000
Construction: (m^3)	1,848.94	Domestic: (L/yr)	1,022,000
Start-up testing: (m^3/yr)	0.27		
Hazardous/toxic chemicals & wastes		Energy requirements	
Lube oil: (L)	2,000	Electrical: (MWh/yr)	7,580
Solid hazardous wastes: (m^3)	24	Fuel oil:	
Radioactive wastes		Steam generation: (L/yr)	233,982
Contaminated soil (LLW): (m^3)	15	Equipment/vehicle oil: (L/yr)	167

a. Sources: EDF-WPF-013; EDF-PDS-L-002.

b. CO, particulates, NO_x, SO_2, hydrocarbons.

Table C.6.2-88. Decontamination and decommissioning project data for Calcine Packaging and Loading to Hanford (P117A).[a]

Decontamination and Decommissioning (D&D) Information			
Schedule start/end:	January 2026 – December 2028	Effluents	
Number of D&D workers :	52 per yr	Sanitary wastewater: (L)	3,327,000
Number of radiation workers (D&D):	33 new workers/yr	Solid wastes	
Avg. annual worker rad. dose: (rem/yr)	0.25 per worker	Neutron shielding: (m^3)	54.4
Heavy equipment		Foam: (m^3)	85.6
Equipment used:	Mobile cranes, roll-off trucks, dozers, loaders	Radioactive wastes	
		Solid wastes (LLW): (m^3)	110
Trips (roll-off trucks):	15 per day	Mixed wastes (LLW)	
Hours of operation		Decon solution: (L)	7,837
(all heavy equipment): (hrs)	4,662	Hazardous/toxic chemicals & wastes	
Acres disturbed		Lead (from shielding): (m^3)	46
New: (acres)	None	Used lube oil: (L)	2,000
Previous: (acres)	1.16	Water usage	
Revegetated: (acres)	None	Process water: (L)	9,140,000
Air emissions: (None/Reference)	See Appendix C.2 for details	Domestic water: (L)	3,327,000
Non-radioactive:		Energy requirements	
Fuel combustion:		Electrical: (MWh/yr)	156
Major gas (CO_2): (tons/yr)	109	Fossil fuel: (L)	105,874
Contaminants[b]: (tons/yr)	5.29 (total)		

a. Sources: EDF-WPF-013; EDF-PDS-L-002.

b. CO, particulates, NO_x, SO_2, hydrocarbons.

Table C.6.2-89. Construction and operations project data for Calcine Packaging and Loading to Hanford Just-in-Time (P117B).[a]

Generic Information	
Description/function and EIS project number:	Fill & make ready to send containers of unprocessed calcine to Hanford on a just-in-time schedule (P117B)
EIS alternatives/options:	Minimum INEEL Processing Alt.
Project type or waste stream:	Containers of unprocessed calcine
Action type:	New
Structure type	New facility
Size: (m^2)	2,384
Other features: (pits, ponds, lines)	None
Location	
Inside/outside of fence:	Inside INTEC fence
Inside/outside of building:	New building
Construction Information	
Schedule start/end	
Pre-construction:	June 2014 – May 2019
Construction:	September 2019 – November 2024
SO test and start-up:	December 2024 – January 2028
Number of workers:	53 per yr
Number of radiation workers:	None
Heavy equipment	
Equipment used:	Excavator, grader, crane, trucks
Trips:	1,617
Hours of operation: (hrs)	3,216 (total)
Acres disturbed	
New/Previous/Revegetated (acres)	None/1.45/None
Air emissions: (None/Reference)	See Appendix C.2 for details.
Construction:	
Dust: (tons/yr)	21
Fuel combustion:	
Major gas (CO_2): (tons/yr)	123
Contaminants[b]: (tons/yr)	5.89
SO testing and start-up:	
Fossil fuel (steam use): (tons/yr)	26
Effluents	
Sanitary wastewater (constr.): (L)	5,981,000
Sanitary wastewater (SO test.): (L)	6,813,000
Construction Information (continued)	
Water usage	
Dust control (construction): (L)	789,000
Domestic water (construction): (L)	5,981,000
Domestic water (SO testing): (L)	6,813,000
Process water (SO testing): (L)	1,100
Energy requirements	
Electrical: (MWh/yr)	180
Fossil fuel:	
Equip./vehicle fuel (constr.): (L)	208,000
Steam generation (SO testing): (L)	943,000
Equip./vehicle fuel (SO testing): (L)	7,994
Operational Information	
Schedule start/end:	February 2028 - March 2030
Number of workers	
Operations/Maintenance/Support:	64/4/32 per yr
Number of radiation worker:	99 (included in above total)
Avg. annual worker rad. dose: (rem/yr)	0.19 per worker
Heavy equipment	
Equipment used:	Mobile cranes, forklifts, trucks
Trips:	30
Air emissions: (None/Reference)	See Appendix C.2 for details.
Building ventilation: (Ci/yr)	2.98E-07
Process radioactive emissions: (Ci/yr)	3.64E-05
Fossil fuel (steam use): (tons/yr)	26
Effluents	
Sanitary wastewater: (L/yr)	2,129,000
Solid wastes	
Sanitary/industrial trash: (m^3/yr)	0.55
Radioactive wastes	
Unprocessed calcine canisters: (m^3/yr)	1,962
Cesium resin canisters: (m^3/yr)	2.5
HEPA filters (LLW): (m^3/yr)	14
Mixed wastes (LLW)	
PPE & misc. mixed waste (ash): (m^3/yr)/(Ci/yr)	0.4/0.31
Hazardous/toxic chemicals & wastes	
Paint, solvents, etc: (m^3/yr)/(Ci/yr)	2.8/<1

Table C.6.2-89. Continued (P117B).

Construction Information (continued)		Operational Information (continued)	
Solid wastes		Water usage	
Construction trash: (m^3)	3,329	Process water: (L/yr)	3,225,000
Start-up testing:		Domestic water: (L/yr)	2,129,000
Sanitary/industrial trash: (m^3/yr)	0.55	Energy requirements	
Hazardous/toxic chemicals & wastes		Electrical: (MWh/yr)	10,470
Lube oil: (m^3)	Incinerated at WERF	Total fuel oil:	
Hazardous wastes: (m^3)	13.6 (total)	Steam generation: (L/yr)	294,800
Storage/inventory: (m^3)	2.5	Equipment/vehicle fuel: (L/yr)	2,498

a. Sources: EDF-WPF-015; EDF-PDS-L-002.
b. CO, particulates, NO_x, SO_2, hydrocarbons.

Table C.6.2-90. Decontamination and decommissioning project data for Calcine Packaging and Loading to Hanford Just-in-Time (P117B).[a]

Decontamination and Decommissioning (D&D) Information			
Schedule start/end:	January 2035 – December 2037	Effluents	
Number of D&D workers:	88 per yr	Sanitary wastewater: (L)	7,510,000
Number of radiation workers (D&D):	56 new workers/yr	Solid wastes	
Avg. annual worker rad. dose: (rem/yr)	0.25 per worker	Neutron shielding: (m^3)	171.7
Heavy equipment		Foam: (m^3)	270.3
Equipment used:	Mobile cranes, roll-off trucks, dozers, loaders	Radioactive wastes	
		Metal (LLW): (m^3)/(Ci)	348/insignificant rad
Trips (roll-off trucks):	15 per day	Mixed wastes (LLW)	
Hours of operation		LLW Combustible PPE (ash): (m^3)/(Ci)	0.099/0.071
(all heavy equipment): (hrs)	44,024	Hazardous/toxic chemicals & wastes	
Acres disturbed		Lead (from shielding): (m^3)	146.2
New: (acres)	None	Used lube oil:	Incinerated at WERF
Previous: (acres)	1.45	Water usage	
Revegetated: (acres)	None	Process water: (L)	17,033,000
Air emissions: (None/Reference)	See Appendix C.2 for details.	Domestic water: (L)	7,510,000
Non-radioactive		Energy requirements	
Fuel combustion:		Electrical: (MWh/yr)	156
Major gas (CO_2): (tons/yr)	770	Fossil fuel: (L)	1,000,000
Contaminants[b]: (tons/yr)	37.51 (total)		
HEPA filtered offgas: (Ci/yr)	1.74E-7		

a. Sources: EDF-WPF-015; EDF-PDS-L-002.

b. CO, particulates, NO_x, SO_2, hydrocarbons.

Table C.6.2-91. Construction and operations project data for the Separations Organic Incinerator (P118).[a]

Generic Information	
Description/function and EIS project number:	Treat spent organic solvents from separation process (P118)
EIS alternatives/options:	Full Separations, Planning Basis, & Transuranic Separations Options
Project type or waste stream:	Spent organic solvent
Action type:	New
Structure type	New facility
Size: (m^2)	232
Other features: (pits, ponds, power/water/sewer lines)	None
Location	
Inside/outside of fence:	Inside INTEC fence
Inside/outside of building:	Inside new building
Construction Information	
Schedule start/end:	
Full Separations Option[b]:	
Preconstruction:	April 2006 – September 2009
Construction:	October 2009 – December 2012
SO test and start-up:	January 2013 – December 2014
Number of workers:	10 per yr
Number of radiation workers:	None
Heavy equipment:	Crane, material delivery trucks
Trips:	41
Hours of operation (hrs):	4,723 (total)
Acres disturbed	
New/Previous/Revegetated (acres)	None/0.1/None
Air emissions: (None/Reference)	See Appendix C.2 for details.
Construction:	
Dust: (tons/yr)	2
Diesel exhaust:	
Major gas (CO_2): (tons/yr)	103
Contaminants[c]: (tons/yr)	5
Effluents	
Sanitary ww (construction): (L)	702,591
Sanitary ww (SO testing): (L/yr)	293,574
Solid wastes	
Construction trash: (m^3)	391
Construction Information (continued)	
Hazardous/toxic chemicals & wastes	
Lube oil: (L)	896
Solid hazardous waste: (m^3)	1
Water usage	
Dust control (construction): (L)	24,981
Domestic (construction): (L)	702,591
Domestic (SO testing): (L/yr)	293,574
Process (SO testing): (L)	66,238
Energy requirements	
Electrical: (MWh/yr)	None
Fossil fuel	
Heavy equipment: (L)	110,671
Process use (SO testing): (L)	766
Operational Information	
Schedule start/end:	
Full Separations Option[b]:	January 2015 – December 2035
Number of workers per year	
Operations/Maintenance/Support:	4/1/3.5 per yr
Number of radiation workers:	8.5 (inc. in above total)
Avg. annual worker rad. dose: (rem/yr)	0.19 per worker
Heavy equipment	Mobile cranes, forklifts, trucks
Trips:	4 per yr
Air emissions: (None/Reference)	See Appendix C.2 for details.
Process chemical emissions[d]: (lb/hr)	1,149.8
Effluents	
Sanitary wastewater: (L/yr)	293,574
Solid wastes	
Sanitary/industrial trash: (m^3/yr)	47
Radioactive wastes	
Solid radioactive wastes (LLW): (m^3)	84
HEPA filter (LLW): (m^3)	3
Hazardous/toxic chemicals & wastes	
Solid hazardous waste: (m^3)	21
Mixed wastes (LLW)	
PPEs & misc. rad. waste: (m^3)	268
Mixed liquid rad. waste: (L)	31,500
Water usage	

Table C.6.2-91. Continued (P118).

Construction Information		Operational Information	
SO testing & start-up:		Process: (L/yr)	461,808
Sanitary/industrial trash: (m^3/yr)	47	Domestic: (L/yr)	293,574
Radioactive wastes		Energy requirements	
Contaminated soil (LLW): (m^3)	2	Electrical: (MWh/yr)	17
		Fuel oil (equipment/vehicles): (L/yr)	333

a. Sources: EDF-PDS-E-008; EDF-PDS-L-002.

b. Schedule for other options:
Planning Basis Option: Preconstruction: March 2011 – September 2014; Construction: October 2014 – December 2017; SO testing: January 2018 – December 2019; Operations: January 2020 – December 2035.
TRU Separations Option: Preconstruction: March 2005 – September 2009; Construction: October 2009 – December 2012; SO testing: January 2013 – December 2014; Operations: January 2015 – December 2035.

c. CO, particulates, NO_x, SO_2, hydrocarbons.

d. Source: EDF-PDS-C-043.

Table C.6.2-92. Decontamination and decommissioning project data for the Separations Organic Incinerator (P118).[a]

Decontamination and Decommissioning (D&D) Information			
Schedule start/end:	January 2036 – December 2037	Effluents	
Number of D&D workers:	2 per yr	Sanitary wastewater: (L)	716,747
Number of radiation workers (D&D):	2 new workers per yr	Solid wastes:	None
Avg. annual worker rad. dose: (rem/yr)	0.25 per worker	Hazardous/toxic chemicals and wastes	
Heavy equipment		Lube oil: (L)	710
Equipment used:	Mobile cranes, roll-off trucks, dozers, loaders	Radioactive wastes	
		Decon solution: (L)	946
Trips:	30 per day	Mixed waste	
Total hours of operation: (hrs)	3,752	Mixed solid waste: (m^3)	14
Acres disturbed		Water usage	
New/Previous/Revegetated: (acres)	None/0.1/None	Domestic water: (L)	716,747
Air emissions: (None/Reference)	See Appendix C.2 for details	Process water: (L)	228,488
Fuel combustion:		Energy requirements	
Major gas (CO_2): (tons/yr)	131	Electrical: (MWh/yr)	7.8
Contaminants[b]: (tons/yr)	6 (total)	Fossil fuel: (L)	85,208

a. Sources: EDF-PDS-E-008; EDF-PDS-L-002.
b. CO, particulates, NO_x, SO_2, hydrocarbons.

Table C.6.2-93. Construction and operations project data for the Waste Treatment Pilot Plant (P133).[a]

Generic Information	
Description/function and EIS project number:	Pilot plant process development studies
EIS alternatives/options:	All options under Separations & Non-Separations Alternatives & Min. INEEL Processing Alt.
Project type or waste stream:	Solid LLW
Action type:	New
Structure type	New facility
Size: (m^2)	5,440
Other features: (pits, ponds, power/water/sewer lines)	None
Location	
Inside/outside of fence:	Inside INTEC fence
Inside/outside of building:	New building
Construction Information	
Schedule start/end: [b]	
Preconstruction:	January 2000 – December 2004
Construction:	January 2005 – December 2007
SO test and start-up:	January 2008 – December 2008
For Planning Basis Option only:	
Preconstruction:	January 2005 – December 2009
Construction:	January 2010 – December 2012
SO test and start-up:	January 2013 – December 2013
Number of workers:	63 per yr
Number of radiation workers:	None
Heavy equipment	Excavator, grader, crane, backhoe, trucks
Trips:	895
Hours of operation (hrs):	16,370
Acres disturbed	
New/Previous/Revegetated: (acres)	None/1.2/None
Air emissions: (None/Reference)	See Appendix C.2 for details.
Dust (construction): (tons/yr)	17
Diesel exhaust (construction):	
Major gas (CO_2): (tons/yr)	467
Contaminants[c]: (tons/yr)	21.2

Construction Information (continued)	
Radioactive wastes	
Contaminated soil (LLW): (m^3)	42
Water usage	
Dust control (construction): (L)	362,000
Domestic (construction): (L)	4,024,000
Domestic (SO testing): (L)	830,000
Energy requirements	
Electrical: (MWh/yr)	180
Fuel oil:	
Heavy equipment (construction): (L)	455,000
Steam generation (SO testing): (L/yr)	1,473,516[f]
Operational Information	
Schedule start/end:	January 2009 – December 2035
Min. INEEL Process. Alternative only:	January 2009 – December 2025
Planning Basis Option only:	January 2014 – December 2035
Number of workers per year	
Operations/Maintenance/Support:	23/7/9 per yr
Number of radiation workers:	33 (included in above totals)
Annual average worker rad. dose: (rem/yr)	0.19 per worker
Heavy equipment	
Trips:	4 per yr
Air emissions: (None/Reference)	See Appendix C.2 for details.
Diesel exhaust:	Essentially none
Steam generation:	
Major gas (CO_2): (tons/yr)	4,185[d]
Contaminants[b]: (tons/yr)	19.2[e]
Building ventilation: (Ci/yr)	2.8E-08
Effluents	
Sanitary wastewater: (L/yr)	830,000
Solid wastes	
Sanitary/industrial trash: (m^3/yr)	0.22 (ash)
Waste salt: (m^3/yr)	10
Radioactive wastes	
HEPA filters (LLW): (m^3)	90
Hazardous/toxic chemicals & wastes	
Solid hazardous waste: (m^3)	4

Table C.6.2-93. Continued (P133).

Construction Information (continued)		**Operational Information (continued)**	
Steam generation (SO testing):		Mixed wastes (LLW)	
Major gas (CO_2): (tons/yr)	4,185[d]	PPEs: (m^3)	1,337
Contaminants[c]: (tons/yr)	19.2[e]	Mixed liquid waste: (L)	948,672
Effluents		Water usage	
Sanitary ww (construction): (L)	4,024,000	Domestic water: (L/yr)	830,000
Sanitary ww (SO testing): (L)	830,000	Energy requirements	
Solid wastes		Electrical: (MWh/yr)	2,514
Sanitary/industrial trash:		Fuel oil:	
Construction: (m^3)	2,240	Equipment/vehicle fuel: (L/yr)	369
SO testing: (m^3)	0.22	Steam generation: (L/yr)	1,473,516[f]
Waste salt (SO testing): (m^3)	10		
Hazardous/toxic chemicals & wastes			
Used lube oil: (m^3)	6,300		
Solid hazardous waste: (m^3)	14		

a. Sources: EDF-PDS-I-028; EDF-PDS-L-002.
b. Durations for Full Separations, TRU Separations, HIPed Waste, Direct Cement, Early Vitrification Options, and Minimum INEEL Processing Altenative.
c. CO, particulates, NO_x, SO_2, hydrocarbons.
d. Value shown is for Full Separations and Planning Basis Option only. For Transuranic Separations Option: 2,091 tons/yr and for Hot Isostatic Press Waste Option, Direct Cement, Early Vitrification Options, and Minimum INEEL Processing Alternative: 1,257 tons/yr.
e. Value shown is for Full Separations and Planning Basis Option only. For Transuranic Separations Option: 9.6 tons/yr and for Hot Isostatic Press Waste Option, Direct Cement, Early Vitrification Options, and Minimum INEEL Processing Alternative: 5.8 tons/yr.
f. Value shown is for Full Separations and Planning Basis Option only. For Transuranic Separations Option: 736,285 L/yr; and for Hot Isostatic Press Waste Option, Direct Cement, and Early Vitrification Options, and Minimum INEEL Processing Alternative: 442,801 L/yr..

Table C.6.2-94. Decontamination and decommissioning project data for the Waste Treatment Pilot Plant (P133).[a]

Decontamination and Decommissioning (D&D) Information			
Schedule start/end:	January 2036 – December 2037	Solid wastes	
Number of D&D workers:	45 per yr	Metal recycle: (m^3)	36.9
Number of radiation workers (D&D):	25 workers per yr	Building recycle: (m^3)	5,397
Avg. annual worker rad. dose: (rem/yr)	0.25 per worker	Radioactive wastes	
Heavy equipment		Building debris (LLW): (m^3)	6,745
Equipment used:	Mobile cranes, roll-off trucks, dozers, loaders	Hazardous/toxic chemicals and wastes	
		Solid hazardous wastes: (m^3)	3
Trips:	2 per day	Used lube oil: (L)	5,000
Total hours of operation: (hrs)	19,624	Mixed wastes	
Acres disturbed		Decon solution: (L)	22,165
New/Previous/Revegetated: (acres)	None/1.17/None	Water usage	
Air emissions: (None/Reference)	See Appendix C.2 for details.	Domestic water: (L)	1,932,000
Diesel exhaust:		Process water: (L)	341,000
Major gas (CO_2): (tons/yr)	1,374	Energy requirements	
Contaminants[b]: (tons/yr)	31.3	Electrical: (MWh/yr)	156
Effluents		Fossil fuel: (L)	446,000
Sanitary wastewater: (L)	1,932,000		

a. Sources: EDF-PDS-I-028; EDF-PDS-L-002.
b. CO, particulates, NO_x, SO_2, hydrocarbons.

Table C.6.2-95. Decontamination and decommissioning project data for the Performance-Based Clean Closure with Subsequent Clean Fill of Bin Set 1 in the Calcined Solids Storage Facility (P1F).[a]

Generic Information	
Description/function and EIS project number:	Bin set closure to clean closure
EIS alternatives/options:	Continued current operations
Project type or waste stream:	Waste management program
Action type:	New
Structure type:	Calcine solids storage units, Weather enclosure
Size: (m^2)	86
Other features: (pits, ponds, power/water/sewer lines)	Electrical, firewater, sewer, and Water
Location:	
Inside/outside of fence:	Inside INTEC fence
Inside/outside of building:	Inside and around calciner bin set 1
Decontamination and Decommissioning (D&D) Information	
Schedule start/end:	
Pre-D&D:	January 2010 – January 2014
D&D:	January 2014 – December 2019
Number of D&D workers:	110 workers/yr
Number of radiation workers (D&D):	110 workers/yr
Avg. annual worker rad. dose: (rem/yr)	0.25 per worker
Heavy equipment	
Equipment used:	Cement trucks
Trips:	113
Hours of operation: (hrs)	3,946
Acres disturbed	
New/Previous/Revegetation: (acres)	None/1.5/None

Decontamination and Decommissioning (D&D) Information (continued)	
Air emissions: (None/Reference)	See Appendix C.2 for details.
Fuel combustion:	
Gases (CO_2): (tons/yr)	204
Contaminants[b]: (tons/yr)	9.9
Calcine (cleaning): (Ci/yr)	2.23E-08
Effluents	
Sanitary wastewater: (L)	3,513,000
Grout truck wash: (L)	18,000
Solid wastes	
Construction/D&D trash: (m^3)	1,956
Radioactive solid wastes:	All expected to be mixed haz. wastes
Hazardous/toxic chemicals & wastes	
Storage/inventory: (m^3)	32.6 (total)
Generation	
Misc. D&D: (m^3)	1.2
Lube oil: (L)	18,837
Mixed hazardous waste (generation)	
PPE: (m^3)/(Ci)	0.30/2.2
Debris from D&D: (m^3)/(Ci)	131/1.31
Water usage	
Process water: (L)	23,678
Domestic water: (L)	3,513,000
Energy requirements	
Electrical: (MWh/yr)	382
Fossil fuel: (L)	99,534

a. Sources: EDF-PDS-C-041; EDF-PDS-L-002.

b. CO, particulates, NO_x, SO_2, hydrocarbons.

Table C.6.2-96. Decontamination and decommissioning project data for Closure of the Tank Farm – Performance-Based Clean Closure with Clean Fill (P3B).[a]

Generic Information	
Description/function and EIS project Number:	Performance-based closure of tank facility with clean fill (P3B)
EIS alternatives/options:	Waste Management
Project type or waste stream:	Waste management program
Action type:	New
Structure type:	D&D of existing facility, low
Size: (m^2)	10,400
Other features: (pits, ponds, power/water/sewer lines)	Electrical, firewater, sewer, & water required
Location:	
Inside/outside of fence:	Inside INTEC fence
Inside/outside of building:	Outside buildings
Decontamination and Decommissioning (D&D) Information	
Schedule start/end	
Deactivation:	April 2000- September 2005[b]
Demolition:	January 2004 – November 2020[c]
Number of D&D workers:	20 per yr
Number of radiation workers (D&D):	20 per yr (included in above total)
Avg. annual worker rad. dose: (rem/yr)	0.92 per worker
Heavy equipment	
Equipment used:	Earthmoving equipment, trucks, Crane
Trips:	3,987
Hours of operation: (hrs)	7,975

Decontamination and Decommissioning (D&D) Information (continued)	
Acres disturbed:	
New/Previous/Revegetated: (acres)	None/2.6/None
Air emissions: (None/Reference)	See Appendix C.2 for details.
Diesel exhaust:	
Major gases[d]: (tons/yr)	1473
Contaminants[e]: (tons/yr)	8.6 (total)
Excavation dust: (tons/yr)	0.26
Enclosure emissions: (tons/yr)	1.1E-07
Effluents	
Sanitary wastewater: (L)	7,199,400
Service waste: (L)	1,147,000
Solid wastes	
Sanitary/industrial trash: (m^3)	1.9
Hazardous/toxic chemicals & wastes	
Storage	
TAA (based on one 55-gal drum): (m^3)	0.2
Generation	
Used lube oil: (L)	Incinerated at WERF
Mixed hazardous wastes:	
PPE: (m^3)	0.9
Water usage	
Domestic water: (L)	7,199,400
Process water: (L)	3,520,865
Energy requirements	
Electrical: (MWh/yr)	4,373
Fossil fuel: (L)	972,713

a. Sources: EDF-PDS-C-010; EDF-PDS-L-002. Construction and operational information is not applicable to this project.

b. This deactivation period applies to VES-WM-180-190, CPP 622, 623, 632, 634-636, CPP 780-86, CPP 713 and CPP 721-23. For CPP-737, CPP-738, CPP-739, CPP-743 deactivation would occur from 2010 - 2015. For CPP-729, CPP- 732, CPP-741-742, CPP-744, CPP-746-747, CPP-760-761, CPP-765, CPP-791, CPP-795, and CPP-1615 deactivation would occur from March 2009 - July 2014.

c. This demolition period applies to VES-WM-180-190, CPP 622, 623, 632, 634-636, CPP 780-86, CPP 713 and CPP 721-23. For CPP-737, CPP-738, CPP-739, CPP-743 demolition would occur from 2018 - 2023. . For CPP-729, CPP- 732, CPP-741-742, CPP-744, CPP-746-747, CPP-760-761, CPP-765, CPP-791, CPP-795, and CPP-1615 demolition would occur from 2014 – 2034.

d. CO2, H2O, O2 and N2.

e. CO, particulates, NO_x, SO_2, hydrocarbons.

Table C.6.2-97. Decontamination and decommissioning project data for Tank Farm Closure to RCRA Landfill Standards (P3C).[a]

Generic Information	
Description/function and EIS project number:	Closure of tank farm to RCRA Landfill standards (P3C)
EIS alternatives/options:	Facility Disposition
Project type or waste stream:	Mixed low-level waste (MLLW)
Action type:	Closure to landfill standards
Structure type:	11 underground storage tanks
Size: (m^2)	10,400
Other features: (pits, ponds, power/water/sewer lines)	Electrical, firewater, sewer, Steam, & water required
Location:	
Inside/outside of fence:	Inside INTEC fence
Inside/outside of building:	Outside buildings
Decontamination and Decommissioning (D&D) Information	
Schedule start/end	
Deactivation:	April 2000 – September 2005[b]
Demolition:	January 2004 – November 2020[c]
Number of D&D workers:	12 per yr
Number of radiation workers (D&D):	11.6 per yr
Avg. annual worker rad. dose: (rem/yr)	1.2 per worker
Heavy equipment	
Equipment used:	Cement trucks, backhoes, Cranes, front-end loaders, graders
Trips:	3,992 trips
Hours of operation: (hrs)	24,300

Decontamination and Decommissioning (D&D) Information (continued)	
Acres disturbed:	
New/Previous/Revegetated: (acres)	None/2.6/None
Air emissions: (None/Reference)	See Appendix C.2 for details.
Nonradioactive	
Dust: (tons/yr)	0.02
Fuel combustion: (tons/yr)	1,050
Radioactive: (Ci/yr)	0.031
Effluents	
Service waste water: (L)	882,200
Mixed: (L)	2,823,200
Hazardous: (L)	106,000
Solid wastes	
Sanitary/industrial trash: (m^3)	1,656
Radioactive wastes:	
Mixed: (m^3)/(Ci)	478/30
Hazardous/toxic chemicals & wastes	
Generation:	
Lubrication oil: (L)	2,715
Storage: (L)	37,860
Pits/pond created: Yes/No (m^2)	Yes – 37
Water usage	
Domestic water: (L)	3,951,540
Process water: (L)	5,535,274
Energy requirements	
Electrical: (MWh/yr)	1,152
Fossil fuel: (L)	724,803

a. Sources: EDF-PDS-C-011; EDF-PDS-L-002. Construction and operational information is not applicable to this project.

a. This deactivation period applies to VES-WM-180-190, CPP 622, 623, 632, 634-636, CPP 780-86, CPP 713 and CPP 721-23. For CPP-737, CPP-738, CPP-739, CPP-743 deactivation would occur from 2010 - 2015. For CPP-729, CPP- 732, CPP-741-742, CPP-744, CPP-746-747, CPP-760-761, CPP-765, CPP-791, CPP-795, and CPP-1615 deactivation would occur from March 2009 - July 2014.

b. This demolition period applies to VES-WM-180-190, CPP 622, 623, 632, 634-636, CPP 780-86, CPP 713 and CPP 721-23. For CPP-737, CPP-738, CPP-739, CPP-743 demolition would occur from 2018 - 2023. For CPP-729, CPP- 732, CPP-741-742, CPP-744, CPP-746-747, CPP-760-761, CPP-765, CPP-791, CPP-795, and CPP-1615 demolition would occur from 2014 – 2034.

Table C.6.2-98. Decontamination and decommissioning project data for the Performance-Based Clean Closure of the Calcined Solids Storage Facility (P59C).[a]

Generic Information	
Description/function and EIS project number:	Performance-based closure of the bin sets (P59C)
EIS alternatives/options:	Facility Disposition
Project type or waste stream:	D&D
Action type:	New
Structure type:	Calcined solids storage units, weather enclosure
Size: (m^2)	1,350
Other features: (pits, ponds, power/water/sewer lines)	Electrical, firewater, sewer, & water required
Location	
Inside/outside of fence:	Inside INTEC fence
Inside/outside of building:	Inside and around calciner bins
Decontamination and Decommissioning (D&D) Information	
Schedule start/end	
Deactivation:	March 2011 – July 2015
Demolition:	January 2015 – February 2036
Number of D&D workers:	55 per yr
Number of radiation workers (D&D):	55 per yr
Avg. annual worker rad. dose: (rem/yr)	0.88 per worker
Heavy equipment	
Equipment used:	Flatbed trucks and cement trucks
Trips:	3,340
Hours of operation: (hrs)	6,874
Acres disturbed	
New/Previous/Revegetated: (acres)	None/4.6/None

Decontamination and Decommissioning (D&D) Information (continued)	
Air emissions: (None/Reference)	See Appendix C.2 for details.
Fuel combustion:	
Gases (CO_2): (tons/yr)	36.9
Contaminants[b]: (tons/yr)	1.8 (total)
Calcine (cleaning & grouting): (Ci/yr)	2.05E-05
Effluents	
Sanitary wastewater: (L)	24,471,949
Grout truck wash: (L)	595,251
Solid wastes	
Building rubble: (m^3)	3,569
Metals: (m^3)	20
Radioactive wastes	
Building rubble: (m^3)/(Ci)	145/1.45
PPE: (m^3)/(Ci)	85/0.49
Hazardous/toxic chemicals & wastes	
Storage	
TAA: (m^3)	1.5
Generation	
Building demolition: (m^3)	1.5
Misc. decontamination/demolition: (m^3)	98
Used lube oil: (L)	1,301
Water usage	
Domestic water: (L)	24,471,949
Process water: (L)	837,491
Energy requirements	
Electrical: (MWh/yr)	1,605
Fossil fuel: (L)	251,727

a. Sources: EDF-PDS-C-008; EDF-PDS-L-002. Construction and operational information is not applicable to this project.
b. CO, particulates, NO_x, SO_2, hydrocarbons

Table C.6.2-99. Decontamination and decommissioning project data for the Closure of the Calcined Solids Storage Facility to Landfill Standards with Subsequent Clean Fill (P59D).[a]

Generic Information		**Decontamination and Decommissioning (D&D) Information (continued)**	
Description/function and EIS project number:	Calcined solids storage facility closure study (P59D)	Air emissions: (None/Reference)	See Appendix C.2 for details.
EIS alternatives/options:	Closure to land fill standards/ Clean fill	Fuel combustion (diesel exhaust):	
		Major gas (CO_2): (tons/yr)	36.9
		Contaminants[b]: (tons/yr)	1.8
Project type or waste stream:	Waste management program	Calcine (cleaning & grouting): (Ci/yr)	1.20E-06
Action type:	New	Effluents	
Structure type:	Calcine solids storage units, weather enclosure	Sanitary wastewater: (L)	12,174,283
		Grout truck wash: (L)	595,251
Size: (m^2)	1,347	Solid wastes	
Other features: (pits, ponds, power/water/sewer lines)	Electrical, firewater, sewer, and water required	Building rubble: (m^3)	3,569
		Metals: (m^3)	20
Location:		Radioactive wastes:	
Inside/outside of fence:	Inside INTEC fence	Building rubble: (m^3)/(Ci)	145/1.45
Inside/outside of building:	Inside and around calciner bins	PPE: (m^3)/(Ci)	33/0.19
Decontamination and Decommissioning (D&D) Information		Hazardous/toxic chemicals & wastes	
Schedule start/end		Storage	
Deactivation:	March 2011 – July 2015	TAA (based on blding demolition): (m^3)	1.5
Demolition:	January 2015 – February 2036	Generation	
Number of D&D workers:	27 workers/yr	Building demolition: (m^2)	1.5
Number of radiation workers (D&D):	27 workers/yr	Misc. D&D: (m^2)	98
Avg. annual worker rad. dose: (rem/yr)	698 per worker	Used lube oil: (L)	1,301
Heavy equipment		Water usage	
Equipment used:	Flatbed trucks, cement trucks	Domestic water: (L)	12,174,283
Trips :	3,340	Process water: (L)	837,491
Hours of operation: (hrs)	6,874	Energy requirements	
Acres disturbed:		Electrical: (MWh/yr)	990
New/Previous/Revegetated: (acres)	None/4.6/None	Fossil fuel: (L)	251,727

a. Sources: EDF-PDS-C-009; EDF-PDS-L-002. Construction and operational information is not applicable to this project.

b. CO, particulates, NO_x, SO_2, hydrocarbons

Table C.6.2-100. Decontamination and decommissioning project data for the Clean Closure to Detection Limits of the Calcined Solids Storage Facility (P59F).[a]

Generic Information	
Description/function and EIS project number:	Clean closure of bin set group[b] (P59F)
EIS alternatives/options:	D&D
Project type or waste stream:	Waste management program
Action type:	New
Structure type:	Calcine solids storage units, Weather enclosure, bin facility
Size bin set area: (m^2)	1,347
Remote cutting facility: (m^2)	1,691
Other features: (pits, ponds, power/water/sewer lines)	Electrical, firewater, sewer, & water required
Location:	
Inside/outside of fence:	Inside INTEC fence
Inside/outside of building:	Inside and around calciner
Decontamination and Decommissioning (D&D) Information	
Schedule start/end	
Deactivation:	March 2009 – July 2014
Demolition:	2014 – 2034
Number of D&D workers:	58 per yr
Number of radiation workers (D&D):	58 per yr (included in above total)
Avg. annual worker rad. dose: (rem/hr)	0.60 per worker
Heavy equipment	
Equipment used:	Trucks, excavator, crane, grader, front end loader
Trips:	1,471
Hours of operation: (hrs)	13,142
Acres disturbed and duration	
New/Previous/Revegetated: (acres)	None/7.3/None
Air emissions: (None/Reference)	See Appendix C.2 for details.
Fuel combustion (diesel exhaust):	
Major gas (CO_2): (tons/yr)	43.7
Contaminants[c]: (tons/yr)	2.1

Decontamination and Decommissioning (D&D) Information (continued)	
Air emissions: (continued)	
Building ventilation: (Ci/yr)	1.74E-08
Calcine bins (cleaning): (Ci/yr)	4.50E-08
Calcine bins (cutting & vacuuming): (Ci/yr)	6.80E-08
Effluents	
Sanitary wastewater: (L)	33,140,000
Solid wastes	
Construction/D&D trash: (m^3)	18,450
Building rubble: (m^3)	5,858
Metals: (m^3)	31
Radioactive wastes:	
Bins: (m^3)/(Ci)	1,208/12
Vault piping: (m^3)/(Ci)	167/1.67
Building rubble: (m^3)/(Ci)	3,189/32
Hazardous/toxic chemicals & wastes	
Storage	
TAA (based on two 4x4x8 boxes): (m^3)	7.3
Generation	
Non-radioactive:	
Used lube oil: (L)	50,111
Misc. D&D: (m^3)	126
Radioactive:	
Acid Bath: (L)/(Ci)	146,923/11,336
Water Bath: (L)/(Ci)	293,847/810
PPE: (m^3)/(Ci)	176
Water usage	
Domestic water: (L)	33,140,000
Process water: (L)	396,042
Energy requirements	
Electrical: (MWh/yr)	3,086
Fossil fuel: (L)	330,187

a. Sources: EDF-PDS-B-003; EDF-PDS-L-002. Construction and operational information is not applicable to this project.

b. Bin set group considered for clean closure includes: CSSF 1-7, CPP-729, CPP-741, CPP-742, CPP-744, CPP-746, CPP-747, CPP-760, CPP-761, CPP-765, CPP-791, CPP-795, CPP-1615.

c. CO, particulates, NO_x, SO_2, hydrocarbons.

Table C.6.2-101. Decontamination and decommissioning project data for the Total Removal Clean Closure of the Tank Farm Facility (P59G).[a]

Generic Information	
Description/function and EIS project number:	INTEC tank farm closure (total Removal clean closure) (P59D)
EIS alternatives/options:	Facility Disposition
Project type or waste stream:	Waste management program
Action type:	Total removal clean closure
Structure type:	Weather enclosure for tank farm
Size: (m^2)	14,057
Other features: (pits, ponds, power/water/sewer lines)	Electrical, firewater, sewer, & water required
Location:	
Inside/outside of fence:	Inside INTEC fence
Inside/outside of building:	Outside
Decontamination and Decommissioning (D&D) Information	
Schedule start/end	
Deactivation:	April 2000 – September 2005[b]
Demolition:	January 2004 – November 2020[c]
Number D&D workers:	280 per yr
Number of radiation workers (D&D):	280 per yr
Avg. annual worker rad. dose: (rem/yr)	1 per worker
Heavy equipment	
Equipment used:	Earthmoving equipment, crane, trucks, pulverizer, plane shear, vibratory pile extractor
Trips :	30,166
Hours of operation (all heavy equipment): (hrs)	226,608
Acres disturbed:	
New/Previous/Revegetated: (acres)	15/6/None
Air emissions: (None/Reference)	See Appendix C.2 for details.
Diesel exhaust:	
Major gas (CO_2): (tons/yr)	883
Contaminants[d]: (tons/yr)	40
Fossil fuel (steam use): (tons/yr)	641.9

Decontamination and Decommissioning (D&D) Information (continued)	
Air emissions (continued):	
Dust (landfill): (tons/yr)	262
Enclosure emissions: (Ci/yr)	6.14E-07
Tank removal tent emissions: (Ci/yr)	2.25E-07
Debris facility vacuum system: (Ci/yr)	1.35E-08
Debris facility ventilation system: (Ci/yr)	4.49E-09
Total emissions: (Ci/yr)	8.57E-07
Effluents	
Sanitary wastewater: (L)	196,584,857
Solid wastes	
Industrial landfill material: (m^3)	117,453
Sanitary/industrial trash: (m^3)	40.3 (ash)
Radioactive wastes:	
LLW for disposal from D&D: (m^3)/(Ci)	1,102/4,000
LLW for WERF from D&D: (m^3)/(Ci)	20/600
Mixed hazardous wastes:	
PPE: (m^3)/(Ci)	28/20
Mixed hazardous wastes: (m^3)/(Ci)	7,140/4,036
CERCLA waste:	
Soil from tank farm area: (m^3)/(Ci)	133,800/46,200
Hazardous/toxic chemicals & wastes	
Storage	
TAA: (m^3)	649
Generation	
Used lube oil: (L)	Incinerated at WERF
Water usage	
Domestic water: (L)	196,584,857
Process water: (L)	4,422,000
Raw water: (L)	9,252,000
Energy requirements	
Electrical: (MWh/yr)	7,259
Fossil fuel: (L)	7,457,000

a. Sources: EDF-PDS-B-004; EDF-PDS-L-002. Construction and operational information is not applicable to this project.

b. This deactivation period applies to VES-WM-180-190, CPP 622, 623, 632, 634-636, CPP 780-86, CPP 713 and CPP 721-23. For CPP-737, CPP-738, CPP-739, CPP-743 deactivation would occur from 2010 - 2015. For CPP-729, CPP- 732, CPP-741-742, CPP-744, CPP-746-747, CPP-760-761, CPP-765, CPP-791, CPP-795, and CPP-1615 deactivation would occur from March 2009 - July 2014.

c. This demolition period applies to VES-WM-180-190, CPP 622, 623, 632, 634-636, CPP 780-86, CPP 713 and CPP 721-23. For CPP-737, CPP-738, CPP-739, CPP-743 demolition would occur from 2018 - 2023. For CPP-729, CPP- 732, CPP-741-742, CPP-744, CPP-746-747, CPP-760-761, CPP-765, CPP-791, CPP-795, and CPP-1615 demolition would occur from 2014 – 2034.

d. CO, particulates, NOx, hydrocarbons.

Table C.6.2-102. Decontamination and decommissioning project data for the PEW and Cell Floor Lines (P154A).[a]

Generic Information	
Description/function and EIS Project number:	PEW and cell floor lines (P154A)
EIS alternatives/options:	Facility disposition
Project type or waste stream:	D&D
Action type:	Closure to landfill standards
Structure type:	Underground lines
Size: (m^2)	34.9
Other features: (pits, ponds, power/water/sewer lines)	None
Location:	
Inside/outside of fence:	Inside INTEC fence
Inside/outside of building:	Existing structure
Decontamination and Decommissioning (D&D) Information	
Schedule start/end:	
Deactivation:	2038 – 2038
Demolition:	2043 – 2043
Number of D&D workers:	4 per yr
Number of radiation workers (D&D):	2 per yr
Avg. annual worker rad dose: (rem/yr)	0.25 per worker
Heavy equipment:	
Equipment used:	Mobile cranes, roll-off trucks, dozers, loaders
Hours of operation: (hrs)	2,700

Decontamination and Decommissioning (D&D) Information (continued)	
Acres disturbed:	
New/Previous/Revegetated: (acres)	None/0.03/None
Air emissions: (None/Reference)	See Appendix C.2 for details.
Fuel combustion (diesel exhaust):	
Gases (CO_2): (tons/yr)	188
Contaminants[b]: (tons/yr)	9 (total)
Effluents	
Sanitary wastewater: (L)	21,938
Solid wastes (abandoned in place)	
Building material: (m^3)	180
Radioactive wastes: (m^3)/(Ci)	
Combustibles:	1/0.01
Bldg. material (abandoned in place):	4/0.04
Hazardous/toxic chemicals & wastes	
Storage/inventory: (L)	None
Generation:	
Used lube oil: (L)	500
Water usage	
Domestic water: (L)	21,938
Energy requirements	
Electrical: (MWh/yr)	None
Fossil fuel: (L)	61,000

a. Sources: EDF-PDS-C-031; EDF-PDS-L-002. Construction and operational information is not applicable to this project.
b. CO, particulates, NO_x, SO_2, hydrocarbons.

Table C.6.2-103. Decontamination and decommissioning project data for the PEW Condensate Lines (P154B).[a]

Generic Information		**Decontamination and Decommissioning (D&D) Information (continued)**	
Description/function and EIS Project number:	PEW Condensate Lines (P154B)	Acres disturbed New/Previous/Revegetated: (acres)	None/0.02/None
EIS alternatives/options:	Facility Disposition	Air emissions: (None/Reference) Fuel combustion (diesel exhaust): Major gas (CO_2): (tons/yr) Contaminants[b]: (tons/yr)	See Appendix C.2 for details. 188 9 (total)
Project type or waste stream:	D&D		
Action type:	Closure to landfill standards		
Structure type: Size: (m^2) Other features: (pits, ponds, power/water/sewer lines)	Lines 19.5 None	Effluents Radioactive: Mixed waste: (L)/(Ci) Non-radioactive: Sanitary wastewater: (L)	 3,785/1000 16,313
Location: Inside/outside of fence: Inside/outside of building:	 Inside INTEC fence Existing structure	Solid wastes:	None
Decontamination and Decommissioning (D&D) Information		Radioactive wastes: (m^3)/(Ci) Bldg. material (abandoned in place):	 3/0.03
Schedule start/end: Deactivation: Demolition:	 2038 – 2038 2043 – 2043	Hazardous/toxic chemicals & wastes Storage/inventory: (L) Generation: Used lube oil: (L)	 None 500
Number of D&D workers:	3 per yr		
Number of radiation workers (D&D):	2 per yr		
Avg. annual worker rad dose: (rem/yr)	0.25 per worker	Water usage Domestic water: (L)	 16,313
Heavy equipment: Equipment used: Hours of operation: (hrs)	 Mobile cranes, roll-off trucks, dozers, loaders 2,700	Energy requirements Electrical: (MWh/yr) Fossil fuel: (L)	 None 61,000

a. Sources: EDF-PDS-C-031; EDF-PDS-L-002. Construction and operational information is not applicable to this project.
b. CO, particulates, NO_x, SO_2, hydrocarbons.

Table C.6.2-104. Decontamination and decommissioning project data for the Waste Storage Control House (P156B).[a]

Generic Information	
Description/function and EIS Project number:	Waste storage control house-CPP 619 (P156B)
EIS alternatives/options:	Facility disposition
Project type or waste stream:	D&D
Action type:	Closure to landfill standards
Structure type:	Masonry-exterior
Size: (m^2)	38.7
Other features: (pits, ponds, power/water/sewer lines)	None
Location:	
Inside/outside of fence:	Inside INTEC fence
Inside/outside of building:	Existing structure
Decontamination and Decommissioning (D&D) Information	
Schedule start/end:	
Deactivation:	2010 – 2015
Demolition:	2018 – 2023
Number of D&D workers:	<1 per yr
Number of radiation workers (D&D):	<1 per yr
Avg. annual worker rad dose: (rem/yr)	0.25 per worker
Heavy equipment:	
Equipment used:	Mobile cranes, roll-off trucks, Dozers, loaders
Hours of operation: (hrs)	22,200

Decontamination and Decommissioning (D&D) Information (continued)	
Acres disturbed	
New/Previous/Revegetated: (acres)	None/0.02/None
Air emissions: (None/Reference)	See Appendix C.2 for details.
Fuel combustion (diesel exhaust):	
Major gas (CO_2): (tons/yr)	259
Contaminants[b]: (tons/yr)	13 (total)
HEPA filtered offgas: (Ci/yr)	1.45E-08
Effluents: (L)	None
Solid wastes (abandoned in place)	
Building rubble: (m^3)	53
Radioactive wastes: (m^3)/(Ci)	
Building material (abandoned in place):	67/0.67
Hazardous/toxic chemicals & wastes	
Storage/inventory: (L)	3
Generation:	
Solvents, etc.: (L)	79
Used lube oil: (L)	4,200
Water usage: (L)	None
Energy requirements	
Electrical: (MWh/yr)	None
Fossil fuel: (L)	504,000

a. Sources: EDF-PDS-C-033; EDF-PDS-L-002. Construction and operational information is not applicable to this project.

b. CO, particulates, NO_x, SO_2, hydrocarbons.

Table C.6.2-105. Decontamination and decommissioning project data for the Waste Storage Control House (P156C).[a]

Generic Information	
Description/function and EIS Project number:	Waste storage control house-CPP 628 (P156C)
EIS alternatives/options:	Facility disposition
Project type or waste stream:	D&D
Action type:	Closure to landfill standards
Structure type:	Masonry-exterior
Size: (m^2)	145.3
Other features: (pits, ponds, power/water/sewer lines)	None
Location	
Inside/outside of fence:	Inside INTEC fence
Inside/outside of building:	Existing structure
Decontamination and Decommissioning (D&D) Information	
Schedule start/end:	
Deactivation:	2010 – 2015
Demolition:	2018 – 2023
Number of D&D workers	<1 per yr
Number of radiation workers (D&D):	<1 per yr
Avg. annual worker rad dose: (rem/yr)	0.25 per worker
Heavy equipment:	
Equipment used:	Mobile cranes, roll-off trucks, Dozers, loaders
Hours of operation: (hrs)	22,200
Acres disturbed:	
New/Previous/Revegetated: (acres)	None/0.1/None

Decontamination and Decommissioning (D&D) Information (continued)	
Air emissions: (None/Reference)	See Appendix C.2 for details.
Fuel combustion (diesel exhaust):	
Major gas (CO_2): (tons/yr)	259
Contaminants[b]: (tons/yr)	13 (total)
HEPA filtered offgas: (Ci/yr)	1.45E-08
Effluents	
Sanitary wastewater: (L)	2,250
Solid wastes (abandoned in place)	
Building material: (m^3)	198
Radioactive wastes: (m^3)/(Ci)	
Combustibles (disposal at WERF):	13/0
Bldg. material (abandoned in place):	250/2.50
Hazardous/toxic chemicals & wastes	
Storage/inventory: (L)	12
Generation:	
Solvents, etc.: (L)	296
Used lube oil: (L)	4,200
Water usage	
Domestic water: (L)	2,250
Energy requirements	
Electrical: (MWh/yr)	None
Fossil fuel: (L)	504,000

a. Sources: EDF-PDS-C-033; EDF-PDS-L-002. Construction and operational information is not applicable to this project.

b. CO, particulates, NO_x, SO_2, hydrocarbons.

Table C.6.2-106. Decontamination and decommissioning project data for the Waste Storage Pipe Manifold Building (P156D).[a]

Generic Information	
Description/function and EIS Project number:	Waste Storage Pipe Manifold Building – CPP 634
EIS alternatives/options:	Facility disposition
Project type or waste stream:	D&D
Action type:	Closure to landfill standards
Structure type:	Masonry-exterior
Size: (m^2)	21.5
Other features: (pits, ponds, power/water/sewer lines)	None
Location:	
Inside/outside of fence:	Inside INTEC fence
Inside/outside of building:	Existing structure
Decontamination and Decommissioning (D&D) Information	
Schedule start/end:	
Deactivation:	2010 – 2015
Demolition:	2018 – 2023
Number of D&D workers:	<1 per yr
Number of radiation workers (D&D):	<1 per yr
Avg. annual worker rad dose: (rem/yr)	0.25 per worker
Heavy equipment:	
Equipment used:	Mobile cranes, roll-off trucks, Dozers, loaders
Hours of operation: (hrs)	22,200

Decontamination and Decommissioning (D&D) Information (continued)	
Acres disturbed:	
New/Previous/Revegetated: (acres)	None/0.01/None
Air emissions: (None/Reference)	See Appendix C.2 for details.
Fuel combustion (diesel exhaust):	
Major gas (CO_2): (tons/yr)	259
Contaminants[b]: (tons/yr)	13 (total)
HEPA filtered offgas: (Ci/yr)	1.45E-08
Effluents: (L)	None
Solid wastes (abandoned in place)	
Building material: (m^3)	29
Radioactive wastes: (m^3)/(Ci)	
Combustibles (disposal at WERF):	2/0
Bldg. material (abandoned in place):	37/0.37
Hazardous/toxic chemicals & wastes	
Storage/inventory: (L)	2
Generation:	
Solvents, etc.: (L)	44
Used lube oil: (L)	4,200
Water usage: (L)	None
Energy requirements	
Electrical: (MWh/yr)	None
Fossil fuel: (L)	504,000

a. Sources: EDF-PDS-C-033; EDF-PDS-L-002. Construction and operational information is not applicable to this project.

b. CO, particulates, NO_x, SO_2, hydrocarbons.

Table C.6.2-107. Decontamination and decommissioning project data for the Waste Station (WM-180) Tank Transfer Building (P156E).[a]

Generic Information	
Description/function and EIS Project number:	Waste Station VES-WM-180 Shielded Tank Transfer Building - CPP 638 (P156E)
EIS alternatives/options:	Facility disposition
Project type or waste stream:	D&D
Action type:	Closure to landfill standards
Structure type:	Masonry-exterior
Size: (m^2)	8.1
Other features: (pits, ponds, power/water/sewer lines)	None
Location:	
Inside/outside of fence:	Inside INTEC fence
Inside/outside of building:	Existing structure
Decontamination and Decommissioning (D&D) Information	
Schedule start/end:	
Deactivation:	2010 – 2012
Demolition:	2014 – 2015
Number of D&D workers:	<1 per yr
Number of radiation workers (D&D):	<1 per yr
Avg. annual worker rad dose: (rem/yr)	0.25 per worker
Heavy equipment:	
Equipment used:	Mobile cranes, roll-off trucks, dozers, loaders
Hours of operation: (hrs)	7,400

Decontamination and Decommissioning (D&D) Information (continued)	
Acres disturbed:	
New/Previous/Revegetated: (acres)	None/None/None
Air emissions: (None/Reference)	See Appendix C.2 for details.
Fuel combustion (diesel exhaust):	
Major gas (CO_2): (tons/yr)	259
Contaminants[b]: (tons/yr)	13 (total)
HEPA filtered offgas: (Ci/yr)	1.45E-08
Effluents	
Sanitary wastewater: (L)	1,125
Solid wastes (abandoned in place)	
Building material: (m^3)	11
Radioactive wastes: (m^3)/(Ci)	
Combustibles disposal at WERF:	1/0
Bldg. Material (abandoned in place):	14/0.14
Hazardous/toxic chemicals & wastes	
Storage/inventory: (L)	2
Generation:	
Solvents, etc.: (L)	16
Used lube oil: (L)	1,400
Water usage	
Domestic water: (L)	1,125
Energy requirements	
Electrical: (MWh/yr)	None
Fossil fuel: (L)	168,000

a. Sources: EDF-PDS-C-033; EDF-PDS-L-002. Construction and operational information is not applicable to this project.

b. CO, particulates, NO_x, SO_2, hydrocarbons.

Table C.6.2-108. Decontamination and decommissioning project data for the Instrument House (P156F).[a]

Generic Information	
Description/function and EIS Project number:	Instrument house (VES-WM-180, 181) - CPP 712 (P156F)
EIS alternatives/options:	Facility Disposition
Project type or waste stream:	D&D
Action type:	Closure to landfill standards
Structure type:	Concrete block
Size: (m^2)	20.1
Other features: (pits, ponds, power/water/sewer lines)	None
Location:	
Inside/outside of fence:	Inside INTEC fence
Inside/outside of building:	Existing structure
Decontamination and Decommissioning (D&D) Information	
Schedule start/end:	
Deactivation:	2010 – 2015
Demolition:	2018 – 2023
Number of D&D workers:	<1 per yr
Number of radiation workers (D&D):	<1 per yr
Avg. annual worker rad dose: (rem/yr)	0.25 per worker
Heavy equipment:	
Equipment used:	Mobile cranes, roll-off trucks, dozers, loaders
Hours of operation: (hrs)	22,200

Decontamination and Decommissioning (D&D) Information (continued)	
Acres disturbed:	
New/Previous/Revegetated: (acres)	None/0.01/None
Air emissions: (None/Reference)	See Appendix C.2 for details.
Fuel combustion (diesel exhaust):	
Gases (CO_2): (tons/yr)	259
Contaminants[b]: (tons/yr)	13 (total)
HEPA filtered offgas: (Ci/yr)	1.45E-08
Effluents: (L)	None
Solid wastes (abandoned in place)	
Building material: (m^3)	27
Radioactive wastes: (m^3)/(Ci)	
Combustibles (disposal at WERF):	2/0
Building material (abandoned in place):	35/0.35
Hazardous/toxic chemicals & wastes	
Storage/inventory: (L)	2
Generation:	
Solvents, etc.: (L)	41
Used lube oil: (L)	4,200
Water usage: (L)	None
Energy requirements	
Electrical: (MWh/yr)	None
Fossil fuel: (L)	504,000

a. Sources: EDF-PDS-C-033; EDF-PDS-L-002. Construction and operational information is not applicable to this project.

b. CO, particulates, NO_x, SO_2, hydrocarbons.

Table C.6.2-109. Decontamination and decommissioning project data for the Closure of the STR Waste Storage Tank (WM-103, 104, 105, 106) – CPP 717 to Landfill Standards (P156G).[a]

Generic Information		**Decontamination and Decommissioning (D&D) Information (continued)**	
Description/function and EIS Project number:	STR Waste Storage Tank - CPP 717 (P156G)	Acres disturbed: New/Previous/Revegetated: (acres)	None/0.02/None
EIS alternatives/options:	Facility Disposition	Air emissions: (None/Reference) Fuel combustion (diesel exhaust): Gases (CO_2): (tons/yr) Contaminants[b]: (tons/yr) HEPA filtered offgas: (Ci/yr)	See Appendix C.2 for details. 259 13 (total) 1.45E-08
Project type or waste stream:	D&D		
Action type:	Closure to landfill standards		
Structure type: Size: (m^2) Other features: (pits, ponds, power/water/sewer lines)	Concrete 39.1 None	Effluents Sanitary wastewater: (L)	6,750
Location: Inside/outside of fence: Inside/outside of building:	Inside INTEC fence Existing structure	Solid wastes (abandoned in place) Building material: (m^3)	53
Decontamination and Decommissioning (D&D) Information		Radioactive wastes: (m^3)/(Ci) Combustibles (disposal at WERF): Bldg. Material (abandoned in place):	4/0 67/0.67
Schedule start/end Deactivation: Demolition:	2010 – 2015 2018 – 2023	Hazardous/toxic chemicals & wastes Storage/inventory: (L) Generation: Solvents, etc.: (L) Used lube oil: (L)	3 79 4,200
Number of D&D workers:	1 per yr		
Number of radiation workers (D&D):	1 per yr		
Avg. annual worker rad dose: (rem/yr)	0.25 per worker		
Heavy equipment: Equipment used: Hours of operation: (hrs)	Mobile cranes, roll-off trucks, dozers, loaders 22,200	Water usage Domestic water: (L)	6,750
		Energy requirements Electrical: (MWh/yr) Fossil fuel: (L)	None 504,000

a. Sources: EDF-PDS-C-033; EDF-PDS-L-002. Construction and operational information is not applicable to this project.

b. CO, particulates, NO_x, SO_2, hydrocarbons.

Table C.6.2-110. Decontamination and decommissioning project data for the West Side Waste Holdup (P156L).[a]

Generic Information		**Decontamination and Decommissioning (D&D) Information (continued)**	
Description/function and EIS Project number:	West side waste holdup - CPP 641 (P156L)	Acres disturbed: New/Previous/Revegetated: (acres)	 None/0.02/None
EIS alternatives/options:	Facility Disposition	Air emissions: (None/Reference) Fuel combustion (diesel exhaust): Gases (CO_2): (tons/yr) Contaminants[b]: (tons/yr) HEPA filtered offgas: (Ci/yr)	See Appendix C.2 for details. 259 13 (total) 1.45E-08
Project type or waste stream:	D&D		
Action type:	Clean Closure		
Structure type: Size: (m^2) Other features: (pits, ponds, power/water/sewer lines)	Reinforced concrete 41.1 None	Effluents Sanitary wastewater: (L)	 3,375
Location: Inside/outside of fence: Inside/outside of building:	 Inside INTEC fence Existing structure	Solid wastes (abandoned in place) Building material: (m^3)	 56
Decontamination and Decommissioning (D&D) Information		Radioactive wastes: (m^3)/(Ci) Combustibles: Building material (abandoned in place):	 4/0 71/0.71
Schedule start/end: Deactivation: Demolition:	 2010 – 2012 2014 – 2015	Hazardous/toxic chemicals & wastes Storage/inventory: (L) Generation: Solvents, etc.: (L) Used lube oil: (L)	 10 84 1,400
Number of D&D workers:	1 per yr		
Number of radiation workers (D&D):	<1 per yr		
Avg. annual worker rad dose: (rem/yr)	0.25 per worker		
Heavy equipment: Equipment used: Hours of operation: (hrs)	 Mobile cranes, roll-off trucks, dozers, loaders 7,400	Water usage Domestic water: (L) Energy requirements Electrical: (MWh/yr) Fossil fuel: (L)	 3,375 None 168,000

a. Sources: EDF-PDS-C-033; EDF-PDS-L-002. Construction and operational information is not applicable to this project.
b. CO, particulates, NO_x, SO_2, hydrocarbons.

Table C.6.2-111. Decontamination and decommissioning project data for the closure of the Instrumentation Building for Bin Set 1 (CPP-639) (P157A).[a]

Generic Information	
Description/function and EIS Project number:	Instrumentation Building for bin Set 1 - CPP 639 (P157A)
EIS alternatives/options:	Facility Disposition
Project type or waste stream:	D&D
Action type:	Closure to landfill standards
Structure type:	Masonry – exterior
Size: (m^2)	34.6
Other features: (pits, ponds, power/water/sewer lines)	None
Location:	
Inside/outside of fence:	Inside INTEC fence
Inside/outside of building:	Existing structure
Decontamination and Decommissioning (D&D) Information	
Schedule start/end:	
Deactivation:	2035 – 2037
Demolition:	2038 – 2043
Number of D&D workers:	<1 per yr
Number of radiation workers (D&D):	<1 per yr
Avg. annual worker rad dose: (rem/yr)	0.25 per worker
Heavy equipment:	
Equipment used:	Mobile cranes, roll-off trucks, dozers, loaders
Hours of operation: (hrs)	22,200

Decontamination and Decommissioning (D&D) Information (continued)	
Acres disturbed:	
New/Previous/Revegetated: (acres)	None/0.02/None
Air emissions: (None/Reference)	See Appendix C.2 for details.
Fuel combustion (diesel exhaust):	
Gases (CO_2): (tons/yr)	259
Contaminants[b]: (tons/yr)	13 (total)
HEPA filtered offgas: (Ci/yr)	1.45E-08
Effluents	
Sanitary wastewater: (L)	563
Solid wastes (abandoned in place)	
Building material: (m^3)	47
Radioactive wastes: (m^3)/(Ci)	
Combustibles (disposal at WERF):	3/0
Building material (abandoned in place):	60/0.60
Hazardous/toxic chemicals & wastes	
Storage/inventory: (L)	3
Generation:	
Solvents, etc.: (L)	70
Used lube oil: (L)	4,200
Water usage	
Domestic water: (L)	563
Energy requirements	
Electrical: (MWh/yr)	None
Fossil fuel: (L)	504,000

a. Sources: EDF-PDS-C-034; EDF-PDS-L-002. Construction and operational information is not applicable to this project.

b. CO, particulates, NO_x, SO_2, hydrocarbons.

Table C.6.2-112. Decontamination and decommissioning project data for the Bin Set 2 Instrumentation Building (P157B).[a]

Generic Information	
Description/function and EIS Project number:	Bin set 2 instrumentation building-CPP 646 (P157B)
EIS alternatives/options:	Facility Disposition
Project type or waste stream:	D&D
Action type:	Closure to landfill standards
Structure type:	Masonry- exterior
Size: (m^2)	8.5
Other features: (pits, ponds, power/water/sewer lines)	None
Location:	
Inside/outside of fence:	Inside INTEC fence
Inside/outside of building:	Existing structure
Decontamination and Decommissioning (D&D) Information	
Schedule start/end	
Deactivation:	2035 – 2037
Demolition:	2038 – 2043
Number of D&D workers:	<1 per yr
Number of radiation workers (D&D):	<1 per yr
Avg. annual worker rad dose: (rem/yr)	0.25 per worker
Heavy equipment:	
Equipment used:	Mobile cranes, roll-off trucks, dozers, loaders
Hours of operation: (hrs)	22,200
Decontamination and Decommissioning (D&D) Information (continued)	
Acres disturbed	
New/Previous/Revegetated: (acres)	None/None/None
Air emissions: (None/Reference)	See Appendix C.2 for details.
Fuel combustion (diesel exhaust):	
Gases (CO_2): (tons/yr)	259
Contaminants[b]: (tons/yr)	13 (total)
HEPA filtered offgas: (Ci/yr)	1.45E-08
Effluents: (L)	None
Solid wastes (abandoned in place)	
Building material: (m^3)	12
Radioactive wastes: (m^3)/(Ci)	
Combustibles (disposal at WERF):	1/0
Bldg. material (abandoned in place):	15/0.15
Hazardous/toxic chemicals & wastes	
Storage/inventory: (L)	1
Generation:	
Solvents, etc.: (L)	17
Used lube oil: (L)	4,200
Water usage: (L)	None
Energy requirements	
Electrical: (MWh/yr)	None
Fossil fuel: (L)	504,000

a. Sources: EDF-PDS-C-034; EDF-PDS-L-002. Construction and operational information is not applicable to this project.

b. CO, particulates, NO_x, SO_2, hydrocarbons.

Table C.6.2-113. Decontamination and decommissioning project data for the Bin Set 3 Instrumentation Building (P157C).[a]

Generic Information		**Decontamination and Decommissioning (D&D) Information (continued)**	
Description/function and EIS Project number:	Bin set 3 instrumentation building-CPP 647 (P157C)	Acres disturbed New/Previous/Revegetated: (acres)	None/None/None
EIS alternatives/options:	Facility disposition	Air emissions: (None/Reference) Fuel combustion (diesel exhaust): Gases (CO_2): (tons/yr) Contaminants[b]: (tons/yr) HEPA filtered offgas: (Ci/yr)	See Appendix C.2 for details. 259 13 (total) 1.45E-08
Project type or waste stream:	D&D		
Action type:	Closure to landfill standards		
Structure type: Size: (m^2) Other features: (pits, ponds, power/water/sewer lines)	Masonry - exterior 8.5 None	Effluents: (L)	None
		Solid wastes (abandoned in place) Building material: (m^3)	12
Location: Inside/outside of fence: Inside/outside of building:	Inside INTEC fence Existing structure	Radioactive wastes: (m^3)/(Ci) Combustibles disposal at WERF: Bldg. material (abandoned in place):	1/0 15/0.15
Decontamination and Decommissioning (D&D) Information			
Schedule start/end: Deactivation: Demolition:	2035 – 2037 2038 – 2043	Hazardous/toxic chemicals & wastes Storage/inventory: (L) Generation: Solvents, etc.: (L) Used lube oil: (L)	1 17 4,200
Number of D&D workers:	<1 per yr		
Number of radiation workers (D&D):	<1 per yr		
Avg. annual worker rad dose: (rem/yr)	0.25 per worker	Water usage:	None
Heavy equipment: Equipment used: Hours of operation: (hrs)	Mobile cranes, roll-off trucks, Dozers, loaders 22,200	Energy requirements Electrical: (MWh/yr) Fossil fuel: (L)	None 504,000

a. Sources: EDF-PDS-C-034; EDF-PDS-L-002. Construction and operational information is not applicable to this project.
b. CO, particulates, NO_x, SO_2, hydrocarbons.

Table C.6.2-114. Decontamination and decommissioning project data for the Bin Set 4 Instrumentation Building (P157D).[a]

Generic Information	
Description/function and EIS Project number:	Bin set 4 instrumentation building-CPP 658 (P157D)
EIS alternatives/options:	Facility disposition
Project type or waste stream:	D&D
Action type:	Closure to landfill standards
Structure type:	Reinforced concrete
Size: (m^2)	7.5
Other features: (pits, ponds, power/water/sewer lines)	None
Location:	
Inside/outside of fence:	Inside INTEC fence
Inside/outside of building:	Existing structure
Decontamination and Decommissioning (D&D) Information	
Schedule start/end:	
Deactivation:	2035 – 2037
Demolition:	2038 – 2043
Number of D&D workers:	<1 per yr
Number of radiation workers (D&D):	<1 per yr
Avg. annual worker rad dose: (rem/yr)	0.25 per worker
Heavy equipment:	
Equipment used:	Mobile cranes, roll-off trucks, dozers, loaders
Hours of operation: (hrs)	22,200

Decontamination and Decommissioning (D&D) Information (continued)	
Acres disturbed:	
New/Previous/Revegetated: (acres)	None/None/None
Air emissions: (None/Reference)	See Appendix C.2 for details.
Fuel combustion (diesel exhaust):	
Gases (CO_2): (tons/yr)	259
Contaminants[b]: (tons/yr)	13 (total)
HEPA filtered offgas: (Ci/yr)	1.45E-08
Effluents: (L)	None
Solid wastes (abandoned in place)	
Building material: (m^3)	10
Radioactive wastes: (m^3)/(Ci)	
Combustibles disposal at WERF:	1/0
Building material (abandon in place):	13/0.13
Hazardous/toxic chemicals & wastes	
Storage/inventory: (L)	1
Generation:	
Solvents, etc.: (L)	15
Used lube oil: (L)	4,200
Water usage:	None
Energy requirements	
Electrical: (MWh/yr)	None
Fossil fuel: (L)	504,000

a. Sources: EDF-PDS-C-034; EDF-PDS-L-002.

b. CO, particulates, NO_x, SO_2, hydrocarbons.

Table C.6.2-115. Decontamination and decommissioning project data for the Bin Set 5 Service Building (P157E).[a]

Generic Information		**Decontamination and Decommissioning (D&D) Information (continued)**	
Description/function and EIS Project Number:	Bin set 5 service building-CPP 671 (P157E)	Acres disturbed: New/Previous/Revegetated: (acres)	None/0.01/None
EIS alternatives/options:	Facility disposition	Air emissions: (None/Reference)	See Appendix C.2 for details.
Project type or waste stream:	D&D	Fuel combustion (diesel exhaust):	
Action type:	Closure to landfill standards	Gases (CO_2): (tons/yr)	259
Structure type:	Prefabrication/Modular	Contaminants[b]: (tons/yr)	13 (total)
Size: (m^2)	22.3	HEPA filtered offgas: (Ci/yr)	1.45E-08
Other features: (pits, ponds, power/water/sewer lines)	None	Effluents Sanitary wastewater: (L)	563
Location:		Solid wastes (abandoned in place)	
Inside/outside of fence:	Inside INTEC fence	Building material: (m^3)	30
Inside/outside of building:	Existing structure	Radioactive wastes: (m^3)/(Ci)	
Decontamination and Decommissioning (D&D) Information		Combustibles (disposal at WERF):	2/0
Schedule start/end:		Bldg. Material (abandoned in place):	38/0.38
Deactivation:	2035 – 2037	Hazardous/toxic chemicals & wastes	
Demolition:	2038 – 2043	Storage/inventory: (L)	2
Number of D&D workers	<1 per yr	Generation:	
Number of radiation workers (D&D):	<1 per yr	Solvents, etc.: (L)	45
Avg. annual worker rad dose: (rem/yr)	0.25 per worker	Used lube oil: (L)	4,200
Heavy equipment		Water usage	
Equipment used:	Mobile cranes, roll-off trucks, dozers, loaders	Domestic water: (L)	563
		Energy requirements	
Hours of operation: (hrs)	22,200	Electrical: (MWh/yr)	None
		Fossil fuel: (L)	504,000

a. Sources: EDF-PDS-C-034; EDF-PDS-L-002. Construction and operational information is not applicable to this project.
b. CO, particulates, NO_x, SO_2, hydrocarbons.

Table C.6.2-116. Decontamination and decommissioning project data for the Bin Set 6 Service Building (P157F).[a]

Generic Information		**Decontamination and Decommissioning (D&D) Information (continued)**	
Description/function and EIS Project number:	Bin set 6 service building-CPP 673 (P157F)	Acres disturbed: New/Previous/Revegetated: (acres)	None/0.01/None
EIS alternatives/options:	Facility disposition	Air emissions: (None/Reference)	See Appendix C.2 for details.
Project type or waste stream:	D&D	Fuel combustion (diesel exhaust):	
Action type:	Closure to landfill standards	Gases (CO_2): (tons/yr)	259
Structure type	Metal	Contaminants[b]: (tons/yr)	13 (total)
Size: (m^2)	23.8	HEPA filtered offgas: (Ci/yr)	1.45E-08
Other features: (pits, ponds, power/water/sewer lines)	None	Effluents: (L)	None
		Solid wastes (abandoned in place) Building material: (m^3)	33
Location		Radioactive wastes: (m^3)/(Ci)	
Inside/outside of fence:	Inside INTEC fence	Combustibles (disposal at WERF):	2/0
Inside/outside of building:	Existing structure	Building material (abandoned in place):	41/0.41
Decontamination and Decommissioning (D&D) Information			
Schedule start/end:		Hazardous/toxic chemicals & wastes	
Deactivation:	2035 – 2037	Storage/inventory: (L)	2
Demolition:	2038 – 2043	Generation:	
Number of D&D workers:	<1 per yr	Solvents, etc.: (L)	48
Number of radiation workers (D&D):	<1 per yr	Used lube oil: (L)	4,200
Avg. annual worker rad dose: (rem/yr)	0.25 per worker	Water usage Domestic water: (L)	None
Heavy equipment		Energy requirements	
Equipment used:	Mobile cranes, roll-off trucks, dozers, loaders	Electrical: (MWh/yr)	None
Hours of operation: (hrs)	22,200	Fossil fuel: (L)	504,000

a. Sources: EDF-PDS-C-034; EDF-PDS-L-002. Construction and operational information is not applicable to this project.

b. CO, particulates, NO_x, SO_2, hydrocarbons.

Table C.6.2-117. Decontamination and decommissioning project data for the Blower Building (P158A).[a]

Generic Information	
Description/function and EIS Project number:	Blower building- CPP 605 (P158A)
EIS alternatives/options:	Facility disposition
Project type or waste stream:	D&D
Action type:	Closure to landfill standards
Structure type	Concrete block/steel
Size: (m^2)	243.9
Other features: (pits, ponds, power/water/sewer lines)	None
Location	
Inside/outside of fence:	Inside INTEC fence
Inside/outside of building:	Existing structure
Decontamination and Decommissioning (D&D) Information	
Schedule start/end:	
Deactivation:	2035 – 2037
Demolition:	2038 – 2043
Number of D&D workers:	1.2 per yr
Number of radiation workers (D&D):	0.7 per yr
Avg. annual worker rad dose: (rem/yr)	0.25 per worker
Heavy equipment:	
Equipment used:	Mobile cranes, roll-off trucks, dozers, loaders, scabbler, ram
Hours of operation: (hrs)	22,200

Decontamination and Decommissioning (D&D) Information (continued)	
Acres disturbed: (acres)	0.24
Air emissions: (None/Reference)	See Appendix C.2 for details.
Fuel combustion (diesel exhaust):	
Gases (CO_2): (tons/yr)	259
Contaminants[b]: (tons/yr)	13 (total)
HEPA systems offgas: (Ci/yr)	1.45E-08
Effluents	
Sanitary wastewater: (L)	153,000
Solid wastes	
Industrial: (m^3)	776
Abandoned in place: (m^3)	333
Radioactive wastes: (m^3)/(Ci)	
Combustibles (WERF disposal):	22/0.22
Bldg. material (abandoned in place):	420/4.20
Hazardous/toxic chemicals & wastes	
Storage/inventory: (L)	21
Generation:	
Hazardous waste: (L)	496
Used lube oil: (L)	4,201
Water usage	
Domestic water: (L)	153,000
Energy requirements	
Electrical: (MWh/yr)	None
Fossil fuel: (L)	504,000

a. Sources: EDF-PDS-C-035; EDF-PDS-L-002. Construction and operational information is not applicable to this project.

b. CO, particulates, NO_x, SO_x, hydrocarbons.

Table C.6.2-118. Decontamination and decommissioning project data for the closure of the Atmospheric Protection Building (CPP-649) (P158B).[a]

Generic Information		Decontamination and Decommissioning (D&D) Information (continued)	
Description/function and EIS Project number:	Atmospheric Protection Building - CPP 649 (P158B)	Acres disturbed: New/Previous/Revegetated: (acres)	None/0.2/None
EIS alternatives/options:	Facility disposition	Air emissions: (None/Reference) Fuel combustion (diesel exhaust): Gases (CO_2): (tons/yr) Contaminants[b]: (tons/yr) HEPA filtered offgas: (Ci/yr)	See Appendix C.2 for details. 259 13 (total) 1.45E-08
Project type or waste stream:	D&D		
Action type:	Closure to landfill standards		
Structure type: Size: (m^2) Other features: (pits, ponds, power/water/sewer lines)	Concrete 332.3 None	Effluents Sanitary wastewater: (L)	 9,000
Location: Inside/outside of fence: Inside/outside of building:	 Inside INTEC fence Existing structure	Solid wastes Building material: (m^3)	 454
Decontamination and Decommissioning (D&D) Information		Radioactive wastes: (m^3)/(Ci) Combustibles (disposal at WERF): Bldg. Material (abandoned in place):	 30/0 573/5.73
Schedule start/end: Deactivation: Demolition:	 2035 – 2037 2038 – 2043	Hazardous/toxic chemicals & wastes Storage/inventory: (L) Generation: Solvents, etc.: (m^3) Used lube oil: (L)	 28 676 4,200
Number of D&D workers	2 per yr		
Number of radiation workers (D&D):	1 per yr		
Avg. annual worker rad dose: (rem/yr)	0.25 per worker		
Heavy equipment: Equipment used: Hours of operation: (hrs)	 Mobile cranes, roll-off trucks, dozers, loaders 22,200	Water usage Domestic water: (L) Energy requirements Electrical: (MWh/yr) Fossil fuel: (L)	 9,000 None 504,000

a. Sources: EDF-PDS-C-035; EDF-PDS-L-002. Construction and operational information is not applicable to this project.
b. CO, particulates, NO_x, SO_2, hydrocarbons.

Table C.6.2-119. Decontamination and decommissioning project data for the Exhaust Stack/Main Stack (P158C).[a]

Generic Information	
Description/function and EIS Project number:	Exhaust stack/main stack CPP-708 (P158C)
EIS alternatives/options:	Facility disposition
Project type or waste stream:	D&D
Action type:	Closure to landfill standards
Structure type:	Concrete
Size: (m^2)	4,837.2
Other features: (pits, ponds, power/water/sewer lines)	None
Location:	
Inside/outside of fence:	Inside INTEC fence
Inside/outside of building:	Existing structure
Decontamination and Decommissioning (D&D) Information	
Schedule start/end:	
Deactivation:	2035 – 2037
Demolition:	2038 – 2043
Number of D&D workers:	9 per yr
Number of radiation workers (D&D):	6 per yr
Avg. annual worker rad dose: (rem/yr)	0.25 per worker
Heavy equipment	
Equipment used:	Mobile cranes, roll-off trucks, dozers, loaders
Hours of operation: (hrs)	22,200

Decontamination and Decommissioning (D&D) Information (continued)	
Acres disturbed:	
New/Previous/Revegetated: (acres)	None/2.4/None
Air emissions: (None/Reference)	See Appendix C.2 for details.
Fuel combustion (diesel exhaust):	
Gases (CO_2): (tons/yr)	259
Contaminants[b]: (tons/yr)	13 (total)
HEPA filtered offgas: (Ci/yr)	1.45E-08
Effluents	
Sanitary wastewater: (L)	48,375
Solid wastes (abandoned in place)	
Building material: (m^3)	6,603
Radioactive wastes: (m^3)/(Ci)	
Combustibles (disposal at WERF):	438/4
Building material (abandoned in place):	8,335/83.35
Hazardous/toxic chemicals & wastes	
Storage/inventory: (L)	410
Generation:	
Solvents, etc.: (L)	9,842
Used lube oil: (L)	4,200
Water usage	
Domestic water: (L)	48,375
Energy requirements	
Electrical: (MWh/yr)	None
Fossil fuel: (L)	504,000

a. Sources: EDF-PDS-C-035; EDF-PDS-L-002. Construction and operational information is not applicable to this project.

b. CO, particulates, NO_x, SO_2, hydrocarbons.

Table C.6.2-120. Decontamination and decommissioning project data for the Pre-Filter Vault (P158D).[a]

Generic Information	
Description/function and EIS Project number:	Pre-Filter Vault - CPP 756 (P158D)
EIS alternatives/options:	Facility disposition
Project type or waste stream:	D&D
Action type:	Closure to landfill standards
Structure type:	Concrete
Size: (m^2)	341.4
Other features: (pits, ponds, power/water/sewer lines)	None
Location:	
Inside/outside of fence:	Inside INTEC fence
Inside/outside of building:	Existing structure
Decontamination and Decommissioning (D&D) Information	
Schedule start/end:	
Deactivation:	2035 – 2037
Demolition:	2038 – 2043
Number of D&D workers:	1 per yr
Number of radiation workers (D&D):	1 per yr
Avg. annual worker rad dose: (rem/yr)	0.25 per worker
Heavy equipment:	
Equipment used:	Mobile cranes, roll-off trucks, dozers, loaders
Hours of operation (all heavy equipment): (hrs)	22,200

Decontamination and Decommissioning (D&D) Information (continued)	
Acres disturbed:	
New/Previous/Revegetated: (acres)	None/0.3/None
Air emissions: (None/Reference)	See Appendix C.2 for details.
Fuel combustion (diesel exhaust):	
Gases (CO_2): (tons/yr)	259
Contaminants[b]: (tons/yr)	13 (total)
HEPA filtered offgas: (Ci/yr)	1.45E-08
Effluents	
Sanitary wastewater: (L)	6,750
Solid wastes (abandoned in place)	
Building material: (m^3)	466
Radioactive wastes: (m^3)/(Ci)	
Combustibles (disposal at WERF):	31/0
Building material (abandoned in place):	588/5.88
Hazardous/toxic chemicals & wastes	
Storage/inventory: (L)	29
Generation:	
Solvents, etc.: (L)	695
Used lube oil: (L)	4,200
Water usage	
Domestic water: (L)	6,750
Energy requirements	
Electrical: (MWh/yr)	None
Fossil fuel: (L)	504,000

a. Sources: EDF-PDS-C-035; EDF-PDS-L-002. Construction and operational information is not applicable to this project.

b. CO, particulates, NO_x, SO_2, hydrocarbons.

Table C.6.2-121. Decontamination and decommissioning project data for the Liquid Effluent Treatment and Disposal Building (P158E).[a]

Generic Information	
Description/function and EIS Project number:	Liquid effluent treatment and disposal building - CPP 1618 (P158E)
EIS alternatives/options:	Facility disposition
Project type or waste stream:	D&D
Action type:	Clean Closure
Structure type:	Steel
Size: (m^2)	637.2
Other features: (pits, ponds, power/water/sewer lines)	None
Location:	
Inside/outside of fence:	Inside INTEC fence
Inside/outside of building:	Existing structure
Decontamination and Decommissioning (D&D) Information	
Schedule start/end:	
Deactivation:	2035 – 2037
Demolition:	2038 – 2043
Number of D&D workers:	1 per yr
Number of radiation workers (D&D):	1 per yr
Avg. annual worker rad dose: (rem/yr)	0.25 per worker
Heavy equipment:	
Equipment used:	Mobile cranes, roll-off trucks, dozers, loaders
Hours of operation: (hrs)	22,200

Decontamination and Decommissioning (D&D) Information (continued)	
Acres disturbed:	
New/Previous/Revegetated: (acres)	None/0.3/None
Air emissions: (None/Reference)	See Appendix C.2 for details.
Fuel combustion (diesel exhaust):	
Gases (CO_2): (tons/yr)	259
Contaminants[b]: (tons/yr)	13 (total)
HEPA filtered offgas: (Ci/yr)	1.45E-08
Effluents	
Sanitary wastewater: (L)	7,875
Solid wastes (abandoned in place)	
Building material: (m^3)	870
Radioactive wastes: (m^3)/(Ci)	
Combustibles:	58/1
Building material (abandoned in place):	1,098/10.98
Hazardous/toxic chemicals & wastes	
Storage/inventory: (L)	54
Generation:	
Solvents, etc.: (L)	1,296
Used lube oil: (L)	4,200
Water usage	
Domestic water: (L)	7,875
Energy requirements	
Electrical: (MWh/yr)	None
Fossil fuel: (L)	504,000

a. Sources: EDF-PDS-C-035; EDF-PDS-L-002. Construction and operational information is not applicable to this project.

b. CO, particulates, NO_x, SO_2, hydrocarbons.

Table C.6.2-122. Decontamination and decommissioning project data for the PEW Evaporator Facility (P158H).[a]

Generic Information	
Description/function and EIS Project number:	PEW Evaporator Facility – CPP- 604 (P158H)
EIS alternatives/options:	Facility disposition
Project type or waste stream:	D&D
Action type:	Closure to landfill standards
Structure type:	Steel frame and reinforced concrete
Size: (m^2)	2,258.1
Other features: (pits, ponds, power/water/sewer lines)	None
Location:	
Inside/outside of fence:	Inside INTEC fence
Inside/outside of building:	Existing structure
Decontamination and Decommissioning (D&D) Information	
Schedule start/end:	
Deactivation:	2035 – 2037
Demolition:	2038 – 2043
Number of D&D workers:	36 per yr
Number of radiation workers (D&D):	25 per yr
Avg. annual worker rad dose: (rem/yr)	0.25 per worker
Heavy equipment:	
Equipment used:	Mobile cranes, roll-off trucks, dozers, loaders
Hours of operation: (hrs)	58,050

Decontamination and Decommissioning (D&D) Information (continued)	
Acres disturbed:	
New/Previous/Revegetated: (acres)	None/1.1/None
Air emissions: (None/Reference)	See Appendix C.2 for details.
Fuel combustion (diesel exhaust):	
Gases (CO_2): (tons/yr)	677
Contaminants[b]: (tons/yr)	33 (total)
HEPA filtered offgas: (Ci/yr)	2.90E-08
Effluents	
Mixed waste: (L)/(Ci)	17,979/18
Sanitary wastewater: (L)	203,625
Solid wastes (abandoned in place)	
Building material: (m^3)	3,082
Radioactive wastes: (m^3)/(Ci)	
Combustibles:	205/2
Bldg. Material (abandoned in place):	3,891/38.91
Mixed waste (abandoned in place):	14/0.14
Hazardous/toxic chemicals & wastes	
Storage/inventory: (L)	5,994
Generation:	
Solvents, etc.: (L)	143,845
Used lube oil: (L)	11,000
Water usage	
Domestic water: (L)	203,625
Energy requirements	
Electrical: (MWh/yr)	None
Fossil fuel: (L)	1,318,000

a. Sources: EDF-PDS-C-035; EDF-PDS-L-002. Construction and operational information is not applicable to this project.

b. CO, particulates, NO_x, SO_2, hydrocarbons.

Table C.6.2-123. Decontamination and decommissioning project data for the Remote Analytical Laboratory (P159).[a]

Generic Information		**Decontamination and Decommissioning (D&D) Information (continued)**	
Description/function and EIS Project number:	Remote analytical laboratory-CPP-684 (P159)	Air emissions: (None/Reference)	See Appendix C.2 for details.
EIS alternatives/options:	Facility disposition	Fuel combustion (diesel exhaust):	
Project type or waste stream:	D&D	Gases (CO_2): (tons/yr)	677
Action type:	Performance-Based Closure	Contaminants[b]: (tons/yr)	33 (total)
		HEPA filtered offgas: (Ci/yr)	2.90E-08
Structure type:	Reinforced concrete	Effluents	
Size: (m^2)	1,116.3	Mixed waste: (L)/(Ci)	568/1
Other features: (pits, ponds, power/water/sewer lines)	None	Sanitary wastewater: (L)	38,813
Location:		Solid wastes (abandoned in place)	
Inside/outside of fence:	Inside INTEC fence	Building material: (m^3)	1,524
Inside/outside of building:	Existing structure	Radioactive wastes: (m^3)/(Ci)	
Decontamination and Decommissioning (D&D) Information		Combustibles:	101/1
Schedule start/end		Bldg. material (abandoned in place):	1,923/19.23
Deactivation:	2037	Mixed waste (abandoned in place):	7/0.07
Demolition:	2038 – 2043	Hazardous/toxic chemicals & wastes	
Number of D&D workers:	7 per yr	Storage/inventory: (L)	114
Number of radiation workers (D&D):	4 per yr	Generation:	
Avg. annual worker rad dose: (rem/yr)	0.25 per worker	Solvents, etc.: (L)	2,271
Heavy equipment:		Used lube oil: (L)	9,200
Equipment used:	Mobile cranes, roll-off trucks, dozers, loaders	Water usage	
Hours of operation: (hrs)	48,375	Domestic water: (L)	38,813
Acres disturbed:		Energy requirements	
New/Previous/Revegetated: (acres)	None/0.6/None	Electrical: (MWh/yr)	None
		Fossil fuel: (L)	1,099,000

a. Sources: EDF-PDS-C-036 ; EDF-PDS-L-002. Construction and operational information is not applicable to this project.
b. CO, particulates, NO_x, SO_2, hydrocarbons.

Table C.6.2-124. Decontamination and decommissioning project data for the Closure of the Fuel Processing Building to Landfill Standards (P160A).[a]

Generic Information		**Decontamination and Decommissioning (D&D) Information (continued)**	
Description/function and EIS Project number:	Fuel Processing Building, CPP-601 (P160A)	Air emissions: (None/Reference)	See Appendix C.2 for details.
		Fuel combustion (diesel exhaust):	
EIS alternatives/options:	Facility disposition	Gases (CO_2): (tons/yr)	1,023
Project type or waste stream:	D&D	Contaminants[b]: (tons/yr)	50 (total)
Action type:	Closure to landfill standards	HEPA filtered offgas: (Ci/yr)	5.81E-08
Structure type:	Reinforced concrete	Effluents	
Size: (m^2)	6,945.5	Mixed waste: (L)/(Ci)	3,533/4
Other features: (pits, ponds, power/water/sewer lines)	None	Sanitary wastewater: (L)	91,125
Location		Solid wastes (abandoned in place)	
		Building material: (m^3)	9,480
Inside/outside of fence:	Inside INTEC fence	Radioactive wastes: (m^3)/(Ci)	
Inside/outside of building:	Existing structure	Combustibles:	629/6
Decontamination and Decommissioning (D&D) Information		Bldg. material (abandoned in place):	11,968/119.68
Schedule start/end		Mixed waste (abandoned in place):	43/0.43
Deactivation:	1999 – 2007	Hazardous/toxic chemicals & wastes	
Demolition:	2015 – 2025	Storage/inventory: (L)	353
Number of D&D workers:	16 per yr	Generation:	
Number of radiation workers (D&D):	10 per yr	Solvents, etc.: (L)	14,132
Avg. annual worker rad dose: (rem/yr)	0.25 per worker	Used lube oil: (L)	27,700
Heavy equipment		Water usage	
Equipment used:	Mobile cranes, roll-off trucks, dozers, loaders	Domestic water: (L)	91,125
		Energy requirements	
Hours of operation: (hrs)	146,250	Electrical: (MWh/yr)	None
Acres disturbed		Fossil fuel: (L)	3,321,000
New/Previous/Revegetated: (acres)	None/3.4/None		

a. Sources: EDF-PDS-C-037; EDF-PDS-L-002. Construction and operational information is not applicable to this project.

b. CO, particulates, NO_x, SO_2, hydrocarbons.

Table C.6.2-125. Decontamination and decommissioning project data for the Closure of the Remote Analytical Facility Building to Landfill Standards (P160C).[a]

Generic Information	
Description/function and EIS Project number:	Remote analytical facility building, CPP-627 (P160C)
EIS alternatives/options:	Facility disposition
Project type or waste stream:	D&D
Action type:	Closure to landfill standards
Structure type:	Concrete
Size: (m^2)	1,469.8
Other features: (pits, ponds, power/water/sewer lines)	None
Location:	
Inside/outside of fence:	Inside INTEC fence
Inside/outside of building:	Existing structure
Decontamination and Decommissioning (D&D) Information	
Schedule start/end	
Deactivation:	1999 – 2007
Demolition:	2015 – 2025
Number of D&D workers:	8 per yr
Number of radiation workers (D&D):	5 per yr
Avg. annual worker rad dose: (rem/yr)	0.25 per worker
Heavy equipment	
Equipment used:	Mobile cranes, roll-off trucks, dozers, loaders
Hours of operation: (hrs)	146,250

Decontamination and Decommissioning (D&D) Information (continued)	
Acres disturbed:	
New/Previous/Revegetated: (acres)	None/0.7/None
Air emissions: (None/Reference)	See Appendix C.2 for details.
Fuel combustion (diesel exhaust):	
Gases (CO_2): (tons/yr)	1,023
Contaminants[b]: (tons/yr)	50 (total)
HEPA filtered offgas: (Ci/yr)	5.81E-08
Effluents	
Sanitary wastewater: (L)	46,688
Solid wastes (abandoned in place)	
Building material: (m^3)	2,006
Radioactive wastes: (m^3)/(Ci)	
Combustibles:	133/1
Bldg. material (abandoned in place):	2,533/25.33
Mixed waste (abandoned in place):	9/0.09
Hazardous/toxic chemicals & wastes	
Storage/inventory:	None
Generation:	
Used lube oil: (L)	27,700
Water usage	
Domestic water: (L)	46,688
Energy requirements	
Electrical: (MWh/yr)	None
Fossil fuel: (L)	3,321,000

a. Sources: EDF-PDS-C-037; EDF-PDS-L-002. Construction and operational information is not applicable to this project.
b. CO, particulates, NO_x, SO_2, hydrocarbons.

Table C.6.2-126. Decontamination and decommissioning project data for the Closure of the Head End Process Plant to Landfill Standards (P160D).[a]

Generic Information	
Description/function and EIS Project number:	Head End Process Plant CPP-640 (P160D)
EIS alternatives/options:	Facility disposition
Project type or waste stream:	D&D
Action type:	Closure to landfill standards
Structure type:	Concrete
Size: (m^2)	1,693.0
Other features: (pits, ponds, power/water/sewer lines)	None
Location:	
Inside/outside of fence:	Inside INTEC fence
Inside/outside of building:	Existing structure
Decontamination and Decommissioning (D&D) Information	
Schedule start/end:	
Deactivation:	1999 – 2007
Demolition:	2015 – 2025
Number of D&D workers:	8 per yr
Number of radiation workers (D&D):	5 per yr
Avg. annual worker rad dose: (rem/yr)	0.25 per worker
Heavy equipment	
Equipment used:	Mobile cranes, roll-off trucks, dozers, loaders
Hours of operation: (hrs)	146,250
Acres disturbed	
New/Previous/Revegetated: (acres)	None/0.8/None

Decontamination and Decommissioning (D&D) Information (continued)	
Air emissions: (None/Reference)	See Appendix C.2 for details.
Fuel combustion (diesel exhaust):	
Gases (CO_2): (tons/yr)	1,023
Contaminants[b]: (tons/yr)	50 (total)
HEPA filtered offgas: (Ci/yr)	5.81E-08
Effluents	
Mixed waste: (L)/(Ci)	3,444/3
Sanitary wastewater: (L)	44,438
Solid wastes (abandoned in place)	
Building material: (m^3)	2,311
Radioactive wastes: (m^3)/(Ci)	
Combustibles:	153/2
Building material (abandon in place):	2,917/29.17
Mixed waste (abandon in place):	10/0.10
Hazardous/toxic chemicals & wastes	
Storage/inventory: (L)	86
Generation:	
Solvents, etc.: (L)	3,445
Used lube oil: (L)	27,700
Water usage	
Domestic water: (L)	44,438
Energy requirements	
Electrical: (MWh/yr)	None
Fossil fuel: (L)	3,321,000

a. Sources: EDF-PDS-C-037; EDF-PDS-L-002. Construction and operational information is not applicable to this project.
b. CO, particulates, NO_x, SO_2, hydrocarbons.

Table C.6.2-127. Decontamination and decommissioning project data for the Performance-Based Closure of the Fuel Processing Building (P160E).[a]

Generic Information		**Decontamination and Decommissioning (D&D) Information (continued)**	
Description/function and EIS Project number:	Fuel Processing Building, CPP-601 (P160E)	Air emissions: (None/Reference)	See Appendix C.2 for details.
EIS alternatives/options:	Facility disposition	Fuel combustion (diesel exhaust):	
Project type or waste stream:	D&D	Gases (CO_2): (tons/yr)	1,023
Action type:	Performance-Based Closure	Contaminants[b]: (tons/yr)	50 (total)
		HEPA filtered offgas: (Ci/yr)	5.81E-08
Structure type:	Reinforced Concrete	Effluents	
Size: (m^2)	6,945.5	Mixed waste: (L)/(Ci)	3,533/4
Other features: (pits, ponds, power/water/sewer lines)	None	Sanitary wastewater: (L)	113,625
		Solid wastes (abandoned in place)	
Location:		Building material: (m^3)	9,480
Inside/outside of fence:	Inside INTEC fence	Radioactive wastes: (m^3)/(Ci)	
Inside/outside of building:	Existing structure	Combustibles:	629/6
Decontamination and Decommissioning (D&D) Information		Building material (abandoned in place):	11,968/119.68
Schedule start/end		Mixed waste (abandoned in place):	43/0.43
Deactivation:	1999 – 2007	Hazardous/toxic chemicals & wastes	
Demolition:	2015 – 2025	Storage/inventory: (L)	353
Number of D&D workers:	20 per yr	Generation:	
Number of radiation workers (D&D):	13 per yr	Solvents, etc.: (L)	14,132
Avg. annual worker rad dose: (rem/yr)	0.25 per worker	Used lube oil: (L)	27,700
Heavy equipment		Water usage	
Equipment used:	Mobile cranes, roll-off trucks, dozers, loaders	Domestic water: (L)	113,625
		Energy requirements	
Hours of operation: (hrs)	146,250	Electrical: (MWh/yr)	None
Acres disturbed:		Fossil fuel: (L)	3,321,000
New/Previous/Revegetated: (acres)	None/3.4/None		

a. Sources: EDF-PDS-C-037; EDF-PDS-L-002. Construction and operational information is not applicable to this project.

b. CO, particulates, NO_x, SO_2, hydrocarbons.

Table C.6.2-128. Decontamination and decommissioning project data for the Performance-Based Closure of the Remote Analytical Facility Building (P160F).[a]

Generic Information	
Description/function and EIS project number:	Remote Analytical Facility Building, CPP-627 (P160F)
EIS alternatives/options:	Facility Disposition
Project type or waste stream:	D&D
Action type:	Performance-Based Closure
Structure type	Concrete
Size: (m^2)	1,469.8
Other features: (pits, ponds, power/water/sewer lines)	None
Location	
Inside/outside of fence:	Inside INTEC fence
Inside/outside of building:	Existing structure
Decontamination and Decommissioning (D&D) Information	
Schedule start/end	
Deactivation:	1999 – 2007
Demolition:	2015 – 2025
Number of D&D workers:	10 per yr
Number of radiation workers (D&D):	6 per yr
Avg. annual worker rad dose: (rem/yr)	0.25 per worker
Heavy equipment	
Equipment used:	Mobile cranes, roll-off trucks, dozers, loaders
Hours of operation: (hrs)	146,250
Acres disturbed:	
New/Previous/Revegetated: (acres)	None/0.7/None

Decontamination and Decommissioning (D&D) Information (continued)	
Air emissions: (None/Reference)	See Appendix C.2 for details.
Fuel combustion (diesel exhaust):	
Gases (CO_2): (tons/yr)	1,023
Contaminants[b]: (tons/yr)	50 (total)
HEPA filtered offgas: (Ci/yr)	5.81E-08
Effluents	
Sanitary wastewater: (L)	58,500
Solid wastes (abandoned in place)	
Building material: (m^3)	2,006
Radioactive wastes: (m^3)/(Ci)	
Combustibles:	133/1
Building material (abandoned in place):	2,533/25.33
Mixed waste (abandoned in place):	9/0.09
Hazardous/toxic chemicals & wastes	
Storage/inventory: (L)	None
Generation:	
Used lube oil: (L)	27,700
Water usage	
Domestic water: (L)	58,500
Energy requirements	
Electrical: (MWh/yr)	None
Fossil fuel: (L)	3,321,000

a. Sources: EDF-PDS-C-037; EDF-PDS-L-002. Construction and operational information is not applicable to this project.

b. CO, particulates, NO_x, SO_2, hydrocarbons.

Table C.6.2-129. Decontamination and decommissioning project data for the Performance-Based Closure of the Head End Process Plant (P160G).[a]

Generic Information	
Description/function and EIS Project number:	Head End Process Plant, CPP-640 (P160G)
EIS alternatives/options:	Facility disposition
Project type or waste stream:	D&D
Action type:	Performance-Based Closure
Structure type:	Concrete
Size: (m^2)	1,693.0
Other features: (pits, ponds, power/water/sewer lines)	None
Location:	
Inside/outside of fence:	Inside INTEC fence
Inside/outside of building:	Existing structure
Decontamination and Decommissioning (D&D) Information	
Schedule start/end	
Deactivation:	1999 – 2007
Demolition:	2015 – 2025
Number of D&D workers:	10 per yr
Number of radiation workers (D&D):	6 per yr
Avg. annual worker rad dose: (rem/yr)	0.25 per worker
Heavy equipment	
Equipment used:	Mobile cranes, roll-off trucks, dozers, loaders
Hours of operation: (hrs)	146,250
Acres disturbed:	
New/Previous/Revegetated: (acres)	None/0.8/None

Decontamination and Decommissioning (D&D) Information (continued)	
Air emissions: (None/Reference)	See Appendix C.2 for details.
Fuel combustion (diesel exhaust):	
Gases (CO_2): (tons/yr)	1,023
Contaminants[b]: (tons/yr)	50 (total)
HEPA filtered offgas: (Ci/yr)	5.81E-08
Effluents	
Mixed waste: (L)/(Ci)	3,444/3
Sanitary wastewater: (L)	55,688
Solid wastes (abandoned in place)	
Building material: (m^3)	2,311
Radioactive wastes: (m^3)/(Ci)	
Combustibles:	153/2
Bldg. material (abandoned in place):	2,917/29.17
Mixed waste (abandoned in place):	10/0.10
Hazardous/toxic chemicals & wastes	
Storage/inventory: (L)	86
Generation:	
Solvents, etc.: (L)	3,445
Used lube oil: (L)	27,700
Water usage	
Domestic water: (L)	55,688
Energy requirements	
Electrical: (MWh/yr)	None
Fossil fuel: (L)	3,321,000

a. Sources: EDF-PDS-C-037; EDF-PDS-L-002. Construction and operational information is not applicable to this project.

b. CO, particulates, NO_x, SO_2, hydrocarbons.

Table C.6.2-130. Decontamination and decommissioning project data for the Performance-Based Closure of the Fluorinel Storage Facility (P161A).[a]

Generic Information	
Description/function and EIS Project number:	Fuel storage facility (FAST) – CPP-666 (P161A)
EIS alternatives/options:	Facility disposition
Project type or waste stream:	D&D
Action type:	Performance-Based Closure
Structure type:	Structural steel, reinforced concrete
Size: (m^2)	16,279.1
Other features: (pits, ponds, power/water/sewer lines)	None
Location:	
Inside/outside of fence:	Inside INTEC fence
Inside/outside of building:	Existing structure
Decontamination and Decommissioning (D&D) Information	
Schedule start/end:	
Deactivation:	2006 – 2010
Demolition:	2011 – 2017
Number of D&D workers:	54 per yr
Number of radiation workers (D&D):	34 per yr
Avg. annual worker rad dose: (rem/yr)	0.25 per worker
Heavy equipment:	
Equipment used:	Mobile cranes, roll-off trucks, dozers, loaders
Hours of operation: (hrs)	87,750
Acres disturbed:	
New/Previous/Revegetated: (acres)	None/8.0/None

Decontamination and Decommissioning (D&D) Information (continued)	
Air emissions: (None/Reference)	See Appendix C.2 for details.
Fuel combustion (diesel exhaust):	
Gases (CO_2): (tons/yr)	1,023
Contaminants[b]: (tons/yr)	50 (total)
HEPA filtered offgas: (Ci/yr)	5.81E-08
Effluents	
Sanitary wastewater: (L)	303,188
Solid wastes (abandoned in place)	
Building material: (m^3)	22,220
Radioactive wastes: (m^3)/(Ci)	
Combustibles:	1,475/15
Building material (abandoned in place):	28,050/280.50
Mixed waste (abandoned in place):	100/1.00
Hazardous/toxic chemicals & wastes	
Storage/inventory: (L)	1,380
Generation:	
Solvents, etc.: (L)	33,122
Used lube oil: (L)	16,600
Water usage	
Domestic water: (L)	303,188
Energy requirements	
Electrical: (MWh/yr)	None
Fossil fuel: (L)	1,993,000

a. Sources: EDF-PDS-C-038; EDF-PDS-L-002.

b. CO, particulates, NO_x, SO_2, hydrocarbons.

Table C.6.2-131. Decontamination and decommissioning project data for the Closure of the High-Level Waste (Raffinate) Lines (P162A).[a]

Generic Information	
Description/function and EIS Project number:	High level liquid waste (raffinate) lines (P162A)
EIS alternatives/options:	Facility Disposition
Project type or waste stream:	D&D
Action type:	Closure to landfill standards
Structure type:	Underground Lines
Size: (m^2)	117.2
Other features: (pits, ponds, power/water/sewer lines)	None
Location:	
Inside/outside of fence:	Inside INTEC fence
Inside/outside of building:	Existing structure
Decontamination and Decommissioning (D&D) Information	
Schedule start/end:	
Deactivation:	2038 – 2038
Demolition:	2043 – 2043
Number of D&D workers:	1 per yr
Number of radiation workers (D&D):	<1 per yr
Avg. annual worker rad dose: (rem/yr)	0.25 per worker
Heavy equipment:	
Equipment used:	Mobile cranes, roll-off trucks, dozers, loaders
Hours of operation: (hrs)	2,700

Decontamination and Decommissioning (D&D) Information (continued)	
Acres disturbed:	
New/Previous/Revegetated: (acres)	None/0.1/None
Air emissions: (None/Reference)	See Appendix C.2 for details.
Fuel combustion (diesel exhaust):	
Gases (CO_2): (tons/yr)	188
Contaminants[b]: (tons/yr)	9 (total)
Effluents	
Sanitary wastewater: (L)	2,813
Solid wastes (abandoned in place)	
Building material: (m^3)	81
Radioactive wastes: (m^3)/(Ci)	
Combustibles:	2/0.02
Building material (abandoned in place):	1/0.01
Hazardous/toxic chemicals & wastes	
Storage/inventory: (L)	None
Generation:	
Used lube oil: (L)	500
Water usage	
Domestic water: (L)	2,813
Energy requirements	
Electrical: (MWh/yr)	None
Fossil fuel: (L)	61,000

a. Sources: EDF-PDS-C-039; EDF-PDS-L-002. Construction and operational information is not applicable to this project.

b. CO, particulates, NO_x, SO_2, hydrocarbons.

Table C.6.2-132. Decontamination and decommissioning project data for the Closure of the Calcine Solids Transport Lines (P162B).[a]

Generic Information	
Description/function and EIS Project number:	Calcine solids transport lines (P162B)
EIS alternatives/options:	Facility Disposition
Project type or waste stream:	D&D
Action type:	Closure to landfill standards
Structure type:	Underground Lines
Size: (m^2)	70.3
Other features: (pits, ponds, power/water/sewer lines)	None
Location:	
Inside/outside of fence:	Inside INTEC fence
Inside/outside of building:	Existing structure
Decontamination and Decommissioning (D&D) Information	
Schedule start/end:	
Deactivation:	2038 – 2038
Demolition:	2043 – 2043
Number of D&D workers:	<1 per yr
Number of radiation workers (D&D):	<1 per yr
Avg. annual worker rad dose: (rem/yr)	0.25 per worker
Heavy equipment:	
Equipment used:	Mobile cranes, roll-off trucks, dozers, loaders
Hours of operation: (hrs)	2,700

Decontamination and Decommissioning (D&D) Information (continued)	
Acres disturbed:	
New/Previous/Revegetated: (acres)	None/0.1/None
Air emissions: (None/Reference)	See Appendix C.2 for details.
Fuel combustion (diesel exhaust):	
Gases (CO_2): (tons/yr)	188
Contaminants[b]: (tons/yr)	9 (total)
Effluents	
Sanitary wastewater: (L)	1,125
Solid wastes (abandoned in place)	
Building material: (m^3)	157
Radioactive wastes: (m^3)/(Ci)	
Combustibles:	1/0.01
Bldg. material: (abandoned in place):	4/0.04
Hazardous/toxic chemicals & wastes	
Storage/inventory: (L)	None
Generation:	
Used lube oil: (L)	500
Water usage	
Domestic water: (L)	1,125
Energy requirements	
Electrical: (MWh/yr)	None
Fossil fuel: (L)	61,000

a. Sources: EDF-PDS-C-039; EDF-PDS-L-002. Construction and operational information is not applicable to this project.

b. CO, particulates, NO_x, SO_2, hydrocarbons.

Table C.6.2-133. Decontamination and decommissioning project data for the Closure of the Process Offgas Lines and Drains (P162C).[a]

Generic Information	
Description/function and EIS Project number:	Process offgas lines and drains (P162C)
EIS alternatives/options:	Facility disposition
Project type or waste stream:	D&D
Action type:	Performance-Based Closure
Structure type:	Underground Lines
Size: (m^2)	175.8
Other features: (pits, ponds, power/water/sewer lines)	None
Location:	
Inside/outside of fence:	Inside INTEC fence
Inside/outside of building:	Existing structure
Decontamination and Decommissioning (D&D) Information	
Schedule start/end:	
Deactivation:	2038 – 2038
Demolition:	2043 – 2043
Number of D&D workers:	1 per yr
Number of radiation workers (D&D):	1 per yr
Avg. annual worker rad dose: (rem/yr)	0.25 per worker
Heavy equipment:	
Equipment used:	Mobile cranes, roll-off trucks, dozers, loaders
Hours of operation: (hrs)	2,700

Decontamination and Decommissioning (D&D) Information (continued)	
Acres disturbed:	
New/Previous/Revegetated: (acres)	None/0.2/None
Air emissions: (None/Reference)	See Appendix C.2 for details.
Fuel combustion (diesel exhaust):	
Gases (CO_2): (tons/yr)	188
Contaminants[b]: (tons/yr)	9
Effluents	
Sanitary wastewater: (L)	5,625
Mixed waste: (L)/(Ci)	31,037/31
Solid wastes (abandoned in place)	
Bldg. material: (m^3)	130
Radioactive wastes: (m^3)/(Ci)	
Combustibles:	3/0.03
Bldg. material (abandoned in place):	11/0.11
Hazardous/toxic chemicals & wastes	
Storage/inventory: (L)	None
Generation:	
Used lube oil: (L)	500
Water usage	
Domestic water: (L)	5,625
Energy requirements	
Electrical: (MWh/yr)	None
Fossil fuel: (L)	61,000

a. Sources: EDF-PDS-C-039; EDF-PDS-L-002. Construction and operational information is not applicable to this project.

b. CO, particulates, NO_x, SO_2, hydrocarbons.

Table C.6.2-134. Decontamination and decommissioning project data for the Closure of the Vessel Offgas Lines (P162D).[a]

Generic Information	
Description/function and EIS Project number:	Vessel offgas lines (P162D)
EIS alternatives/options:	Facility disposition
Project type or waste stream:	D&D
Action type:	Performance-Based Closure
Structure type:	Underground Lines
Size: (m^2)	175.8
Other features: (pits, ponds, power/water/sewer lines)	None
Location:	
Inside/outside of fence:	Inside INTEC fence
Inside/outside of building:	Existing structure
Decontamination and Decommissioning (D&D) Information	
Schedule start/end:	
Deactivation:	2038 – 2038
Demolition:	2043 – 2043
Number of D&D workers:	1 per yr
Number of radiation workers (D&D):	<1 per year
Avg. annual worker rad dose: (rem/yr)	0.25 per worker
Heavy equipment:	
Equipment used:	Mobile cranes, roll-off trucks, dozers, loaders
Hours of operation: (hrs) (all heavy equipment): (hrs)	2,700

Decontamination and Decommissioning (D&D) Information (continued)	
Acres disturbed:	
New/Previous/Revegetated: (acres)	None/0.2/None
Air emissions: (None/Reference)	See Appendix C.2 for details.
Fuel combustion (diesel exhaust):	
Gases (CO_2): (tons/yr)	188
Contaminants[b]: (tons/yr)	9 (total)
Effluents	
Mixed waste: (L)/(Ci)	12,112/12
Sanitary wastewater: (L)	3,938
Solid wastes (abandoned in place)	
Bldg. material: (m^3)	392
Radioactive wastes: (m^3)/(Ci)	
Combustibles:	3/0.03
Bldg. material (abandoned in place):	9/0.09
Hazardous/toxic chemicals & wastes	
Storage/inventory: (L)	None
Generation:	
Used lube oil: (L)	500
Water usage	
Domestic water: (L)	3,938
Energy requirements	
Electrical: (MWh/yr)	None
Fossil fuel: (L)	61,000

a. Sources: EDF-PDS-C-039; EDF-PDS-L-002. Construction and operational information is not applicable to this project.

b. CO, particulates, NO_x, SO_2, hydrocarbons.

Table C.6.2-135. Decontamination and decommissioning project data for the Performance-Based Closure of the New Waste Calcining Facility (P165A).[a]

Generic Information	
Description/function and EIS project number:	Deactivation of the New Waste Calcining Facility
EIS alternatives/options:	Facility Disposition
Project type or waste stream:	Performance-Based Closure
Action type:	D&D of existing facility
Structure type:	Concrete/steel construction
Size: (m^2)	8,930.2
Other features: (pits, ponds, power/water/sewer lines)	None
Location:	
Inside/outside of fence:	Inside INTEC fence
Inside/outside of building:	Includes building
Decontamination and Decommissioning (D&D) Information	
Schedule start/end	
Deactivation:	2017 – 2019
Demolition:	2019 – 2021
Number of D&D workers:	47 per yr
Number of radiation workers (D&D):	35 per yr
Avg. annual worker rad. dose: (rem/yr)	0.25 per worker
Heavy equipment	
Equipment used:	Mobile cranes, roll-off trucks, dozers, loaders
Hours of operation: (hrs)	73,125
Acres disturbed	
New/Previous/Revegetated: (acres)	None/4.4/None

Decontamination and Decommissioning (D&D) Information (continued)	
Air emissions: (None/Reference)	See Appendix C.2 for details.
Dust: (tons/yr)	317
Fuel combustion (diesel exhaust):	
Gases (CO_2): (tons/yr)	1,023
Contaminants[b]: (tons/yr)	50
HEPA filtered offgas: (Ci/yr)	5.81E-08
Effluents	
Sanitary wastewater: (L)	263,250
Solid wastes	
Bldg. material (abandoned in place): (m^3)	18,271
Radioactive wastes: (m^3)/(Ci)	
Combustibles:	To be incinerated at WERF
LLW disposal:	2,082/21
Bldg. material (abandoned in place):	4,783/47.83
Mixed waste (abandoned in place):	23/0.023
Hazardous/toxic chemicals & wastes	
Generation:	
Used lube oil: (L)	13,839
Solvents: (L)	253,622
Storage/inventory: (L)	12,681
Water usage	
Domestic: (L)	263,250
Energy requirements	
Electrical: (MWh/yr)	300
Fossil fuel: (L)	1,661,000

a. Sources: EDF-PDS-C-050; EDF-PDS-L-002. Construction and operational information is not applicable to this project.
b. CO, particulates, NO_x, SO_2, hydrocarbons

Table C.6.2-136. Decontamination and decommissioning project data for the Closure to Landfill Standards of the New Waste Calcining Facility (P165B).[a]

Generic Information		**Decontamination and Decommissioning (D&D) Information (continued)**	
Description/function and EIS project number:	Deactivation of the New Waste Calcining Facility	Air emissions: (None/Reference)	See Appendix C.2 for details.
		Dust: (tons/yr)	317
EIS alternatives/options:	Facility Disposition	Fuel combustion (diesel exhaust):	
Project type or waste stream:	Closure to landfill standards	Gases (CO_2): (tons/yr)	1,023
Action type:	D&D of existing facility	Contaminants[b]: (tons/yr)	50
Structure type:	Concrete/steel construction	HEPA filtered offgas: (Ci/yr)	5.81E-08
Size: (m^2)	8,930.2	Effluents	
Other features: (pits, ponds, power/water/sewer lines)	None	Sanitary wastewater: (L)	246,938
		Solid wastes	
Location:		Bldg. material (abandoned in place): (m^3)	18,271
Inside/outside of fence:	Inside INTEC fence	Radioactive wastes: (m^3)/(Ci)	
Inside/outside of building:	Includes building	Combustibles:	To be incinerated at WERF
Decontamination and Decommissioning (D&D) Information		LLW disposal:	2,082/21
Schedule start/end		Bldg. material (abandoned in place):	4,783/47.83
Deactivation:	2017 – 2019	Mixed waste (abandoned in place):	23/0.023
Demolition:	2019 – 2021	Hazardous/toxic chemicals & wastes	
Number of D&D workers:	44 per yr	Generation:	
Number of radiation workers (D&D):	32 per yr	Used lube oil: (L)	13,839
Avg. annual worker rad. dose: (rem/yr)	0.25 per worker	Solvents: (L)	253,622
Heavy equipment		Storage/inventory: (L)	12,681
Equipment used:	Mobile cranes, roll-off trucks, Dozers, loaders	Water usage	
		Domestic: (L)	246,938
Hours of operation: (hrs)	73,125	Energy requirements	
Acres disturbed		Electrical: (MWh/yr)	300
New/Previous/Revegetated: (acres)	None/4.4/None	Fossil fuel: (L)	1,661,000

a. Sources: EDF-PDS-C-050; EDF-PDS-L-002. Construction and operational information is not applicable to this project.
b. CO, particulates, NO_x, SO_2, hydrocarbons

APPENDIX C.7

DESCRIPTION OF INPUT AND FINAL WASTE STREAMS

TABLE OF CONTENTS

List of Tables

C.7 Description of Input and Final Waste Streams

The alternatives analyzed in this EIS were designed to offer a full range of options for treating the high-level waste (HLW) and sodium-bearing waste (SBW) presently stored by DOE at the Idaho Nuclear Technology and Engineering Center (INTEC). Each option would begin with essentially the same input streams (i.e., the inventory of HLW and SBW). In addition, ongoing INTEC operations would generate new radioactive liquid wastes from decontamination activities. Ultimately, each option would result in a final waste stream suitable for disposal. For each option, the final waste stream would consist of one or more forms (i.e., borosilicate glass, Class A grout, etc.). Each of these forms would be designed to meet the waste acceptance criteria set by the intended disposal facility (i.e., the Waste Isolation Pilot Plant, geologic repository, etc.). Table C.7-1 lists existing and projected input waste streams and quantities. Table C.7-2 through C.7-5 list the concentrations of chemical and radioactive constituents in the calcine and SBW. The values provided in Tables C.7-2 through C.7-5 have been estimated by a variety of methods, and not all constituents have been verified by sampling and analysis. Table C.7-6 lists output waste streams for each option. The table includes the output compositions, quantities, numbers of containers, and final dispositions. Table C.7-6 only includes those wastes designated as “product waste” as defined in Section 5.2.13. Other waste generated indirectly as a result of the activities under the waste processing alternatives (“process wastes”) are described in Section 5.2.13. References are provided for the data in all tables.

Table C.7-1. Waste processing alternative inputs.

Waste (type)	Quantity	Source
Calcine – granular solid (mixed HLW)	4,155 $m^{3(a)}$	Staiger (1999)
	5,435 $m^{3(b)}$	Russell et al. (1998)
SBW – acid solution (mixed transuranic waste)	~800,000 gallons	Russell et al. (1998)
Concentrated NGLW (Type 1) – acid solution (mixed transuranic waste)	~300,000 gallons[c] (1998-2016)	Russell et al. (1998) Barnes (1999) McDonald (1998)
Other NGLW (Type 2) – acid solution (mixed low-level waste)	~230,000 gallons[c] (1998-2032)	Russell et al. (1998) Barnes (1999) McDonald (1998)

a. Without SBW/NGLW calcination.
b. With SBW/NGLW calcination.
c. The volume of these wastes may be reduced or eliminated by actions taken under the INEEL liquid waste management program.
NGLW = newly generated liquid waste; m^3 = cubic meters; ~ = approximately.

Table C.7-2. Bin set total chemical inventory (kilograms).[a]

Constituent	Bin set 1	Bin set 2	Bin set 3	Bin set 4	Bin set 5	Bin set 6	Total mass (kg)	Average concentration (kg/m^3)
Al	8.70×10^4	2.66×10^5	1.56×10^5	7.08×10^4	1.52×10^5	2.41×10^5	9.74×10^5	234
B	452	6.02×10^3	1.15×10^4	6.58×10^3	1.23×10^4	3.97×10^3	4.08×10^4	9.81
Ca	0	1.85×10^5	3.54×10^5	2.06×10^5	3.41×10^5	6.22×10^4	1.15×10^6	276
Cd	0	0	0	0	4.07×10^4	6.07×10^3	4.68×10^4	11.3
Cr	0	1.50×10^3	2.88×10^3	1.78×10^3	1.74×10^3	1.07×10^3	8.97×10^3	2.16
Fe	1.54×10^3	1.30×10^3	3.21×10^3	4.41×10^3	7.23×10^3	5.25×10^3	2.29×10^4	5.52
Cs	55.9	129	123	86	149	41	584	0.14
Hg	3.43×10^3	127	27	12	28	28	3.65×10^3	0.88
K	0	1.38×10^3	2.75×10^3	3.28×10^3	9.23×10^3	1.15×10^4	2.81×10^4	6.76
Mg	0	5.37×10^3	8.79×10^3	1.72×10^3	6.36×10^3	4.60×10^3	2.68×10^4	6.46
Mn	0	0	363	0	285	583	1.23×10^3	0.30
Na	2.41×10^3	6.48×10^3	1.36×10^4	1.34×10^4	4.59×10^4	4.55×10^4	1.27×10^5	30.6
Nb	0	0	0	0	2.77×10^3	0	2.77×10^3	0.67
Ni	0	422	831	602	381	424	2.66×10^3	0.64
Sr	37.3	1.99×10^3	3.66×10^3	2.17×10^3	3.60×10^3	215	1.17×10^4	2.81
Sn	0	1.75×10^3	3.27×10^3	1.61×10^3	2.20×10^3	246	9.08×10^3	2.18
U	12.8	40	18	41	209	214	535	0.13
Zr	0	1.08×10^5	2.05×10^5	1.01×10^5	1.42×10^5	1.55×10^4	5.71×10^5	138
Br	0	0	546	805	1.90×10^3	1.43×10^3	4.69×10^3	1.13
F	0	1.61×10^5	2.89×10^5	1.45×10^5	2.26×10^5	2.80×10^4	8.48×10^5	204
CO_3	0	2.65×10^4	4.29×10^4	8.48×10^3	3.07×10^4	2.27×10^4	1.31×10^5	31.6
NO_3	4.28×10^3	1.30×10^4	2.72×10^4	2.74×10^4	9.16×10^4	8.93×10^4	2.53×10^5	60.9
PO_4	1.96×10^3	3.28×10^3	1.35×10^4	532	2.51×10^3	2.35×10^3	2.42×10^4	5.82
SO_4	2.94×10^3	5.14×10^3	6.97×10^3	871	2.79×10^4	8.83×10^3	5.27×10^4	12.7

a. Source : Staiger (1999).

Table C.7-3. Bin set total inventory of radionuclides decayed to 2016 (curies).[a]

Constituent	Bin set 1	Bin set 2	Bin set 3	Bin set 4	Bin set 5	Bin set 6	Total activity (Ci)	Average concentration (Ci/m^3)
Ni-63	0	592	2.22×10^{3}	1.62×10^{5}	1.61×10^{3}	376	1.67×10^{5}	40.2
Sr-90	7.46×10^{5}	2.09×10^{6}	1.78×10^{6}	1.31×10^{6}	2.64×10^{6}	6.80×10^{5}	9.24×10^{6}	2.22×10^{3}
Y-90	7.46×10^{5}	2.09×10^{6}	1.78×10^{6}	1.31×10^{6}	2.64×10^{6}	6.80×10^{5}	9.24×10^{6}	2.22×10^{3}
Tc-99	419	881	736	479	861	216	3.59×10^{3}	0.86
Sb-126	1.54	2.68	2.75	1.81	3.17	0.97	12.9	3.11×10^{-3}
Sb-126m	11	23	20	13.1	23.1	7.46	97.6	0.02
Ba-137m	7.70×10^{5}	1.87×10^{6}	1.83×10^{6}	1.17×10^{6}	2.18×10^{6}	6.07×10^{5}	8.43×10^{6}	2.03×10^{3}
Cs-137	8.15×10^{5}	1.98×10^{6}	1.93×10^{6}	1.24×10^{6}	2.31×10^{6}	6.38×10^{5}	8.91×10^{6}	2.14×10^{3}
Th-231	0.02	0.09	0.25	0.10	0.61	3.36	4.43	1.07×10^{-3}
Pa-233	1.16	2.11	1.87	0.20	2.83	21.7	29.8	7.18×10^{-3}
Np-237	1.16	2.11	2.30	0.20	3.23	25.2	34.2	8.23×10^{-3}
Pu-238	443	1.12×10^{4}	2.47×10^{4}	1.67×10^{4}	2.81×10^{4}	5.36×10^{3}	8.65×10^{4}	20.8
Pu-239	55.9	256	473	303	534	512	2.13×10^{3}	0.51
Pu-240	22.4	189	401	274	445	129	1.46×10^{3}	0.35
Pu-241	196	5.19×10^{3}	8.10×10^{3}	4.76×10^{3}	1.08×10^{4}	2.32×10^{3}	3.13×10^{4}	7.54
Am-241	126	1.38×10^{3}	2.22×10^{3}	1.36×10^{3}	2.81×10^{3}	749	8.65×10^{3}	2.08

a. Source : Staiger (1999).

Table C.7-4. Calculated radionuclide activities for SBW (curies per liter) (decayed to 2016).[a]

Radionuclide		Radionuclide		Radionuclide	
Hydrogen 3	6.6×10^{-6}	Samarium 148	4.7×10^{-17}	Thorium 228	2.4×10^{-9}
Beryllium 10	3.7×10^{-12}	Samarium 149	4.2×10^{-18}	Thorium 229	4.8×10^{-13}
Carbon 14	1.5×10^{-10}	Europium 150	1.4×10^{-11}	Thorium 230	1.1×10^{-9}
Cobalt 60	8.1×10^{-6}	Samarium 151	3.8×10^{-4}	Thorium 231	2.6×10^{-8}
Nickel 63	3.5×10^{-5}	Europium 152	1.6×10^{-6}	Thorium 232	9.0×10^{-16}
Selenium 79	5.4×10^{-7}	Gadolinium 152	1.8×10^{-18}	Thorium 234	2.6×10^{-8}
Rubidium 87	3.6×10^{-11}	Europium 154	7.0×10^{-5}	Protactinium 231	1.2×10^{-10}
Strontium 90	0.047	Europium 155	3.3×10^{-5}	Protactinium 233	3.6×10^{-6}
Yttrium 90	0.047	Holmium 166m	5.7×10^{-11}	Protactinium 234m	2.6×10^{-8}
Zirconium 93	2.7×10^{-6}	Thulium 171	5.7×10^{-18}	Protactinium 234	3.3×10^{-11}
Niobium 93m	2.3×10^{-6}	Thallium 207	7.0×10^{-11}	Uranium 232	2.3×10^{-9}
Niobium 94	1.4×10^{-6}	Thallium 208	8.5×10^{-10}	Uranium 233	3.0×10^{-10}
Technetium 98	3.2×10^{-12}	Thallium 209	1.0×10^{-14}	Uranium 234	1.0×10^{-6}
Technetium 99	1.2×10^{-5}	Lead 209	4.8×10^{-13}	Uranium 235	2.6×10^{-8}
Rhodium 102	4.8×10^{-11}	Lead 210	6.7×10^{-12}	Uranium 236	4.1×10^{-8}
Ruthenium 106	1.5×10^{-10}	Lead 212	2.4×10^{-9}	Uranium 238	2.6×10^{-8}
Rhodium 106	1.5×10^{-10}	Lead 211	7.0×10^{-11}	Uranium 237	4.3×10^{-9}
Palladium 107	2.0×10^{-8}	Lead 214	1.6×10^{-11}	Uranium 240	8.4×10^{-16}
Silver 108m	4.9×10^{-13}	Bismuth 210m	2.7×10^{-25}	Neptunium 237	3.6×10^{-6}
Cadmium 113m	2.2×10^{-6}	Bismuth 210	6.7×10^{-12}	Neptunium 238	8.9×10^{-11}
Indium 115	1.2×10^{-16}	Bismuth 211	7.0×10^{-11}	Neptunium 239	2.6×10^{-8}
Tin 121m	6.9×10^{-8}	Bismuth 212	2.4×10^{-9}	Plutonium 236	1.4×10^{-10}
Tellurium 123	4.7×10^{-19}	Bismuth 213	4.8×10^{-13}	Plutonium 238	4.2×10^{-4}
Antimony 125	6.2×10^{-7}	Bismuth 214	1.6×10^{-11}	Plutonium 239	6.7×10^{-5}
Tellurium 125m	1.5×10^{-7}	Polonium 210	6.7×10^{-12}	Plutonium 240	1.3×10^{-5}
Tin 126	5.1×10^{-7}	Polonium 212	1.5×10^{-9}	Plutonium 241	1.7×10^{-4}
Antimony 126	7.1×10^{-8}	Polonium 216	2.4×10^{-9}	Plutonium 242	9.8×10^{-9}
Antimony 126m	5.1×10^{-7}	Polonium 218	1.6×10^{-11}	Plutonium 244	8.4×10^{-16}
Iodine 129	1.0×10^{-5}	Astatine 217	4.8×10^{-13}	Americium 241	6.6×10^{-5}
Cesium 134	3.3×10^{-7}	Radon 219	7.0×10^{-11}	Americium 242m	1.8×10^{-8}
Cesium 135	1.1×10^{-6}	Radon 220	2.4×10^{-9}	Americium 242	1.8×10^{-8}
Cesium 137	0.046	Radon 222	1.6×10^{-11}	Americium 243	2.6×10^{-8}
Barium 137m	0.044	Francium 221	4.8×10^{-13}	Curium 242	1.5×10^{-8}
Lanthanum 138	2.4×10^{-16}	Francium 223	9.7×10^{-13}	Curium 243	2.6×10^{-8}
Cerium 142	3.7×10^{-11}	Radium 223	7.0×10^{-11}	Curium 244	1.3×10^{-6}
Cerium 144	7.3×10^{-12}	Radium 224	2.4×10^{-9}	Curium 245	3.7×10^{-10}
Praseodymium 144	7.3×10^{-12}	Radium 225	4.8×10^{-13}	Curium 246	2.4×10^{-11}
Praseodymium 144m	8.7×10^{-14}	Radium 226	1.6×10^{-11}	Curium 247	2.7×10^{-17}
Neodymium 144	2.0×10^{-15}	Radium 228	8.3×10^{-16}	Curium 248	2.9×10^{-17}
Promethium 146	1.2×10^{-8}	Actinium 225	4.8×10^{-13}	Californium 249	2.1×10^{-17}
Samarium 146	3.4×10^{-13}	Actinium 227	7.0×10^{-11}	Californium 250	8.8×10^{-18}
Promethium 147	6.8×10^{-6}	Actinium 228	8.3×10^{-16}	Californium 251	3.3×10^{-19}
Samarium 147	9.1×10^{-12}	Thorium 227	6.9×10^{-11}		

a. Source: Wenzel (1997).

Table C.7-5. Concentration of fission product chemical elements in SBW (decayed to 2016) (g/L).[a]

Element		Element	
Lithium	3.5×10^{-10}	Praseodymium	1.5×10^{-3}
Beryllium	1.9×10^{-10}	Neodymium	5.5×10^{-3}
Gallium	1.7×10^{-12}	Promethium	7.3×10^{-9}
Germanium	8.2×10^{-7}	Samarium	1.1×10^{-3}
Arsenic	2.3×10^{-7}	Europium	9.9×10^{-5}
Selenium	8.1×10^{-5}	Gadolinium	5.2×10^{-5}
Bromine	3.1×10^{-5}	Terbium	4.3×10^{-7}
Rubidium	6.1×10^{-4}	Dysprosium	1.3×10^{-7}
Strontium	9.3×10^{-4}	Holmium	5.6×10^{-9}
Yttrium	7.8×10^{-4}	Erbium	2.2×10^{-9}
Zirconium	4.8×10^{-3}	Thulium	1.1×10^{-12}
Molybdenum	4.4×10^{-3}	Ytterbium	1.9×10^{-13}
Niobium	7.5×10^{-6}	Thallium	1.3×10^{-17}
Technetium	7.3×10^{-4}	Lead	1.9×10^{-10}
Ruthenium	2.2×10^{-3}	Bismuth	3.8×10^{-15}
Rhodium	4.8×10^{-4}	Polonium	1.5×10^{-15}
Palladium	4.8×10^{-4}	Astatine	1.5×10^{-25}
Silver	8.8×10^{-6}	Francium	2.4×10^{-20}
Cadmium	2.6×10^{-5}	Radium	1.6×10^{-11}
Indium	2.0×10^{-6}	Actinium	8.9×10^{-13}
Tin	5.0×10^{-5}	Thorium	6.4×10^{-8}
Antimony	1.0×10^{-5}	Protactinium	2.2×10^{-9}
Tellurium	4.7×10^{-4}	Uranium	0.089
Iodine	0.058	Neptunium	5.3×10^{-5}
Cesium	3.0×10^{-3}	Plutonium	1.2×10^{-3}
Barium	2.9×10^{-3}	Americium	1.9×10^{-5}
Lanthanum	1.6×10^{-3}	Curium	1.9×10^{-8}
Cerium	3.2×10^{-3}	Californium	5.4×10^{-18}

a. Source: Wenzel (1998).

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Table C.7-6. Waste processing alternative outputs.

Alternative/Waste Form	Composition	Quantity	No. of Containers	Disposition	Source
<u>Continued Current Operation Alternative</u>					
Transuranic Waste (remote-handled Waste Isolation Pilot Plant containers)	Dry solids	110 m^3	280	Waste Isolation Pilot Plant	Fewell (1999a,b)
<u>Separations Alternative</u>					
Full Separations Option					
Vitrified high-level waste (SRS canisters)	Glass	470 m^3	780	Onsite storage – NGR	Fluor Daniel (1997)
Class A low-activity waste (cylinders)	Grout	27,000 m^3	25,100	INEEL or offsite disposal	Fewell (1999b)
Planning Basis Option					
Vitrified high-level waste (SRS canisters)	Glass	470 m^3	780	Onsite storage – NGR	Fluor Daniel (1997)
Class A low-activity waste (cylinders)	Grout	30,000 m^3	27,900	Offsite disposal	Fewell (1999b)
Transuranic Waste (remote-handled Waste Isolation Pilot Plant containers)	Dry solids	110 m^3	280	Waste Isolation Pilot Plant	Fewell (1999a,b)
Transuranic Separations Option					
Transuranic solids (remote-handled Waste Isolation Pilot Plant containers)	Al_20_3, $Zr0_2$, phosphates, sulfates	220 m^3	560	Waste Isolation Pilot Plant	Kinnaman (1999)
Class C low-activity waste (cylinders)	cesium, strontium grout	22,700 m^3	21,100	INEEL or offsite disposal	Russell et al. (1998)
<u>Non-Separations Alternative</u>					
Hot Isostatic Pressed Waste Option					
Glass ceramic high-level waste (SRS canister)	$Si0_2$, $Ti0_2$, calcine (70 percent)	3,400 m^3	5,700	Onsite storage – NGR	Lee (1999a) Fewell (1999b)
Transuranic Waste (remote-handled Waste Isolation Pilot Plant containers)	Dry solids	110 m^3	280	Waste Isolation Pilot Plant	Fewell (1999a,b)

Table C.7-6. (continued).

Alternative/Waste Form	Composition	Quantity	No. of Containers	Disposition	Source
Direct Cement Waste Option					
Hydroceramic high-level waste (SRS canisters)	Clay, Slag, Caustic soda, Calcine	13,000 m^3	18,000	Onsite storage – NGR	Dafoe and Losinski (1998); Prendergast (1999); Lee (1999b)
Transuranic Waste (remote-handled Waste Isolation Pilot Plant containers)	Dry solids	110 m^3	280	Waste Isolation Pilot Plant	Fewell (1999a,b)
Early Vitrification Option					
Vitrified SBW transuranic (remote-handled Waste Isolation Pilot Plant containers)	Glass	360 m^3	900	Waste Isolation Pilot Plant	Kimmett (1999) Lopez (1998)
Vitrified calcine high-level waste (SRS canisters)	Glass	8,500 m^3	11,700	Onsite storage – NGR	Kimmett (1999)
<u>Minimum INEEL Processing Alternative</u>					
Transuranic Grout (contact-handled Waste Isolation Pilot Plant containers)	Grout	7,500 m^3	37,500	Waste Isolation Pilot Plant	Dafoe (1999) Fewell (1999b)
Vitrified high-level waste (Hanford canisters)	Glass	730 m^3	625	INEEL onsite storage – NGR	Jacobs (1998)
Vitrified low-activity waste (Hanford low-activity waste boxes)	Glass	14,400 m^3	5,550	INEEL or offsite disposal	Jacobs (1998)

m^3 = cubic meters SRS = Savannah River Site
NGR = National Geologic Repository

APPENDIX C.8

DESCRIPTION OF ACTIVITIES AND IMPACTS AT THE HANFORD SITE

TABLE OF CONTENTS

TABLE OF CONTENTS (Continued)

Section Page

List of Tables

Table Page

TABLE OF CONTENTS (Continued)

List of Tables

List of Figures

C.8 Description of Activities and Impacts at The Hanford Site

C.8.1 INTRODUCTION

The U.S. Department of Energy (DOE) is preparing this Idaho High-Level Waste and Facilities Disposition Environmental Impact Statement (HLW & FD EIS) to analyze the environmental impacts of alternative methods of managing the Idaho National Engineering and Environmental Laboratory (INEEL) HLW. One alternative, the Minimum INEEL Processing Alternative, includes shipping INEEL HLW to the Hanford Site for immobilization in the proposed Hanford HLW vitrification plant. The Minimum INEEL Processing Alternative includes two shipping scenarios—Just-in-Time and Interim Storage—which are described in Section C.8.2. Under the Minimum INEEL Processing Alternative, INEEL HLW would be transported to the Hanford Site where it could be stored prior to waste processing. It would be processed in Hanford Site facilities (waste separations and vitrification) and shipped back to INEEL for interim storage pending disposal at a geologic repository.

The environmental impacts to the Hanford Site from managing and immobilizing Hanford Site HLW are described in the *Tank Waste Remediation System, Hanford Site, Richland, Washington, Final Environmental Impact Statement* (DOE 1996a), known as the TWRS EIS, and Record of Decision (62 FR 8693; February 26, 1997). The TWRS EIS analysis was used to support the analysis of the Minimum INEEL Processing Alternative because it analyzed alternatives that are similar to the Idaho HLW & FD EIS Minimum INEEL Processing Alternative. Consequently some, if not most, of the impact analysis for the INEEL alternative may be bounded by the TWRS EIS impact analysis and thus, the analysis can be incorporated by reference into the Idaho HLW & FD EIS (DOE 1993). For impacts that may exceed those presented in the TWRS EIS, calculations of the magnitude of the impacts can be derived from the TWRS EIS using scaling factors to determine whether the exceedances in impacts are substantial and, therefore, require additional analysis. This approach was used in the TWRS EIS analysis and in two TWRS supplement analyses (DOE 1997; 1998) and conforms to DOE NEPA guidance (DOE 1993).

For purposes of analysis under the National Environmental Policy Act, DOE assumed that the Hanford Site facilities would begin processing the INEEL HLW in 2028. This corresponds to the completion date for processing the Hanford tank wastes as presented in the TWRS EIS. Processing schedules for the Hanford tank wastes continue to evolve as the design and implementation of the Tank Waste Remediation System progresses. As more definitive information becomes available over the next 10 years, DOE will supplement this analysis as necessary.

This appendix addresses the potential environmental and human health impacts associated with the storage and treatment of INEEL HLW at the Hanford Site in conformance with NEPA requirements. The appendix does not address issues or impacts associated with the management of waste at the INEEL site or the transportation of waste to, or from, the Hanford Site. Those impacts are being considered as part of the analysis of the INEEL-related impacts. Specifically, this appendix:

- Summarizes the two scenarios for processing the waste at the Hanford Site (1) Just-in-Time Shipping and (2) Interim Storage Shipping (see Section C.8.2)

- Assesses the potential environmental impacts of the Minimum INEEL Processing Alternative at the Hanford Site. Both the Just-in-Time and Interim Storage Shipping Scenarios are evaluated. If there are no notable differences between the two scenarios in terms of potential environmental impacts, they are discussed collectively as the Minimum INEEL Processing Alternative. In cases where there are differences between the two scenarios they are discussed separately.

- Unless otherwise noted, all information in this appendix is based on the *Minimum INEEL Processing Alternative Hanford Site Environmental Impact Assessment Report* (Jacobs 1998). A comprehensive summary of the potential environmental impacts associated with the Hanford Site waste management activities is also presented in Jacobs (1998).

C.8.2 DESCRIPTION OF ALTERNATIVE TREATMENT OF INEEL WASTE AT HANFORD

C.8.2.1 Introduction

This section describes alternatives for processing INEEL waste at the Hanford Site as a part of the Minimum INEEL Processing Alternative. This section also summarizes the waste to be processed. Additional information regarding the waste inventory and components of the alternatives are provided in Jacobs (1998). The description of alternatives in this section is limited to those activities associated with the potential treatment of INEEL waste that would take place on the Hanford Site. Activities associated with retrieving, handling, and packaging the waste at INEEL along with transporting the INEEL waste to and from the Hanford Site are not within the scope of this appendix. Appendix C.6 presents project descriptions for the activities at INEEL. All INEEL waste received at the Hanford Site for treatment would be returned to the INEEL for interim storage and/or disposal.

C.8.2.2 Minimum INEEL Processing Alternative

The Minimum INEEL Processing Alternative would involve processing approximately 4,000 cubic meters of calcine and approximately 160 cubic meters of cesium ion-exchange resin from the INEEL at the Hanford Site. Two transportation scenarios are evaluated from the standpoint of waste handling and interim storage requirements at the Hanford Site: (1) Just-in-Time Shipping, where the INEEL calcine would not be stored at the Hanford Site prior to processing and treatment, and (2) Interim Storage Shipping, where 308 cubic meters of calcine per year would be transported over a 14-year period and stored in new Canister Storage Buildings at the Hanford Site prior to processing and treatment. Calcine processing activities would include dissolution of the dry calcine powder, pH adjustment, lag storage in existing Hanford Site double-shell tanks, separation into HLW and low-activity waste fractions, vitrification, and packaging for shipment to INEEL. Calcine processing is summarized on Figure C.8-1. The cesium ion-exchange resin would be blended with the HLW feed, vitrified, and packaged for shipment to the INEEL.

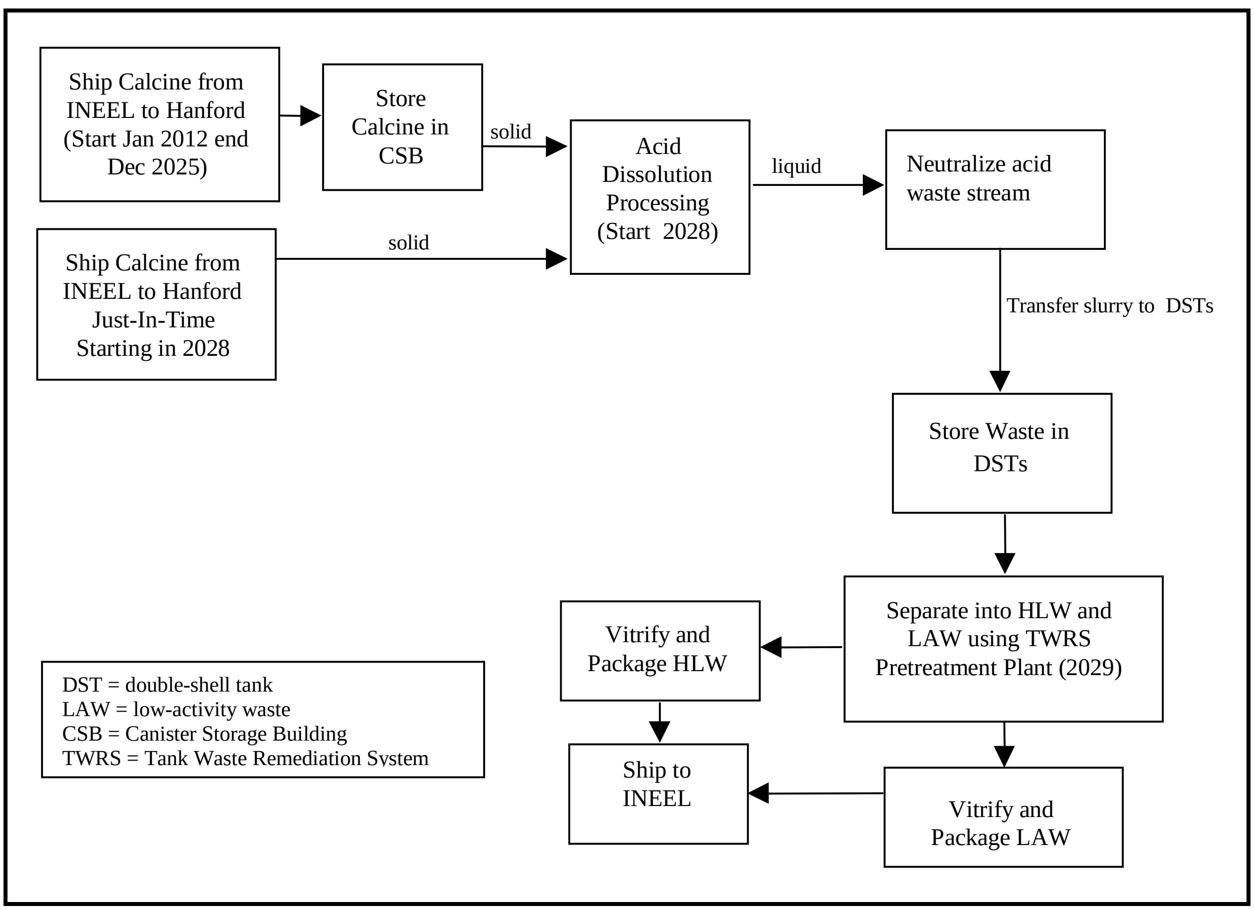

Figure C.8-1. Minimum INEEL Processing Alternative process flow diagram.

C.8.2.3 Construction

Construction activities for this alternative would consist of building three Canister Storage Buildings and a Calcine Dissolution Facility. The Canister Storage Buildings would not be constructed if Just-in-Time Shipping were used. Each Canister Storage Building would be approximately 3,700 square meters (m^2) in plan area (footprint) and would consist of a large subsurface vault consisting of three individual bays each with a capacity of 440 Hanford Site (1.17 cubic meters) HLW canisters per bay or 1,320 canisters per Canister Storage Building. The below-surface vaults would be covered by an aboveground operating deck, within a prefabricated metal enclosure. Approximately 3,690 canisters of calcine would require storage. Preconstruction activities would take 1 year, starting in January 2009, followed by two years of construction for the first Canister Storage Building. The two remaining Canister Storage Buildings would be constructed as needed. The first Canister Storage Building would be ready to receive INEEL calcine canisters in January 2012.

The Calcine Dissolution Facility would be approximately 3,800 m^2 in plan area and would be a hot-cell type facility. The Calcine Dissolution Facility would be constructed to provide systems to retrieve calcine from transport canisters, dissolve calcine, adjust pH, and transfer to the existing TWRS double-shell tank system. Preconstruction activities would start in 2021, while facility construction would start in 2024 with completion by December 2027.

C.8.2.4 Operations

Operations for the Canister Storage Building portion of this alternative would take place between January 2012 and April 2030. Shipment of calcine from the INEEL would begin in 2012 and vitrification operations at the Hanford Site would be complete in 2030. If Just-in-Time Shipping were used, no Canister Storage Building operations would be required. Operations of the Calcine Dissolution Facility would start in February 2028 and would end in April 2030. The existing waste separation facilities and the HLW and low-activity waste melters would operate from January 2029 through April 2030 (16 months).

Under the interim storage shipping scenario, INEEL would start shipping calcine canisters in January 2012. Each year approximately 260 canisters (308 cubic meters) of calcine would be shipped from INEEL to the Hanford Site. Calcine shipments would be completed in December 2025.

The calcine canisters would be transferred to the calcine dissolution hot cell facility for calcine removal and dissolution. The facility would be operated to accomplish the following:

- Receive and unpackage calcine canisters.
- Rinse/decontaminate transport canisters.
- Transfer powdered calcine into stainless-steel vessels.
- Dissolve calcine in boiling nitric acid.
- Adjust calcine solution to pH of 7 using sodium hydroxide.
- Transfer liquid waste into double-shell tanks or directly into pretreatment system.

Following transfer into the double-shell tank system, the INEEL waste would be separated to create HLW and low-activity waste streams. This would involve sludge washing and enhanced washing with sodium hydroxide, solid/liquid separations, evaporating the liquid stream to concentrate waste, and removing cesium from the low-activity waste feed using ion exchange. The separated cesium-containing liquid stream that would come out of the ion-exchange process would be further evaporated and fed into the HLW stream.

The low-activity waste vitrification facility would be operated to accomplish the following:

- Receive and sample waste.

- Evaporate water from the waste and collect evaporator condensate for treatment or reuse for waste retrieval.

- Operate vitrification melters. (The TWRS EIS processing alternatives were based on the use of fuel-fired melters, which have been included as a representative process detail for impact analysis. Future evaluation may result in the selection of another melter configuration.)

- Pour molten glass into 2.6 cubic meters disposal containers.

- Cool the containers.

- Weld lids on containers and decontaminate exterior surfaces.

- Transfer containers to lag storage pending shipment to the INEEL.

The HLW vitrification facility would be operated to accomplish the following:

- Receive and sample waste.
- Separate solids and liquid using a centrifuge.
- Evaporate excess water from liquid waste and collect condensate for treatment.
- Operate one joule-heated melter with a capacity of 5 metric tons per day.
- Form glass at approximately 20 weight percent waste oxides.
- Pour glass monoliths in 1.17 cubic meters canisters.
- Cool, seal, and decontaminate exterior canister surfaces.
- Package glass into transport casks for shipment to INEEL.

The off-gas treatment system at both HLW and low-activity waste vitrification facilities would be operated to quench and cool off-gas, remove radionuclides and recycle to the vitrification process, and destroy nitrogen oxides.

Liquid effluent from both HLW and low-activity waste vitrification facilities would be treated after transferring the effluent to the Effluent Treatment Facility. The liquid effluent would be similar to the 242-A Evaporator condensate liquid that meets current waste acceptance criteria for the Effluent Treatment Facility.

C.8.3 AFFECTED ENVIRONMENT

This section provides a summary description of the existing environment at the Hanford Site that could be impacted by TWRS activities under the Minimum INEEL Processing Alternative. More-detailed descriptions of environmental baseline conditions are provided in Volume Five, Appendix I of the TWRS EIS (DOE 1996a), in the *Hanford Site National Environmental Policy Act (NEPA) Characterization* (Cushing 1994 and 1995; Neitzel 1996 and 1997), in the *Hanford Site Environmental Report for Calendar Years 1994 and 1995*, (PNL 1995 and 1996), and in Jacobs (1998). All information contained in this section is from these sources unless otherwise noted.

The Hanford Site is in the semi-arid region of the Columbia Plateau in southeastern Washington State (Figure C.8-2). The Hanford Site occupies about 560 square miles of shrub-steppe and grasslands just north of Richland, Washington. The majority of this large restricted-access land area provides a buffer to the smaller areas within the Hanford Site historically used for nuclear materials production, waste storage, and waste disposal. About 6 percent of the land has been disturbed and is actively used. The Hanford Site extends approximately 48 miles north to south and 38 miles east to west.

The Columbia River flows through the northern part of the Hanford Site, turning south to form part of its eastern boundary. The Yakima River runs along part of the southern boundary and joins the Columbia River within the city of Richland. Adjoining lands to the west, north, and east are principally range and agricultural land. The cities of Richland, Kennewick, and Pasco (also known as the Tri-Cities) comprise the nearest population centers and are located southeast of the Site.

C.8.3.1 Geology and Soils

This geology section provides an overview of the Hanford Site's surface and subsurface environment and focuses primarily on the 200 Areas located in the center of the Site. With the exception of two potential borrow sites located approximately 4 miles to the north and west of the 200 Areas, and a third potential borrow site located between the 200-East and 200-West Areas, the 200 Areas would be the location of virtually all TWRS activities under the Minimum INEEL Processing Alternative.

Topography

The TWRS sites are located on and near a broad flat area of the Hanford Site commonly referred to as the Central Plateau. The Central Plateau is within the Pasco Basin, a topographic and structural depression in the southwest corner of the Columbia Basin. The basin is characterized by generally low-relief hills with deeply incised river drainage. The Central Plateau of the Hanford Site is an area of generally low relief, ranging from 390 feet above mean sea level at the Columbia River to 750 feet above mean sea level in the vicinity of the TWRS sites (see Figure C.8-3).

Geologic Structure and Soils

The Hanford Site is underlain by basalt flows. Sedimentary layers referred to as the suprabasalt sediments lie on top of the basalts. A thin layer of silt, sand, and gravel is found on the surface across much of the Site.

Soil in the 200 Areas consists of sand, loamy-sand, and sandy-loam soil types. Soil in the 200 Areas adjacent to facilities and other locations on the Hanford Site is slightly contaminated by various radionuclides.

Mineral Resources

The only mineral resources produced from the Pasco Basin are crushed rock, sand, and gravel. Deep natural gas production has been tested in the Pasco Basin without commercial success. Local borrow areas would supply rock, silt, sand, and gravel for processing alternatives requiring those materials.

Seismicity

Seismic activity in the Hanford Site area is low compared to other regions of the Pacific Northwest. In 1936, the largest known earthquake (a Richter magnitude of 5.75) in the Columbia Plateau occurred near Milton-Freewater, Oregon. Other earthquakes with a Richter magnitude of 5.0 or higher have occurred near Lake Chelan, Washington, to the northwest; along the boundary of the Columbia Plateau and the Cascade Mountain Range, west and north of the Hanford Site; and east of the Hanford Site in Washington State and northern Idaho. In addition, small-magnitude earthquake swarms that are not associated with mapped faults occur on and around the Hanford Site. An earthquake swarm is a series of earthquakes closely related in terms of time and location.

Four earthquake sources are considered relevant for the purpose of seismic design of TWRS sites: the Rattlesnake-Wallula alignment, Gable Mountain, an earthquake anywhere in the tectonic province, and the swarm area. For the Rattlesnake-Wallula alignment, which passes along the southwest boundary of the Hanford Site, a maximum Richter magnitude of 6.5 has been estimated. For Gable Mountain, an east-west structure that passes through the northern portion of the Hanford Site, a maximum Richter magnitude of 5.0 has been estimated. The estimate for the tectonic province was developed from the Milton-Freewater earthquake, with a Richter magnitude of 5.75. A Richter magnitude 4.0 event is considered the maximum swarm earthquake, based on the maximum swarm earthquake in 1973. The Hanford Site current design basis for new facilities is the ability to withstand a 0.2 gravity earthquake (Richter magnitude of approximately 6.4) with a recurrence frequency of 5.0×10^{-4}.

C.8.3.2 Water Resources

Water resources include surface water, the vadose zone (the area between the ground surface and underlying groundwater), and groundwater. The section also summarizes the existing quality of both surface and groundwater and withdrawal rates.

Surface Water

There are no naturally occurring water bodies or flood-prone areas near the TWRS sites. The Hanford Site and the surrounding communities draw all or most of their water from the Columbia River, which has radiological and nonradiological contamination levels below drinking water standards.

The onsite ponds (not used for human consumption) and springs that flow into the Columbia River all show radiological contamination from Hanford Site activities. Nonradiological contamination levels in the onsite ponds and springs are generally below limits set by drinking water standards.

Vadose Zone and Groundwater

A thick vadose 230 to over 300 feet, confined aquifer, and unconfined aquifers are present beneath the 200 Areas. The vadose zone is over 300 feet thick in the vicinity of the TWRS sites in the 200-East Areas. The confined aquifers are found primarily within the Columbia River Basalts. These aquifers are not a major focus of this appendix because they are separated from the TWRS sites by the vadose zone, an unnamed unconfined aquifer, and confining layers, and thus are not likely to be impacted.

Natural recharge to the unconfined aquifer of the Hanford Site is extremely low and occurs primarily in the upland areas west of the Hanford Site. Artificial recharge from retention ponds and trenches contribute approximately 10 times more recharge than natural recharge. Seasonal water table fluctuations are small because of the low natural recharge.

Water Quality and Supply

The following sections present water quality and supply for surface water and groundwater associated with the 200-East Area.

Surface Water

Water at the Hanford Site is supplied by the Columbia River, which is a source of raw water. River water is supplied to Hanford Site facilities through several distribution systems. In addition, wells supply water to the 400 Area and several remote facilities.

The Tri-Cities draw most (Richland and Kennewick) or all (Pasco) of their water supplies from the Columbia River. In 1994, water usage ranged from 2.4 billion gallons in Pasco to 7.4 billion gallons in Richland (Neitzel 1997). Each community operates its own water supply and treatment system.

The Columbia River provides water for both irrigation and municipal uses. Washington State has classified the water in the stretch of the Columbia River that includes the Hanford Reach as Class A, Excellent. Class A waters must be suitable for essentially all uses, including raw drinking water, recreation, and wildlife habitat. Both Federal and state drinking water quality standards apply to the Columbia River and are currently being met.

Groundwater

Groundwater is not used in the 200 Areas except for emergency cooling water, nor do any water supply wells exist downgradient of the 200 Areas. Three wells for emergency cooling water are located near B Plant in the 200-East Area. However, there are dry and groundwater monitoring wells in and around the 200 Areas. Hanford Site water supply wells are located at the Yakima Barricade, the Fast Flux Test Facility, and at the Hanford Safety Patrol Training Academy, all 8 miles or more from the TWRS sites in the 200-East Area.

Unconfined groundwater beneath the 200-East Area contains 14 different contaminants that have been mapped as plumes: arsenic, chromium, cyanide, nitrate, gross alpha, gross beta, tritium, cobalt-60, strontium-90, technetium-99, iodine-129, cesium-137, and plutonium-239 and -240.

In the 200-West Area, 13 overlapping contaminant plumes are located within the unconfined gravels of Ringold Unit E: technetium, uranium, nitrate, carbon tetrachloride, chloroform, trichloroethylene, iodine-129, gross alpha, gross beta, tritium, arsenic, chromium, and fluoride.

C.8.3.3 Meteorology and Air Quality

The following section describes meteorological and air quality conditions at the Hanford Site.

Meteorology

The Hanford Site is located in a semi-arid region. The Cascade Mountains to the west greatly influence the Hanford Site's climate by providing a rainshadow. This range also serves as a source of cold air drainage, which has a considerable effect on the Site's wind regime.

Good atmospheric dispersion conditions exist at the Hanford Site about 57 percent of the time during the summer. Less favorable dispersion conditions occur when the wind speed is light and the mixing layer is shallow. These conditions are most common during the winter, when moderately to extremely stable stratification exists about 66 percent of the time. The probability of an inversion period (e.g., poor dispersion conditions) extending more than 12 hours varies from a low of about 10 percent in May and June to a high of about 64 percent in September and October.

Air Quality

Air quality is good in the Hanford Site vicinity. The only air pollutant for which regulatory standards are exceeded is particulates. In 1994, concentrations of radionuclides and hazardous air pollutants were lower than regulatory standards both onsite and offsite.

C.8.3.4 Ecological Resources

Ecological resources on the Hanford Site are extensive, diverse, and important. Because the Hanford Site has not been farmed or grazed for over 50 years, it has become a refuge for a variety of plant and animal species.

The Hanford Site is one of the largest shrub-steppe vegetation areas remaining in Washington State, and nearly half of the Site's 560-square mile area is designated as ecological study areas or refuges. Shrub-steppe vegetation areas are considered priority habitat by Washington State because of their relative scarcity and their importance to wildlife species. The 200 Areas and the nearby potential borrow sites consist mostly of shrub-steppe habitat. The TWRS sites in the 200 Areas are currently heavily disturbed. However, the potential borrow sites are largely undisturbed.

Species of concern on the Hanford Site include Federal candidate species, Washington State threatened or endangered species, Washington State candidate species, and monitor species and sensitive plant species. No Federally-listed threatened or endangered plant or animal species occur on or around the Central Plateau (site of the TWRS facilities). Wildlife species of concern on the Central Plateau and vicinity include the loggerhead shrike, which is a Federal and Washington State candidate species, and the sage sparrow, which is a Washington State candidate species. Both species nest in undisturbed sagebrush habitat in the Central Plateau and nearby areas.

Other bird species of concern that may occur in shrub-steppe habitat of the Hanford Site are the burrowing owl, a Washington State candidate species; the ferruginous hawk, a Washington State threatened and Federal Category 2 candidate species; the golden eagle, a Washington State candidate species; the long-billed curlew, a Washington State monitor species; the sage thrasher, a Washington State candidate species; the prairie falcon, a Washington State monitor species; and Swainsons hawk, a Washington State candidate species. Nonavian wildlife species of concern include the striped whipsnake, a Washington State candidate species; the desert night snake, a Washington State monitor species; the pygmy rabbit, a Federal Category 2 candidate species; and the northern sagebrush lizard, also a Federal Category 2 candidate species (DOE 1996a).

Sensitive habitats on the Hanford Site include wetlands and riparian habitats. However, there are no sensitive habitats at or near any TWRS sites. The Hanford Site's primary wetlands occur along the Columbia River. Other Hanford Site wetland habitats are associated with human-made ponds and ditches (e.g., B Pond and its associated ditches located near the 200-East Area). Wetland plants occurring along the shoreline of B Pond include herbaceous and woody species such as showy milkweed, western goldenrod, three square bulrush, horsetail rush, common cattail, and mulberry, among others. Wildlife species observed at B Pond include a variety of mammals and waterfowl species. The fishery resource of the Columbia River is important to Native Americans.

C.8.3.5 Cultural Resources

Archaeological sites in the 200 Areas are scarce. Cultural resource surveys have been conducted within the 200-East Area covering all undeveloped areas. The number of prehistoric and historic archaeological sites recorded as the result of these surveys is very limited. Findings recorded in the areas around and including the TWRS sites consist of isolated artifacts and four archaeological sites. Cultural resources surveys of the TWRS sites and immediate vicinity in the 200-East Area, which were conducted in 1994, found no sites eligible for the National Register of Historic Places. Past surveys of the Phased Implementation Alternative site in the easternmost portion of the 200-East Area revealed no archaeological sites. However, both the 200-East and 200-West Areas contain potentially historic buildings and structures associated with the Hanford Site's defense mission.

Surveys of the 200-West Areas recorded a few historic sites, isolated archaeological artifacts, and a segment of the historic White Bluffs Road that runs across the Site between Rattlesnake Springs and the Columbia River. The White Bluffs Road, which has been nominated for the National Register of Historic Places, traverses the northwest corner of the 200-West Area. This road was used in prehistoric and historic times by Native Americans and was an important transportation route for Euro-Americans in the 19th and early 20th century for mining, agriculture, and other development uses. The segment in the 200-West Area is not considered an important element historically because it has been fragmented by past activities. However, the Confederated Tribes of the Umatilla Indian Reservation have indicated that the White Bluffs Road is important culturally to Native Americans even though it has been affected by past activities.

Native American Sites

The Hanford Site vicinity contains lands ceded to the United States both by the Confederated Tribes and Bands of the Yakama Indian Nation and the Confederated Tribes of the Umatilla Indian Reservation in the treaties of 1855. Until 1942, the Wanapum resided on land that is now part of the Hanford Site. In 1942, the Wanapum People moved to Priest Rapids when the Hanford Site was established. The Nez Perce Tribe also retained rights to the Columbia River under a separate treaty with the U.S. Government.

The area of the Hanford Site near the Columbia River has been occupied by humans for over 10,000 years, as reflected by the extensive archaeological deposits along the river shores. Inland areas with water resources also point to evidence of concentrated human activity. Recent surveys indicate extensive although dispersed use of semi-arid lowlands for hunting. However, surveys have recorded very few Native American sites or artifacts in and around the 200 Areas. Native American sites and artifacts have been identified at both McGee Ranch and the Vernita Quarry (potential borrow sites).

Native Americans have retained traditional secular and religious ties to the Hanford Site, although no specific sites of religious significance have been identified at the TWRS sites. However, affected Tribal Nations indicate that there are culturally important biota, sacred sites such as Gable Mountain, and other culturally important properties within areas that might be impacted by TWRS alternatives (e.g., groundwater downgradient from TWRS sites, the Columbia River, and locations downwind of possible TWRS air releases).

C.8.3.6 Socioeconomics

The socioeconomic analysis focuses on Benton and Franklin counties. These counties make up the Richland-Kennewick-Pasco Metropolitan Statistical Area, also known as the Tri-Cities. Other jurisdictions in Benton county include Benton City, Prosser, and West Richland. Connell is the largest city in Franklin county after Pasco. Neighboring counties (Yakima, Walla Walla, Adams, and Grant counties in Washington State, and Umatilla and Morrow counties in Oregon) are impacted by activities at the Hanford Site; however, in terms of socioeconomics, the Site's impacts on these counties are very small.

In 1995, the Hanford Site represented 22 percent of the area’s total non-farm employment. With the rapid economic growth from the late 1980’s, population rose as did the housing market. Housing prices declined in 1995 as the market softened when Hanford Site jobs were reduced.

As of 1990, the population within a 50-mile radius of the Hanford Site contained 19.3 percent minority and Native American residents and 17.3 percent low-income residents.

Most public service systems in the Tri-Cities operate well within their service capacity. Local school systems and some local public safety agencies are operating at or near their capacities.

Median household yearly income in Benton county was $43,684 in 1994, while per capita income was $22,053. Median household yearly income in Franklin county was $31,121 in 1994, while per capita income was $16,999. For Washington State, 1994 median household yearly income was $38,094 and per capita income was $22,526 (Neitzel 1997).

Benton county residents have approximately the same level of educational attainment as residents statewide, while Franklin county residents tend to have a lower level.

C.8.3.7 <u>Land Use</u>

Approximately 6 percent of the Hanford Site is actively used by Site operations, with the remainder left undeveloped. Nearly half the Site's area is designated for ecological or wildlife purposes.

The 200 Areas historically have been used for processing and waste management activities. Current plans envision the 200 Areas to be dedicated exclusively as a waste management and disposal area for the entire Hanford Site (see Figure C.8-4).

The Draft Comprehensive Land-Use Plan for the Hanford Site, prepared by DOE, was released in August 1996. Both Benton County and the City of Richland released their land-use plans for the Site in 1996.

In April 1999, DOE issued a Revised Draft Hanford Remedial Action Environmental Impact Statement and Comprehensive Land Use Plan (DOE/EIS-0222D). This Revised Draft EIS will be used by DOE and its nine cooperating and consulting agencies to develop a comprehensive land-use plan for the next 50 years for the Hanford Site. Under DOE's preferred alternative, the Central Plateau (200 Areas) geographic area would be designated for Industrial-Exclusive use. An Industrial-Exclusive land-use designation would allow for continued waste management operations within the Central Plateau geographic area. This designation would also allow expansion of existing facilities or development of new waste management facilities.

Prime and Unique Farmland

The Farmland Protection Policy Act requires Federal agencies to consider prime or unique farmlands when planning major projects and programs on Federal lands (7 CFR 657.4). Federal agencies are required to use prime and unique farmland criteria developed by the U.S. Department of Agriculture Natural Resources Conservation Service. The Natural Resources Conservation Service has determined that due to low annual precipitation in southeast Washington State, none of the soil occurring on the Hanford Site would meet prime and unique farmland criteria without irrigation.

C.8.3.8 Aesthetic and Scenic Resources

Visually, the Hanford Site is characterized by wide-open vistas interspersed with over a dozen large industrial facilities (e.g., reactors and processing facilities). The 200 Areas contain several large processing facilities.

Site facilities can be seen from elevated locations (e.g., Gable Mountain), a few public roadways (State Routes 24 and 240), and the Columbia River. Facilities in the 200-East Area can be seen only in the visual background from offsite locations. For purposes of study, viewing areas are generally divided into four distance zones: the foreground, within 0.5 mile; the middleground, from 0.5 to 5 miles; the background, from 5 to 15 miles; and seldom-seen areas that are either beyond 15 miles or are unseen because of topography (Figure C.8-5).

C.8.3.9 Noise

Noise produced by current, routine operations at the Hanford Site does not violate any Federal or Washington State standards (Washington Administrative Code 173-60). Even near the operating facilities along the Columbia River, measured noise levels are lower than noise experienced in parts of the city of Richland (less than 52 decibels on the A scale [dBA] versus 61 dBA) (dBA is a noise scale used to describe sounds in the frequencies most readily detected by human hearing). Noise levels measured near intake structures at the Columbia River are well within the 60 dBA tolerance levels for daytime residential use. Three miles upstream of the intake structures, measured noise levels fall well within levels suited for daytime and nighttime residential use. Moreover, the relative remoteness of population centers from the Hanford Site as a whole (and the TWRS sites in particular) gives the Site a Class C

(industrial) classification with a maximum allowable equivalent sound level of 70 dBA in compliance with Washington State and Federal standards. The equivalent sound level integrates noise levels over time and expresses them as continuous sound levels. Native Americans have expressed the concern that Hanford Site religious locations such as Gable Mountain are near enough to TWRS areas to potentially be impacted by TWRS activities.

C.8.3.10 Traffic and Transportation

Direct rail service is provided to the Tri-Cities area by the Burlington Northern Santa Fe and Union Pacific Railroads. The rail system on the Hanford Site itself consists of approximately 130 miles of tracks. It extends from the Richland Junction (at Columbia Center in Kennewick) where it joins the Union Pacific commercial railroad track, to an abandoned commercial right-of-way near the Vernita Bridge in the northwest portion of the Site. There are currently about 1,400 railcar movements annually at the Site, transporting a wide variety of materials including coal, fuels, hazardous process chemicals, and radioactive materials and equipment. Radioactive waste has been transported on the Site without incident for many years.

Regional road transportation is provided by a number of major highways including State Routes 24 and 240 and U.S. Interstate Highways 82 and 182. State Routes 24 and 240 are both two-lane roads that traverse the Hanford Site. State Route 24 is an east-west highway that turns north at the Yakima Barricade in the northern portion of the Site. State Route 240 is a north-south highway that skirts the eastern edge of the Fitzner-Eberhardt Arid Lands Ecology Reserve (Figure C.8-6).

A DOE-maintained road network within the Hanford Site, mostly paved and two lanes wide, provides access to the various work centers. The primary access roads on the Site are Routes 2, 4, 10, and 11A. Primary access to the 200 Areas is by Route 4 South from Richland. The 200-East Area is also accessed from Route 4 North off Route 11A from the north. July 1994 traffic counts on Route 4 indicated severe congestion west of the Wye Barrier (at the intersection of Routes 10 and 4 South) during Hanford Site shift changes. However, completion of the State Route 240 Access Highway (Beloit Avenue) linking the 200 Areas with State Route 240 in late 1994, and declining Hanford Site employment, have reduced the congestion on Route 4.

Stevens Road at the 1100 Area leading into the Site from Richland (Stevens Road becomes Route 4 South further north onsite) also has experienced severe congestion. The 240 Access Highway completion and reduction of Hanford Site employment appear to have reduced this congestion somewhat, although no specific traffic count data are available to quantify this assessment.

Access to the 200-West Area is also provided from Route 11A for vehicles entering the Site through the Yakima Barricade and from Route 6 off Route 11A from the north. No congestion problems are reported on these roadways.

Public access to the 200 Areas and interior locations of the Hanford Site are restricted by manned gates at the Wye Barricade and the Yakima Barricade (at the intersection of State Route 240 and Route 11A).

C.8.3.11 Radiological Environment

This section summarizes 1995 data on radiation doses from operations at the Hanford Site and the potential future fatal cancers attributable to exposures. More recent data indicate that the radiological conditions at the Hanford Site are not appreciably different from those described in this section.

Each year the potential radiation doses to the public from Hanford Site radiation sources are calculated as part of the Hanford Site Environmental Monitoring Program. In particular, the dose to the hypothetical maximally-exposed individual is calculated as described in the *Hanford Site Environmental Report* published each calendar year. This hypothetical maximally-exposed individual is assumed to live where the radiation dose from airborne releases would be larger than for a resident of any other offsite location. The maximally-exposed individual also is assumed to drink water from the Columbia River; eat food grown with Columbia River irrigation water; and use the river extensively for boating, swimming, and fishing (including eating fish from the river). The exposure calculation for this hypothetical individual is based on Hanford Site data from actual reported releases, environmental measurements, and information about operations at Hanford Site facilities.

The calculated dose in 1995 to the maximally-exposed individual near the Hanford Site was a total of 0.02 millirem compared to 0.05 millirem reported for 1994. The DOE radiation dose limit for a member of the public is 100 millirem. Thus, the 1995 total dose to the maximally-exposed individual was far below the limit.

U.S. Environmental Protection Agency regulations impose a dose limit of 10 millirem to a member of the public from radioactivity released in airborne effluents. The 1995 Hanford Site airborne dose to the maximally-exposed individual of 0.006 millirem was far below this limit.

To estimate health effects for radiation protection purposes, it usually is assumed that a collective dose of 2,000 person-rem in the general population will cause one extra latent cancer fatality. In these calculations it does not matter whether 20,000 people each receive an average of 0.1 rem or 2 million people each receive an average of 0.001 rem. In either case, the collective dose would equal 2,000 person-rem and thus, one additional latent cancer facility would be expected. The 1995 collective dose to people surrounding the Hanford Site from Site releases was calculated to be 0.3 person-rem, which is lower than the 0.6 person-rem calculated for 1994. Compared to 2,000 person-rem causing one extra latent cancer fatality, the 0.3 person-rem from the Hanford Site in 1995 is not likely to cause any latent cancer fatalities.

C.8.4 ENVIRONMENTAL IMPACTS

This section describes the potential impacts to the existing environment (described in Section C.8.3) of implementing the Minimum INEEL Processing Alternative (described in Section C.8.2) at the Hanford Site. This section also discusses potential cumulative impacts of the Minimum INEEL Processing Alternative when added to impacts from past, present, and reasonably foreseeable actions; unavoidable adverse impacts; the relationship between short-term uses of the environment and the maintenance and enhancement of long-term productivity; and irreversible and irretrievable commitment of resources.

C.8.4.1 Geology and Soils

Geology and soil impacts would include potential impacts to mineral resources, topography, and soils. In general, the more land disturbed, the higher the level of potential impacts to geologic resources. Mineral resources (i.e., silt, sand, gravel, and riprap) are presented in Table C.8-1. The earthen materials would be used primarily to make concrete for constructing treatment facilities and vaults. Some soil disturbance would be temporary; some would be permanent. Temporary disturbances include areas such as the trample zones around construction sites and work areas. Permanent disturbances include areas where facilities are located.

Just-in-Time Shipping Scenario

Under this scenario, additional Hanford Site sand and gravel resources would be required to make concrete for the construction of the Calcine Dissolution Facility and for the disposition of this facility after its mission is completed (Table C.8-1). No additional silt and riprap resources would be required. Incremental impacts to the potential Pit 30 borrow site, where the additional borrow material would be

Table C.8-1. Mineral resources and soil impacts – Minimum INEEL Processing Alternative.

Tank Waste Alternative		Mineral resource in cubic meters: Sand and gravel	Silt	Riprap	Soil disturbance[a] in acres: Temporary	Permanent
Phased Implementation Alternative[b]		2.6×10^6	5.7×10^5	9.6×10^5	790	120
Minimum INEEL Processing Alternative	Just-in-Time Shipping Scenario	3.4×10^4	NR[d]	NR	2.9	3.9
	Interim Storage Shipping Scenario	2.9×10^5	NR	NR	48	3.9
Total impacts[c]	Just-in-Time Shipping Scenario	2.6×10^6	5.7×10^5	9.6×10^5	790	120
	Interim Storage Shipping Scenario	2.9×10^6	5.7×10^5	9.6×10^5	840	120

a. These estimates are based on closure of the Hanford Site Tank Farms by filling tanks and covering them with a Hanford Barrier.
b. Estimates include remediation and closure as landfill (Phase 1 and 2).
c. Impact estimates include the Phased Implementation Alternative (Phase 1 and 2) plus the Minimum INEEL Processing Alternative.
d. NR = None required.

secured, would increase by approximately 1.3 percent, or 3.4×10^4 cubic meters (see Section C.8.5.2) over the 2.6×10^6 cubic meters calculated in the TWRS EIS for the Phased Implementation Alternative. The Pit 30 borrow site is located on the Hanford Site's Central Plateau between the 200-East Area and 200-West Area.

Under this scenario, small additional changes in topography would result from constructing the Calcine Dissolution Facility and securing borrow materials. The Calcine Dissolution Facility is assumed to be located on the representative site in the 200-East Area analyzed in the TWRS EIS for Phase 2 of the Phased Implementation Alternative.

Implementing this scenario would result in additional soil disturbances associated with the construction of the Calcine Dissolution Facility and the removal of earthen materials from the potential Pit 30 borrow site (Table C.8-1). Assuming that an area equal to the footprint of the Calcine Dissolution Facility plus a small buffer zone would be permanently disturbed, the permanent soil disturbances would increase by approximately 3.3 percent, or 3.9 acres over the 120 acres calculated for the Phased Implementation Alternative. Assuming that soil disturbances associated with the potential Pit 30 borrow site would be temporary, the temporary soil disturbances would be approximately 0.4 percent or 2.9 acres greater than the 790 acres calculated for the Phased Implementation Alternative.

None of the increased impacts associated with this scenario would affect the local cost or availability of mineral resources or substantively change the understanding of the geology and soils impacts presented in the TWRS EIS for the Phased Implementation Alternative.

Interim Storage Shipping Scenario

This scenario would result in greater additional impacts than the Just-in-Time Shipping Scenario, in that it would include all of the impacts of the Just-in-Time Shipping Scenario plus the impacts associated with the construction and subsequent disposition of three new Canister Storage Buildings.

Additional sand and gravel for facility construction and subsequent disposition would be secured from the potential Pit 30 borrow site. Incremental impacts to this borrow site would increase by approximately 11 percent, or 2.9×10^5 cubic meters (see Sections C.8.5.1 and C.8.5.2) over the 2.6×10^6 cubic meters calculated in the TWRS EIS for the Phased Implementation Alternative (Table C.8-1). No additional silt or riprap resources would be required.

Under the Interim Storage Shipping Scenario, small additional changes in topography would result from constructing new facilities (Calcine Dissolution Facility and Canister Storage Buildings) and securing borrow materials. The Calcine Dissolution Facility is assumed to be located on the representative site in the 200-East Area analyzed in the TWRS EIS for Phase 2 of the Phased Implementation Alternative. The Canister Storage Buildings are assumed to be located in the 200 Areas adjacent to the site of the existing Hanford Site Canister Storage Building.

Soil disturbances associated with the Calcine Dissolution Facility are assumed to be permanent and would be the same as for the Just-in-Time Shipping Scenario (Table C.8-1). Soil disturbances associated with the potential Pit 30 borrow site (24 acres) and the Canister Storage Buildings (24 acres) are assumed to be temporary and would increase the temporary soil disturbances by approximately 6 percent, or 48 acres over the 790 acres calculated for the Phased Implementation Alternative (see Sections C.8.5.1 and C.8.5.2).

Although this scenario would result in greater additional impacts than the Just-in-Time Shipping Scenario, it would not affect the local price or availability of mineral resources or substantively change the understanding of the geology and soils impacts presented in the TWRS EIS for the Phased Implementation Alternative.

C.8.4.2 Water Resources

The following section addresses water resources impacts related to the Minimum INEEL Processing Alternative. Surface water and groundwater are pathways for potential releases to the environment. Releases would travel by advection downward through the vadose zone, intercept the unconfined aquifer (saturated zone), and move laterally to points of discharge along the Columbia River. There would be no direct discharge to surface water.

Surface Water Releases

The Minimum INEEL Processing Alternative would generate liquid effluent; however, the effluent would not be discharged to surface waters and there would be no direct impacts to surface waters from the implementation of the alternative. Liquid stored in the double-shell tanks and liquid added to the tanks during waste retrieval activities ultimately would be removed and sent to an evaporator. Condensed water from the evaporator would be sent to the Effluent Treatment Facility in the 200-East Area. The water would be treated in the Effluent Treatment Facility using a variety of systems, including evaporation, to meet applicable regulatory standards. Ultimately the treated wastewater from vitrification processing would be discharged, with most contaminants removed, from the Effluent Treatment Facility to the State-approved land disposal facility site, a subsurface drain field near the north-central part of the 200-West Area. The discharged water would move through the vadose zone into the groundwater where it would slowly flow towards and discharge to seeps along the Columbia River and directly into the Columbia River. An estimated 100 years would be required for contaminants in groundwater to reach the Columbia River where they would rapidly mix with the large volumes of river water.

Concern has been raised in the past about the amount of tritium that would be released from the land disposal facility. The calcine would be in a solid state when shipped from INEEL to the Hanford Site, and the tritium would have been removed at INEEL. There would be no increase in tritium releases from the land disposal facility as a result of INEEL waste processing.

Surface Water Drainage Systems

The facilities for the Minimum INEEL Processing Alternative (Canister Storage Buildings for Interim Storage Shipping Scenario and Calcine Dissolution Facility) would be constructed on relatively level and flat terrain. No major drainage features are present. Construction activities would result in slightly altered localized drainage patterns for the temporary construction areas and for the permanent facilities. Excess water used for dust control purposes during construction and disposition activities would be collected and routed through erosion and sedimentation control measures prior to discharging to the existing approved National Pollutant Discharge Elimination System outfall and would be monitored following the current Storm Water Pollution Prevention Plan. The area around the Canister Storage Buildings, the Calcine Dissolution Facility, and the existing vitrification facilities would be recontoured to conform with the surrounding drainage patterns. Small increases in surface water runoff during the infrequent heavy precipitation events or rapid snowmelt would occur, but no flooding of drainage systems would occur.

Groundwater Releases

Potential impacts to groundwater would result from potential liquid losses during retrieval of tank waste and the leaching of residual waste that may be left in the double-shell tanks following retrieval. Waste transfer pipelines from the Calcine Dissolution Facility to the AP Tank Farm and from the AP Tank Farm to the vitrification facilities would be of double-wall construction in order to minimize the possibility of a leak to the environment. However, retrieval losses are not anticipated from these double-shell tanks or waste transfer systems. Therefore, no potential impact to the groundwater is anticipated for the Minimum INEEL Processing Alternative. In addition, all of the waste processing and treatment would be conducted in areas of the facility covered with a base that consists of a secondary spill containment system (e.g., engineered system constructed for detection and collection of spills) to prevent leaks and spills of waste until the accumulated materials are detected and removed. Such a base would prevent releases to the environment that could potentially impact groundwater.

For the Interim Storage Shipping Scenario, the Canister Storage Buildings are designed to include storage provisions to isolate containerized waste from the environment and prevent deterioration of container integrity. Additionally, secondary containment would be provided to prevent any inadvertent releases from entering the environment. Waste packages having a potential for residual liquid would have an absorbent agent added to ensure immobilization of potential liquid. In order to prevent contamination of the water supply, no restrooms or drinking water fountains would be located within the operational areas of the various facilities.

Implementing this alternative would result in minimal increases in impacts and would not change the understanding of the water resources impacts for surface water or groundwater presented in the TWRS EIS for the Phased Implementation Alternative.

C.8.4.3 Air Quality

Air pollutant emission estimates were developed and air dispersion modeling performed to analyze air quality impacts for the Phased Implementation Alternative of the TWRS EIS. The emission rates for criteria pollutants and radionuclides for the Minimum INEEL Processing Alternative were scaled from the TWRS EIS. Supporting calculations can be found in Appendix E of Jacobs (1998). Compliance with Washington State and Federal ambient air quality standards for radionuclides were measured at the maximum receptor location at the Hanford Site boundary along the Columbia River and on State Route 240. Compliance with the Federal standard for radionuclide releases was measured at the nearest residence.

Just-in-Time Shipping Scenario

Under this scenario, INEEL waste would be transported to the Hanford Site just in time for vitrification, and there would be no need to construct additional Canister Storage Buildings for interim storage. Therefore, only the Calcine Dissolution Facility and the vitrification facility are evaluated in this scenario as potential sources of air emissions.

Air Emission Sources. Air emission sources for the Just-in-Time Shipping Scenario would include construction of the Calcine Dissolution Facility, unloading and dissolving the INEEL calcined waste at the Calcine Dissolution Facility, separating and vitrifying the waste at the vitrification facility, and decommissioning the Calcine Dissolution Facility. The criteria pollutant emission rates from construction, operations, and decommissioning are presented in Table C.8-2. The radionuclide emission rates from operations are presented in Table C.8-3. The criteria pollutant and radionuclide emission rates for constructing, operating, and decommissioning the Calcine Dissolution Facility are based on annual emissions calculated in the project data presented in Section C.8.5.2. The emission rates for criteria pollutants were then scaled from the emission rates calculated in the TWRS EIS for the Phased Implementation Alternative. The criteria pollutant and radionuclide emission rates from operation of the vitrification facility are based on emission rates calculated in the project data presented in Section C.8.5.3. Supporting calculations are provided in Appendix E of Jacobs (1998).

Air Emission Concentrations. The criteria pollutant emission concentrations were calculated using the ISC2 spreadsheets developed to calculate the air emission concentrations for the TWRS EIS. The criteria pollutant emission concentrations resulting from construction, operations, and decommissioning are compared with state and Federal standards presented in Table C.8-4. The radiological doses to the

Table C.8-2. Criteria pollutant emission rates for Minimum INEEL Processing Alternative – Just-in-Time Shipping Scenario.

			Operations (grams/sec)		
				Vitrification	
Pollutant	Construction (grams/sec)	D&D (grams/sec)	Unloading/ dissolution	HAW	LAW
Sulfur oxides	1.1×10^{-4}	7.5×10^{-5}	0.42	NA[a]	0.35
Carbon monoxide	0.084	0.056	4.7	NA	3.9
Nitrogen dioxide	0.084	0.056	0.28	NA	0.24
PM-10	2.4	2.4	NA	NA	NA

a. NA = Not applicable.
D&D = decontamination and decommissioning; HAW = high-activity waste; LAW = low-activity waste.
PM-10 = particulate matter with a diameter of 10 micrometers or less.

Table C.8-3. Radiological emission rates for Minimum INEEL Processing Alternative – Just-in-Time Shipping Scenario – operations phase.

		Vitrification (curies per year)	
Radionuclide	Unloading/ dissolution (curies per year)	HAW	LAW
Strontium-90	5.1×10^{-5}	5.2×10^{-5}	9.2×10^{-7}
Technetium-99	2.6×10^{-8}	9.0×10^{-10}	4.0×10^{-9}
Cesium-137	4.7×10^{-5}	2.4×10^{-5}	1.8×10^{-7}
Plutonium-238	7.0×10^{-8}	1.7×10^{-7}	1.1×10^{-8}
Plutonium-239/240	9.3×10^{-9}	6.2×10^{-9}	4.2×10^{-10}
Plutonium-241	3.2×10^{-8}	8.4×10^{-8}	1.7×10^{-9}
Americium-241	5.3×10^{-8}	2.0×10^{-8}	1.8×10^{-8}

HAW = high-activity waste; LAW = low-activity waste.

Table C.8-4. Criteria pollutant modeling results for Minimum INEEL Processing Alternative – Just-in-Time Shipping Scenario.

					Standard ($\mu g/m^3$)	
Pollutant	Averaging period	Construction ($\mu g/m^3$)	Operations ($\mu g/m^3$)	D&D ($\mu g/m^3$)	Federal	State
Carbon monoxide	1 hour	1.5	54	1.0	40,000	40,000
	8 hour	1.1	38	0.72	10,000	10,000
Nitrogen oxide	Annual	0.27	0.58	0.18	100	100
Sulfur oxides	1 hour	2.0×10^{-3}	4.8	1.4×10^{-3}	NA[a]	655
	3 hour	1.8×10^{-3}	4.3	1.2×10^{-3}	1300	NA
	24 hour	8.2×10^{-4}	1.9	5.4×10^{-4}	365	260
PM-10	Annual	3.6×10^{-4}	0.86	2.4×10^{-4}	80	60
	24 hour	18	NA	18	150	150
	Annual	7.8	NA	7.8	50	50

a. NA = Not applicable.
$\mu g/m^3$ = micrograms per cubic meter; D&D = decontamination and decommissioning; PM-10 = particulate matter with a diameter of 10 micrometers or less.

nearest resident and the nearest offsite receptor were scaled from the receptor doses calculated in the TWRS EIS for the Phased Implementation Alternative. The radiological modeling results are compared with state and Federal standards in Table C.8-5. Supporting calculations are provided in Appendix E of Jacobs (1998).

Table C.8-5. Radionuclide modeling results for Minimum INEEL Processing Alternative – Just-in-Time Shipping Scenario.

Receptor	Maximum dose (millirem/year)	Standard	
		State	Federal
Nearest resident[a]	2.3×10^{-5}	NA[c]	10
Offsite receptor[b]	2.8×10^{-5}	25	NA

a. Maximum predicted dose at the nearest residence to the 10 mrem/yr effective dose equivalent standard of 40 CFR Part 61.
b. Maximum accumulated dose equivalent at any offsite receptor to the 25 millirem per year standard contained in Washington Administrative Code 173-480.
c. NA = Not applicable.

Emission concentrations of carbon monoxide would be less than 1 percent of the Federal and state standards for construction, operations, or decontamination and decommissioning. Nitrogen oxide would be less than 1 percent, sulfur oxides would be less than 2 percent, and particulate matter with a diameter of 10 micrometers or less would be less than 16 percent.

The radiological dose to the nearest residents from radiological emissions would be less than 1 percent of the Federal standard, and the nearest offsite receptor dose would be less than 1 percent of the state standard.

Hazardous and toxic air pollutant emissions evaluated in the TWRS EIS for the Phased Implementation Alternative were less than 1 percent of the state and Federal standards. Hazardous and toxic air pollutants emissions from Minimum INEEL Processing Alternative would not exceed the emissions evaluated in the TWRS EIS for the Phased Implementation Alternative and would, therefore, be less than 1 percent of the state or Federal standards, with the exception of mercury oxide. Mercury oxide would reach concentration levels of 0.019 microgram per cubic meter compared to the state standard of 0.17 microgram per cubic meter. Mercury oxide would be less than 12 percent of the state or Federal standard. Supporting calculations are provided in Appendix E of Jacobs (1998).

The air emissions for the Just-in-Time Shipping Scenario are below the state and Federal standards and would not substantively change the understanding of the air impacts presented in the TWRS EIS for the Phased Implementation Alternative.

Interim Storage Shipping Scenario

Under this scenario, INEEL waste would be transported to Hanford approximately 20 years prior to being vitrified, which would require additional Canister Storage Buildings to be built for interim storage. The Canister Storage Buildings, Calcine Dissolution Facility, and vitrification facility are evaluated in this scenario as potential air emission sources.

Air Emission Sources. Emission sources for the Interim Storage Shipping Scenario would include air emissions from construction of the Canister Storage Buildings, construction of the Calcine Dissolution Facility, unloading and dissolving INEEL calcine waste at the Calcine Dissolution Facility, separating and vitrifying waste at the vitrification facility, and decommissioning the Canister Storage Buildings and the Calcine Dissolution Facility. The criteria pollutant emission rates from construction and decommissioning are presented in Table C.8-6. Since criteria pollutant emission rates from construction of the Canister Storage Buildings would exceed those from construction of the Calcine Dissolution Facility, and since construction activities for either facility would not take place during the same year, only construction emissions associated with constructing the Canister Storage Buildings are evaluated in this scenario. The criteria pollutant and radionuclide emission rates during operations would be the same as the emission rates for operations presented in Tables C.8-2 and C.8-3, respectively. The criteria pollutant emission rates for constructing and decommissioning the Canister Storage Buildings are based on annual emissions calculated in the project data presented in Section C.8.5.1. The emission rates for decommissioning the Calcine Dissolution Facility are based on annual emissions calculated in the project data presented in Section C.8.5.2. The emission rates for criteria pollutants were then scaled from the emission rates calculated in the TWRS EIS for the Phased Implementation Alternative. Since the Canister Storage Buildings and the Calcine Dissolution Facility would be decommissioned during the same year, the air emissions were combined in Table C.8-6.

Table C.8-6. Criteria pollutant emission rates for Minimum INEEL Processing Alternative – Interim Storage Shipping Scenario.

Pollutant	Construction (g/sec)	D&D (g/sec)
Sulfur oxides	3.4×10^{-3}	3.7×10^{-3}
Carbon monoxide	2.5	2.8
Nitrogen dioxide	2.5	2.8
PM-10	2.4	4.8

D&D = decontamination and decommissioning; g/sec = grams per second.
PM-10 = particulate matter with a diameter of 10 micrometers or less.

Air Emission Concentrations. The criteria pollutant emission concentrations resulting from construction and decommissioning are compared with state and Federal standards in Table C.8-7. The criteria pollutant emission concentrations and radiological modeling results from operations would be the same as those previously shown in Tables C.8-4 and C.8-5, respectively.

Table C.8-7. Criteria pollutant modeling results for Minimum INEEL Processing Alternative – Interim Storage Shipping Scenario.

Pollutant	Averaging period	Construction (μg/m^3)	D&D (μg/m^3)	Standard (μg/m^3)	
				Federal	State
Carbon monoxide	1 hour	46	50	40,000	40,000
	8 hour	32	35	10,000	10,000
Nitrogen oxide	Annual	8.2	8.9	100	100
Sulfur oxides	1 hour	0.061	0.067	NA[a]	655
	3 hour	0.055	0.060	1,300	NA
	24 hour	0.025	0.027	365	260
PM-10	Annual	0.011	0.012	80	60
	24 hour	18	35	150	150
	Annual	7.8	16	50	50

a. NA = Not applicable.
μg/m^3 = micrograms per cubic meter; D&D = decontamination and decommissioning; PM-10 = particulate matter with a diameter of 10 micrometers or less.

Emission concentrations of carbon monoxide would less than 1 percent of the Federal and state standards for construction, operations, or decommissioning. Nitrogen oxide would be less than 9 percent, sulfur oxides would be less than 1 percent, and particulate matter with a diameter of 10 micrometers or less would be less than 32 percent.

The radiological dose to the nearest residents from radiological emissions would be less than 1 percent of the Federal standard and the nearest offsite receptor dose would be less than 1 percent of the state standard.

Hazardous and toxic air pollutant emissions would be the same as those previously discussed for the Just-in-Time Shipping Scenario.

The air emissions for the Interim Storage Shipping Scenario are below the state and Federal standards and would not substantively change the understanding of the air impacts presented in the TWRS EIS for the Phased Implementation Alternative.

C.8.4.4 Ecological Resources

From an ecological resources standpoint, the key issues are (1) whether the land areas proposed for use currently are undisturbed or whether they have been disturbed by past activities; (2) the extent of potential impacts on sensitive shrub-steppe habitat, which is considered a priority habitat by Washington state; and (3) potential impacts on plant and animal species of concern (those listed or candidates for listing by the Federal government or Washington state as threatened, endangered, and sensitive). Most impacts would occur in the 200 Areas where TWRS waste is currently and projected to be stored and where waste treatment, storage, and disposal facilities would be located. Smaller impacts would be located at potential borrow sites where varying levels of borrow material would be secured to support facility construction.

Impacts to plant and animal species from exposures to radionuclides and chemicals were also evaluated in the TWRS EIS. Under the Phased Implementation Alternative, the consumption of contaminated groundwater that reaches the Columbia River was not expected to pose a threat to terrestrial or aquatic receptors. The primary radiological risk is a result of direct contact with stored waste, which is unlikely as long as institutional controls are present. This type of impact would not be expected under the Minimum INEEL Processing Alternative since all of the INEEL waste would have left the Hanford Site prior to the end of the institutional control period.

Just-in-Time Shipping Scenario

Under this scenario, the construction and subsequent decontamination and decommissioning of the Calcine Dissolution Facility would result in additional shrub-steppe habitat disturbances in the 200 Areas and at the potential Pit 30 borrow site (Figure C.8-7). To bound the impacts, it is assumed that the Calcine Dissolution Facility would be sited in an undisturbed portion of the representative 200-East Area site. Using this assumption, an additional 3.9 acres of shrub-steppe habitat would be disturbed in the 200-East Area (see Section C.8.5.2). An additional 2.9 acres of shrub-steppe habitat at Pit 30 would also be disturbed to secure sand and gravel for facility construction and decontamination and decommissioning. There would be no additional impacts at the Vernita Quarry or McGee Ranch borrow sites. The total additional shrub-steppe habitat impacts would increase by approximately 1.3 percent, or 6.8-acres over the 540 acres calculated in the TWRS EIS for the Phased Implementation Alternative (Table C.8-8).

The additional impacts associated with this scenario would not substantively change the understanding of the ecological resource impacts presented in the TWRS EIS for the Phased Implementation Alternative. Shrub-steppe habitat impacts would still be less than 1 percent of the total remaining shrub-steppe on the

Table C.8-8. Revised shrub-steppe impacts - Minimum INEEL Processing Alternative.

Alternative		Total shrub-steppe disturbed in acres[a]: 200 Areas	Potential borrow sites	Total[b]
TWRS Phased Implementation Alternative[c]		240	300	540
Minimum INEEL Processing Alternative	Just-in-Time Shipping Scenario	3.9	2.9	6.8
	Interim Storage Shipping Scenario	28	24	52
Total impacts[d]	Just-in-Time Shipping Scenario	240	300	550
	Interim Storage Shipping Scenario	270	320	590

a. These estimates are based on closure of the Hanford Site Tank Farms by filling tanks and covering them with a Hanford Barrier. Numbers have been rounded to two significant digits.
b. Differences in total values reflect rounding.
c. Estimates include remediation and closure as landfill (Phase 1 and 2).
d. Revised impact estimates include the total Phased Implementation Alternative (Phase 1 and 2) plus the Minimum INEEL Processing Alternative.
TWRS = Tank Waste Remediation System.

Central Plateau and a small fraction of 1 percent of the Hanford Site's total shrub-steppe habitat. Implementing this scenario would not change the EIS's conclusion that there would be no adverse impacts to Hanford Site aquatic, wetland, or riparian habitats and no impacts to Federal- or state-listed threatened or endangered species. The incremental impacts to other species of concern would not be expected to result in substantive impacts to any species as a whole. Mitigation to reduce ecological impacts under this scenario would be performed in accordance with the Hanford Site Biological Resources Management Plan (DOE 1996b).

Interim Storage Shipping Scenario

This scenario would result in more impacts than the Just-in-Time Shipping Scenario because it would include all of the impacts of the Just-in-Time Shipping Scenario plus the impacts associated with the construction and subsequent decontamination and decommissioning of three new Canister Storage Buildings.

To bound the impacts, it is assumed that the Canister Storage Buildings would be sited in the 200-East Area adjacent to the site of the existing Canister Storage Building in undisturbed shrub-steppe habitat (Figure C.8-7). Using this assumption, as well as the bounding assumption that the Calcine Dissolution Facility would be sited in undisturbed habitat (as for the Just-in-Time Shipping Scenario), an additional 28 acres of shrub-steppe habitat would be disturbed in the 200-East Area (see Sections C.8.5.1 and

C.8.5.2). An additional 24 acres of shrub-steppe habitat at Pit 30 would also be disturbed to secure sand and gravel for facility construction and decontamination and decommissioning. There would be no additional impacts at Vernita Quarry or McGee Ranch. The total additional shrub-steppe habitat impacts would be approximately 9.5 percent, or a 52-acre increase to the 540 acres calculated in the TWRS EIS for the Phased Implementation Alternative.

Although this scenario would result in greater additional impacts than the Just-in-Time Shipping Scenario, it would still not substantively change the understanding of the ecological resource impacts presented in the TWRS EIS for the Phased Implementation Alternative. While the total shrub-steppe habitat impacts under this scenario would be greater than for the Phased Implementation Alternative, the affected habitat would represent less than 2 percent of the total remaining shrub-steppe on the Central Plateau and a small fraction of 1 percent of the Hanford Site's total shrub-steppe habitat. Implementing this scenario would not change the EIS conclusion that there would be no adverse impacts to Hanford Site aquatic, wetland, or riparian habitats and no impacts to Federal- or state-listed threatened or endangered species. The level of impact to other species of concern is related to the amount of shrub-steppe disturbed. Thus, while the impacts to other species of concern would be greater, they would not be expected to result in substantive impacts to any species as a whole. Mitigation to reduce ecological impacts under this scenario would be performed in accordance with the Hanford sitewide biological resources management plan.

C.8.4.5 Cultural Resources

The approach used to assess cultural resources for the Minimum INEEL Processing Alternative was to (1) define specific land areas that would be disturbed by construction, operation, and decommissioning and decontamination activities and (2) identify prehistoric or historical materials or sites at those locations that might be adversely impacted. Whether or not an area has been previously disturbed is an important variable in cultural resource impact analysis because areas previously disturbed are highly unlikely to have culturally or historically important resources.

Native American remains and other specific sites of religious and cultural importance exist at various locations around the Hanford Site; approximately 94 percent of these sites have not been disturbed by past activities and are currently unused. The Native American perspective on resources differs in many ways from that of Euro-Americans (Harper 1995).

Development of the Hanford Site has substantially altered the natural landscape. Buildings have been erected, soil and water have been disturbed, and the distribution of plants and animals has been altered.

Environmental cleanup and restoration activities will cause further alterations in the visual landscape, disrupt wildlife, and change plant communities, taking the Site even farther away from its natural state. Such changes affect the relationship between the Native Americans and their native lands.

Access to the Hanford Site by Native Americans, as well as all members of the public, had been restricted until the end of the Hanford Site's production mission. Tribal Nations have continued to express the desire to access and use Hanford Site areas. The Phased Implementation Alternative would have long-term impacts on Native American land access and use. However, access to and use of the 200 Areas would be restricted despite the selection of the Phased Implementation Alternative because of environmental contamination of areas surrounding the Tank Farms (e.g., the existing processing facilities). Since the Calcine Dissolution Facility and the Canister Storage Buildings for the Minimum INEEL Processing Alternative would be decommissioned and decontaminated, this alternative would have no impact on future Native American land use or access.

In accordance with the mitigation action plan for the TWRS EIS, DOE completed a cultural resources review of the proposed location for the Phased Implementation Alternative facilities (HCRL 1998). That review concluded that although there are cultural resources within the proposed TWRS project area, they are not of local or national significance and do not qualify for listing in the National Register of Historic Places. DOE would amend the on-going TWRS cultural resources evaluation, if necessary, to include new activities associated with the Minimum INEEL Processing Alternative.

C.8.4.6 <u>Socioeconomics</u>

This section addresses socioeconomic impacts related to the Minimum INEEL Processing Alternative and compares this alternative to the TWRS EIS Phased Implementation Alternative. The socioeconomics analysis focuses on key indicators of the potentially impacted area, including Hanford Site employment and the effects of Site employment levels on employment, population, taxable retail sales, and housing prices in the surrounding area. DOE analyzed potential impacts to public services and facilities (schools; police and fire protection; medical services; sanitary and solid waste disposal; and electricity, natural gas, and fuel oil) based on the results of the socioeconomic modeling of the key indicators of socioeconomic impacts.

The Minimum INEEL Processing Alternative would exceed the Hanford Site baseline employment level by approximately 3.5 percent between 2023 and 2027. An additional increase for this alternative would occur in the operational years from 2028 to 2030. The increase exceeds the baseline by approximately 10 percent for the Interim Storage Shipping Scenario and 9.1 percent for the Just-in-Time scenario and would then sharply decline in 2031. Table C.8-9 presents the baseline employment for the Hanford Site and the impacts in total number of employees and the percent change that would occur for the Minimum INEEL Processing Alternative.

Table C.8-9. Hanford Site employment changes from the baseline for selected years with TWRS Phased Implementation Alternative and Minimum INEEL Processing Alternative.

Year	Baseline level	Phased Implementation Alternative		Minimum INEEL Processing Alternative[a]	
		Change	Percent change	Change	Percent change
1997	14,900	790	5.3	0	0.0
1998	14,900	2,300	15.4	0	0.0
1999	14,800	3,300	22.3	0	0.0
2000	14,600	3,100	21.2	0	0.0
2001	14,400	1,400	9.7	0	0.0
2002	14,000	540	3.9	0	0.0
2003	13,500	540	4.0	0	0.0
2004	13,100	870	6.6	0	0.0
2005	12,800	2,400	18.8	0	0.0
2006	12,280	3,260	26.5	0	0.0
2007	11,760	4,120	35.0	0	0.0
2008	11,240	4,980	44.3	79	0.7
2009	10,720	5,840	54.5	79	0.7
2010	10,200	6,700	65.7	79	0.8
2011	10,200	6,100	59.8	88	0.9
2012	9,675	5,500	56.8	9	0.1
2013	9,150	4,900	53.6	88	1.0
2014	8,625	4,300	49.9	88	1.0
2015	8,100	3,700	45.7	88	1.1
2016	8,140	3,680	45.2	88	1.1
2017	8,180	3,660	44.7	9	0.1
2018	8,220	3,640	44.3	88	1.1
2019	8,260	3,620	43.8	88	1.1
2020	8,300	3,600	43.4	88	1.1
2021	8,320	3,340	40.1	88	1.1
2022	8,340	3,080	36.9	9	0.1
2023	8,360	2,820	33.7	9	0.1
2024	8,380	2,560	30.5	300	3.5
2025	8,400	2,300	27.4	300	3.5
2026	8,320	1,902	22.9	300	3.5
2027	8,240	1,504	18.3	300	3.6
2028	8,160	1,106	13.6	32	0.4
2029	8,080	708	8.8	740	9.2
2030	8,000	310	3.9	820	10.3
2031	7,760	252	3.2	310	4.0
2032	7,520	194	2.6	0	0.0
2033	7,280	136	1.9	0	0.0
2034	7,040	78	1.1	0	0.0
2035	6,800	20	0.3	0	0.0
2040	5,700	10	0.2	0	0.0

a. The Minimum INEEL Processing Alternative includes the Interim Storage Shipping Scenario employment. For the Just-in-Time Shipping Scenario, employment would be substantially less from 2008 through 2024 and similar or slightly less from 2024 through 2032.

In comparison with the Phased Implementation Alternative, the Minimum INEEL Processing Alternative would increase the Hanford Site employment by 6 percent or 514 workers in the year 2030. This change would not have a substantial impact on Hanford employment.

Tri-Cities Area Employment. The Interim Storage Shipping Scenario of the Minimum INEEL Processing Alternative would increase the Hanford Site employment 0.63 percent over the baseline (about 530 jobs in 2030). A 0.56 percent increase in employment over the calculational baseline, or about 470 jobs in 2030 for the Just-in-Time Shipping Scenario would occur for employment impacts on the Tri-Cities.

Population and Housing. Population under the Minimum INEEL Processing Alternative would follow the changes related to Hanford Site employment resulting in a peak of 1.6 percent for the Interim Storage Shipping Scenario and 1.4 percent for the Just-in-Time Shipping Scenario above the calculational baseline in 2030, followed by a decline through 2032. This level of change would not result in a boom/bust pattern, which could impact housing and public facilities.

Housing prices reflected the pattern of employment under the Minimum INEEL Processing Alternative, with prices peaking in 2030 at 3.2 percent for the Interim Storage Shipping Scenario and 2.8 percent for the Just-in-Time Shipping Scenario above the calculational baseline. Prices would then fall through the year 2032.

Electricity, Natural Gas, and Fuel Oil. The Minimum INEEL Processing Alternative would peak for electrical demands during the operation phase. The peak would be more substantial than the population growth incremental demand. The peak for the operation phase would occur after the population demand peak since waste vitrification is an electrical power-intensive operation.

The incremental electrical demand would be a substantial increase over the 1994 estimated Hanford Site electrical requirements of approximately 57 megawatts. This demand is considerably lower than Site electrical usage in the 1980s, when average Site requirements were approximately 550 megawatts. The incremental demand under the Minimum INEEL Processing Alternative would be similar to the Phased Implementation Alternative, no more than 1.5 percent of the Pacific Northwest electrical generation system’s guaranteed energy supply capacity. Additional hydroelectric generating capacity, which is the primary electrical power source in the region, is being constructed in the region. There are also proposals being considered by various utilities in the region to construct natural gas-fired power plants.

Natural gas is a minor energy source in the Tri-Cities area, and incremental consumption related to population growth under the Minimum INEEL Processing Alternative would have negligible impacts. The operation phase of this alternative also would require up to 3,000 gallons per day of fuel oil. No substantial impacts on local supply or distribution systems would be expected from this level of demand.

C.8.4.7 Land Use

Land-use impacts are addressed in terms of the compatibility of temporary and permanent land-use commitments under each alternative with past, present, and planned and potential future uses of the land and the surrounding area. A map of planned land uses at the Hanford Site can be found on Figure C.8-8. Also addressed are potential conflicts with land uses adjacent to the land that would be impacted under the alternative and unique land uses near the TWRS sites. Nearby land includes the Hanford Reach of the Columbia River and the Fitzner-Eberhart Arid Land Ecology Reserve. Conflicts among alternative Federal, state, local, and tribal nation land-use policies, plans, and controls are described separately in Section C.8.4.17.

All major activities would occur within the current boundaries of the 200 Areas. For more than 40 years, the 200 Areas have been used for industrial and waste management activities associated with the Hanford Site's past national defense mission and current waste management and environmental restoration cleanup mission. The 200 Areas consist of approximately 6,400 acres.

Just-in-Time Shipping Scenario

Under this scenario, additional land-use commitments would result from construction of the Calcine Dissolution Facility and removal of earthen materials from the potential Pit 30 borrow site. No additional land would be committed at the potential Vernita Quarry and McGee Ranch borrow sites. Assuming an area equal to the footprint of the Calcine Dissolution Facility plus a small buffer zone would be permanently committed to waste disposal, the permanent land-use commitments would increase by approximately 3.3 percent, or 3.9 acres (Figure C.8-9) over the 120 acres calculated for the Phased Implementation Alternative. Assuming that disturbances at the potential Pit 30 borrow site would be temporary, the temporary land-use commitments would increase by approximately 0.4 percent, or 2.9 acres (see Section C.8.5.2) over the 790 acres calculated for the Phased Implementation Alternative (Table C.8-10).

Table C.8-10. Revised land-use commitments – Minimum INEEL Processing Alternative

Alternative		Temporary land commitments[a] (acres)	Permanent land commitments[b] (acres)
Phased Implementation Alternative[c]		790	120
Minimum INEEL Processing Alternative	Just-in-Time Shipping Scenario	2.9	3.9
	Interim Storage Shipping Scenario	48	3.9
Total Impacts[d]	Just-in-Time Shipping Scenario	790	120
	Interim Storage Shipping Scenario	840	120

a. Temporary land-use commitments include the construction and operation phases; land used for facilities, construction laydown areas, and materials storage areas; and land used at the three borrow sites.
b. Permanent land-use commitments include areas that would be covered by Hanford Barriers, low-activity waste disposal vaults, and the contaminated portions of processing facilities.
c. Estimates include remediation and closure as landfill (Phase 1 and 2).
d. Impact estimates include the total Phased Implementation Alternative (Phase 1 and 2) plus the Minimum INEEL Processing Alternative.

The small increases in land-use commitments resulting from this scenario would be confined to the 200 Areas and would not substantively affect the understanding of the land-use commitments presented in the TWRS EIS for the Phased Implementation Alternative. The land-use commitments would still constitute only a small fraction of the 6,400 acres of land within the 200 Areas and would be consistent with past, present, and planned and potential future uses of the land and surrounding area (Figure C.8-10).

Interim Storage Shipping Scenario

This scenario would result in greater additional impacts than the Just-in-Time Shipping Scenario because it would include all of the impacts of the Just-in-Time Shipping Scenario plus the impacts associated with the construction and subsequent decontamination and decommissioning of three new Canister Storage Buildings.

Land-use commitments associated with the Calcine Dissolution Facility are assumed to be permanent and would be the same as for the Just-in-Time Shipping Scenario. Disturbances associated with the potential Pit 30 borrow site (24 acres) (see Sections C.8.5.1 and C.8.5.2) and the Canister Storage Buildings (24 acres) are assumed to be temporary and would increase the temporary land-use commitments by approximately 6.1 percent, or 48 acres over the 790 acres calculated for the Phased Implementation Alternative.

Although this scenario would result in greater additional impacts than the Just-in-Time Shipping Scenario, the additional land-use commitments would still be confined to the 200 Areas and would still not substantively affect the land-use commitments as presented in the TWRS EIS for the Phased Implementation Alternative. While the land-use commitments would constitute a slightly larger fraction of the 6,400 acres of land within the 200 Areas, they would not exceed the land available for waste management within the 200 Areas. The land-use commitments would still be consistent with past, present, and planned and potential future uses of the land and surrounding area.

C.8.4.8 Aesthetic and Scenic Resources

The visual impacts from the Phased Implementation Alternative would result from the construction of facilities associated with waste retrieval, processing, treatment, and storage. The Hanford landscape is characterized primarily by its broad plateau near the site's center. The visual setting provides sweeping vistas of the area broken up by more than a dozen large Hanford Site facilities (e.g., processing plants and nuclear reactors). The 200 Areas, where virtually all proposed facilities would be constructed, presently contain three large processing facilities as well as several multi-story support facilities. The facilities proposed for the Phased Implementation Alternative would be similar in size and appearance to the existing facilities.

The visual impacts from the Minimum INEEL Processing Alternative, both scenarios, would result from construction of facilities associated with waste storage, pretreatment, and treatment. The primary visual impact would be from the approximately 150 feet high stacks on each immobilization facility. The stacks would be visible from certain segments of State Route 240. Under certain atmospheric conditions, plumes would be visible at certain Site boundaries. No facilities or plumes would be visible from the Columbia River (DOE 1996a).

The facilities proposed for the Minimum INEEL Processing Alternative would be similar in size and appearance to the existing Hanford Site facilities. Visual impacts would be minor and similar to the impacts that currently exist.

C.8.4.9 Noise

Potential noise impacts would be minor. During both the construction and operation phases, some increase in noise levels onsite would occur due to the operation of heavy equipment and offsite due to vehicular traffic along existing roadways. Construction noises would result from the operation of scrapers, loaders, bulldozers, graders, cranes, and trucks. Because of the Site's remote and natural setting, noise impacts to resident wildlife species are a concern. Table C.8-11 presents an analysis in which a scraper, bulldozer, and grader were assumed to operate at the same location to assess the upper impact limit likely to occur. To place these noise levels in perspective, the table also presents reference noise levels. The table shows there would be some short-term disturbance of noise-sensitive wildlife near the TWRS activities during construction. Construction noise levels would approach background levels at 2,000 feet. Noise levels due to operations would be low and would result almost exclusively from traffic.

Table C.8-11. Probable bounding case cumulative noise impact during the construction phase.

Equipment type	Noise level 15 meters (dBA)	Cumulative noise level (dBA)[a] at 15 meters (50 feet)	at 100 meters (330 feet)	at 400 meters (1,300 feet)
Scraper	88			
Dozer	80	90	74	62
Grader	85			

a. dBA is decibels on the A scale, which adjusts noise levels to account for human hearing capabilities. These levels compare to a food blender (90 dBA), riding inside a car at 40 miles per hour (70 dBA), and normal speech (60 dBA).

Operational phase noise impacts would be largely related to operating process equipment (e.g., evaporator, mixer pumps, and melter and quencher) and from traffic. Because the waste treatment process equipment would be operating inside enclosed structures, exterior noise levels would not substantially increase. All facilities and working conditions would be in compliance with the Occupational Safety and Health Administration’s occupational noise requirements (29 CFR 1910.95). Pursuant to these requirements, noise exposures for an 8-hour duration would not exceed 85 dBA. In cases where the workers would be exposed to noise levels exceeding this value, administrative controls, engineering controls, or personal protective equipment use would be required to reduce the noise exposures below the allowable maximum.

The above assessment characterizes potential noise impacts from the TWRS Phased Implementation Alternative. Under the Minimum INEEL Processing Alternative, noise impacts would be less because there would be less construction activity.

C.8.4.10 Traffic and Transportation

This section describes how vehicular traffic associated with the Minimum INEEL Processing Alternative would impact the roadway system of the Hanford Site and vicinity. The roadways of primary concern would be (1) the segment of Stevens Road at the 1100 Area, which is the primary Site entrance for the city of Richland and (2) the segment of Route 4, which is a continuation of Stevens Road northward into the Hanford Site, west of the Wye Barricade. Stevens Road and Route 4 are by far the Hanford Site's most heavily traveled north-south route. Both of the road segments experienced heavy peak hour congestion in the recent past, although congestion has declined in 1995 as Site employment levels declined. The standard traffic level of service hierarchy ranges from Level of Service A (least congested) to Level of Service F (most congested). Conditions worse than Level of Service D are considered unacceptable. Prior to mid-1995, morning peak hour congestion on Stevens Road frequently reached Level of Service F, while on Route 4, it frequently reached Level of Service E.

To estimate vehicular traffic impacts, expected incremental traffic volumes (approximately 98 percent personal vehicles and 2 percent trucks) were added to estimated future baseline Hanford Site traffic volumes. The analysis focused on the peak year of activity. The approximate timeframes before and after the peak year when increased traffic congestion also would be expected were identified as well. Because Hanford Site traffic volumes typically reach their daily peaks during the morning shift change, this analysis focused on the morning peak hour, the time period of expected greatest impact.

The impact of the vehicular traffic associated with the traffic volume was estimated based on the number of people who would be commuting to and from work to support the Minimum INEEL Processing Alternative activities, including construction and operations. Peak traffic flows would occur in the year 2030 and would result in extreme peak hour congestion (level of service E) on Stevens Road at the 1100 Area. On Stevens Road the morning peak hour volume would be approximately 2,200 vehicles. On Route 4 the incremental Minimum INEEL Processing Alternative traffic volume of 360 vehicles would produce peak hour traffic that would result in level of service B or C conditions. Congestion associated with the Phased Implementation Alternative for Stevens Road would begin to build in 2007 and would continue at high levels until a 2031 peak, the end of activities associated with the Minimum INEEL Processing Alternative. Most traffic would be associated with the TWRS EIS Phased Implementation Alternative until 2029.

For the Phased Implementation Alternative, congestion on Route 4 west of the Wye Barricade would begin to build in 2007 and would continue at high levels until 2024, prior to activities associated with the Minimum INEEL Processing Alternative. Most traffic would be associated with the TWRS EIS Phased Implementation Alternative until 2029.

Traffic and Transportation Accidents. The traffic scenarios analyzed included employee traffic to and from work and transportation of building materials and other miscellaneous materials to support the alternatives. The incidence rates for injuries and fatalities were based on U. S. Department of Transportation statistics, Washington State Highway accident reports, and Hanford Site statistics.

The projected traffic accidents calculated for the Minimum INEEL Processing Alternative were 14 injuries and 0.18 fatalities for commuter traffic accidents. For truck transportation accidents, the total injuries were projected to be 15; for rail accidents resulting in injuries, 0.66. Fatalities would be less than 1 for each case. Supporting calculations are provided in Appendix E of Jacobs (1998).

Rail Traffic. The Minimum INEEL Processing Alternative would involve 26 rail shipments per year to bring materials onto the Site. Offsite shipments of HLW are addressed in Section 5.2.9.

Other Risks Associated With Traffic/Transportation. Chemical exposures from potential transportation accidents while transporting chemicals to support dissolution, pretreatment, and treatment (similar chemicals that would be used for the Phased Implementation Alternative) would result in health consequences similar to those evaluated in the TWRS EIS for the Phased Implementation Alternative. However, more shipments would be required to support the Phased Implementation Alternative resulting in a higher probability of an accident and therefore would bound chemical health risk for the Minimum INEEL Processing Alternative.

C.8.4.11 Health and Safety

Carcinogenic and noncarcinogenic adverse health effects on humans from exposure to radioactive and chemical contaminants associated with each of the following categories of risk were evaluated for the Phased Implementation Alternative in the TWRS EIS.

- Remediation risk resulting from routine remediation activities, such as retrieving waste from tanks and waste treatment operations
- Post remediation risk, such as the risk resulting from residual contamination remaining after the completion of remediation activities
- Post remediation risk resulting from human intrusion directly into the residual tank waste remaining after remediation.

Just-in-Time Shipping Scenario

Under this scenario, there would be radiological risk because of airborne releases and direct exposures associated with operations and decontamination and decommissioning at the Calcine Dissolution Facility and operations at the separations and vitrification facilities (Table C.8-12). The risk to the maximally-exposed individual involved worker was calculated in the TWRS EIS based on an assumed dose rate equal to the administrative control limit of 500 millirem per year and an exposure duration equal to the duration of the operation requiring the greatest amount of time, up to a maximum of 30 years. For the Phased Implementation Alternative, the exposure duration was the full 30 years (based on continued Tank Farm and evaporator operations), which resulted in a radiation dose to the maximally-exposed individual involved worker of 15 rem. The operation requiring the greatest amount of time under the Just-in-Time Shipping Scenario would be calcine dissolution (estimated to require 2.25 years, see Section C.8.5.2). This would result in a radiation dose to the maximally-exposed individual involved worker of 1.1 rem. Because the TWRS EIS radiation dose is greater than the dose calculated for this scenario, the TWRS EIS radiation dose is bounding and this scenario would not change the understanding of the maximally-exposed individual involved worker dose presented in the TWRS EIS.

The radiological risk to the involved worker population was calculated in the TWRS EIS based on the number of workers required for each operation, the anticipated dose each individual would receive (assumed to be either 200 millirem per year or 14 millirem per year, depending on the operation), and the duration of each operation. The Phased Implementation Alternative was calculated to result in approximately 3.27 latent cancer fatalities to the involved worker population. Under the Just-in-Time Shipping Scenario, the worker population would receive additional dose from calcine dissolution operations (23 persons per year × 2.25 years × 0.2 rem = 10 person-rem, see Section C.8.5.2); Calcine Dissolution Facility decontamination and decommissioning (312 persons per year × 2 years × 0.2 rem = 130 person-rem, see Section C.8.5.2); and separations and vitrification operations (657 persons per year × 1.4 years × 0.2 rem = 180 person-rem, see Section C.8.5.3). The cumulative additional dose (320 person-rem) would result in an additional latent cancer fatality risk to the worker population of 0.13, which represents an increase of 3.9 percent over the 3.27 latent cancer fatalities calculated for the Phased Implementation Alternative in the TWRS EIS (Table C.8-12). Because this scenario would result in less than one additional latent cancer fatality, it would not appreciably change the understanding of involved worker risk presented in the TWRS EIS for the Phased Implementation Alternative.

Under this scenario, there would be additional risk to the noninvolved worker and general public associated with the radiological air emissions from the Calcine Dissolution Facility and the separations and vitrification facilities. Air emissions data for these two sources are provided in Sections C.8.5.2 and C.8.5.3, respectively. The dose to each receptor resulting from the additional emissions was estimated by scaling from the doses calculated for the Phased Implementation Alternative (see Appendix E of Jacobs 1998). Two scaling factors were developed, one for each emission source, based on emissions at the stack before dispersion. The dose to each receptor was estimated by applying the scaling factors to the dose calculated for the TWRS EIS and then summing the doses from the two sources. Calculation results are presented in Table C.8-12. For both the noninvolved worker and general public, the latent cancer fatality risk would increase by less than 1 percent over the risk calculated in the TWRS EIS. Thus, this scenario would not substantively change the understanding of risk to the noninvolved worker and general public presented in the TWRS EIS for the Phased Implementation Alternative.

Table C.8-12. Estimated public and occupational radiological impacts.[a]

		Minimum INEEL Processing Alternative	
Receptor	Phased Implementation Alternative	Just-in-Time Shipping Scenario	Interim Storage Shipping Scenario
Total collective involved worker dose (person-rem)	8,200	320	350
Total number of involved worker latent cancer fatalities	3.3	0.13	0.14
Maximally exposed offsite individual dose (millirem/year)	0.29	1.7×10^{-5}	1.7×10^{-5}
Integrated offsite maximally-exposed individual dose (millirem)	4.9	2.9×10^{-5}	2.9×10^{-5}
Noninvolved worker dose (millirem/year)	0.23	1.3×10^{-5}	1.3×10^{-5}
Integrated noninvolved worker dose (millirem)	2.4	2.3×10^{-5}	2.3×10^{-5}
Dose to population within 80 kilometers of Hanford Site (person-rem per year)	23	1.3×10^{-3}	1.3×10^{-3}
Total collective dose to population (person-rem)	390	2.3×10^{-3}	2.3×10^{-3}
Estimated number of latent cancer fatalities in population within 80 kilometers of Hanford Site	0.19	1.1×10^{-6}	1.1×10^{-6}

a. Derived from Jacobs (1998).

This scenario would not result in any additional vitrified HLW being shipped from the Hanford Site to a geologic repository. The latent cancer fatality risk due to HLW transportation would, therefore, remain unchanged from that presented in the TWRS EIS (Table C.8-13). Transportation of INEEL HLW to the Hanford Site and the return of the vitrified HLW and low-activity waste to INEEL are addressed in Section 5.2.9.

Table C.8-13. Vitrified HLW transportation risk – Phased Implementation Alternative.

Receptor	LCF risk
Onsite population	3.1×10^{-4}
Offsite population	3.2×10^{-3}

LCF = latent cancer fatality.

This scenario would also result in very small nonradiological chemical risk due to chemical emissions from the Calcine Dissolution Facility and the separations and vitrification facilities. The chemical emission rates for this scenario would be three to five orders of magnitude lower than the comparable rates for the Phased Implementation Alternative (Tables C.8-14 and C.8-15) and the duration of the emissions would be much shorter than for the Phased Implementation Alternative, with the exception of mercury. The INEEL waste would have a higher mercury concentration than the TWRS EIS waste and would result in higher air emission concentration levels. The maximally-exposed individual noninvolved worker and maximally-exposed individual general public exposure to mercury would result in a hazard quotient of 5.4×10^{-3} and 8.7×10^{-4} respectively [supporting calculations provided in Appendix E of Jacobs (1998)], well below the benchmark value of 1.0. The resulting nonradiological chemical emissions for this scenario would be only a small fraction of the chemical emissions calculated for the Phased Implementation Alternative. Thus, the TWRS EIS risk is bounding, and this scenario would not change the understanding of the nonradiological chemical risk presented in the TWRS EIS.

Table C.8-14. Chemical emissions during routine operations – Phased Implementation Alternative.

Receptor	Hazard quotient
Maximally-exposed individual involved worker	0.31
Maximally-exposed individual noninvolved worker	0.13
Maximally-exposed individual general public	7.5×10^{-5}

Interim Storage Shipping Scenario

This scenario would result in slightly greater additional risk to the involved worker than the Just-in-Time Shipping Scenario because it would include all of the exposures associated with the Just-in-Time Shipping Scenario plus the exposures associated with operations at the Canister Storage Buildings (Table C.8-12). The operation requiring the greatest amount of time under this scenario would be the Canister Storage Building operation (estimated to require 19 years; see Section C.8.5.1). Canister Storage Building operations would result in a radiation dose to the maximally-exposed individual involved worker

Table C.8-15. Comparison of chemical emissions during routine operations from the Phased Implementation Alternative and Minimum INEEL Processing Alternative.

	Emission rate (mg/sec)	
Emissions[a]	TWRS EIS Phased Implementation Alternative	Minimum INEEL Processing Alternative[b]
Boron	6.4×10^{-4}	5.8×10^{-8}
Barium	4.7×10^{-6}	1.5×10^{-9}
Cadmium	1.2×10^{-5}	1.4×10^{-8}
Chromium	2.5×10^{-4}	5.4×10^{-9}

a. Emissions listed are releases that would occur under the Phased Implementation Alternative that would also occur under the Minimum INEEL Processing Alternative.
b. These values represent the combined emission rates from the Calcine Dissolution Facility and the separations and vitrification facilities.
mg/sec = milligrams per second

of 9.5 rem. Because the TWRS EIS radiation dose is greater than the dose calculated for this scenario, the TWRS EIS radiation dose is bounding and this scenario would not change the understanding of the maximally-exposed individual involved worker dose presented in the TWRS EIS.

The involved worker population dose would increase by approximately 34 person-rem due to operations at the Canister Storage Buildings (see Section C.8.5.1.), bringing the cumulative additional dose for this scenario to 350 person-rem. This cumulative dose would result in an additional latent cancer fatality risk to the worker population of 0.14, or a 4.3 percent increase over the 3.3 latent cancer fatalities calculated in the TWRS EIS for the Phased Implementation Alternative (Table C.8-12). Although the worker risk would increase under this scenario, there would be less than one additional latent cancer fatality. Thus, this scenario would not appreciably change the understanding of involved worker risk presented in the TWRS EIS for the Phased Implementation Alternative.

Under this scenario, the additional radiological risk to the noninvolved worker and general public would be the same as for the Just-in-Time Shipping Scenario because operations at the Canister Storage Buildings are assumed to result in no additional airborne radiological releases (see Section C.8.5.1).

This scenario would not result in any additional vitrified HLW being shipped from the Hanford Site to a geologic repository. The latent cancer fatality risk due to HLW transportation would, therefore, remain unchanged from that presented in the TWRS EIS (Table C.8-13). Transportation of INEEL HLW to the Hanford Site and the return of the vitrified HLW and low-activity waste to INEEL are addressed in Section 5.2.9.

This scenario would result in the same nonradiological risk as the Just-in-Time Shipping Scenario because operations at the Canister Storage Buildings are assumed to result in no additional airborne chemical releases (see Section C.8.5.1).

Long-Term Anticipated Health Effects

The Minimum INEEL Processing Alternative would result in no additional long-term human health risks to future users of the Hanford Site. Following processing and treatment, the immobilized INEEL HLW and low-activity waste canisters would be transported back to INEEL for interim storage and eventual disposal. There would be no additional sources of potential groundwater contamination left onsite following completion of remediation. Implementing either shipping scenario would result in the same long-term human health risk impacts as calculated in the TWRS EIS for the Phased Implementation Alternative (Table C.8-16).

Table C.8-16. Long-term anticipated health effects – Phased Implementation Alternative.[a]

Risk / Hazard	Year	Exposure scenario	Bounding[b]	Nominal[c]
Incremental Lifetime Cancer Risk[d]	2,500	Native American	1.2×10^{-4}	2.6×10^{-5}
		Residential farmer	9.6×10^{-6}	1.9×10^{-6}
		Industrial worker	3.0×10^{-6}	7.2×10^{-8}
		Recreational user	2.7×10^{-7}	1.2×10^{-8}
	5,000	Native American	4.3×10^{-3}	7.1×10^{-4}
		Residential farmer	3.4×10^{-4}	2.0×10^{-5}
		Industrial worker	1.0×10^{-4}	2.6×10^{-6}
		Recreational user	9.6×10^{-6}	2.6×10^{-7}
	10,000	Native American	6.9×10^{-4}	6.2×10^{-4}
		Residential farmer	6.8×10^{-5}	4.0×10^{-5}
		Industrial worker	7.4×10^{-6}	6.2×10^{-6}
		Recreational user	7.8×10^{-7}	6.0×10^{-7}
Hazard quotient	2,500	Native American	0.72	0.6
		Residential farmer	0.12	0.11
		Industrial worker	1.1×10^{-4}	9.1×10^{-5}
		Recreational user	1.6×10^{-5}	1.2×10^{-5}
	5,000	Native American	120	34
		Residential farmer	21	6.3
		Industrial worker	0.022	5.2×10^{-3}
		Recreational user	3.0×10^{-3}	7.1×10^{-4}
	10,000	Native American	7.7×10^{-3}	1.4
		Residential farmer	1.6×10^{-3}	2.2×10^{-3}
		Industrial worker	3.7×10^{-4}	4.7×10^{-4}
		Recreational user	4.9×10^{-5}	6.3×10^{-5}

a. Source: DOE (1996a).
b. Bounding case health effects are based on conservative assumptions designed to ensure that the results provide an upper bound of long-term risks.
c. Nominal case health effects are based on average rather than conservative assumptions.
d. Incremental lifetime cancer risk based on long-term exposure to radionuclides and carcinogenic chemicals in groundwater (risk below 1.0×10^{-6} is considered low, risk above 1.0×10^{-4} is considered high).

Intruder Scenario

The TWRS EIS included an analysis of long-term intruder risk. The intrusion scenario used was a postulated well-drilling scenario on the Hanford Site after the assumed loss of institutional control. The latent cancer fatality risk was calculated for a hypothetical driller and a post-drilling resident. The driller was assumed to be an individual who drills a well through the tank waste. The post-drilling resident was assumed to be an individual who lives on a parcel of land over the exhumed waste, from which he obtains 25 percent of his vegetable intake. For the Phased Implementation Alternative, the latent cancer fatality risk was calculated to be 8.5×10^{-5} for the driller and 4.2×10^{-4} for the post-drilling resident.

The Minimum INEEL Processing Alternative would result in no additional risks from inadvertent human intrusion at Hanford Site. Following processing and treatment, the immobilized INEEL HLW and low-activity waste canisters would be transported back to INEEL for interim storage and eventual disposal. There would be no additional onsite sources of contamination to increase the potential risks from a postulated well drilling intrusion scenario. Implementing either shipping scenario would result in the same risks to the driller and post-drilling resident as calculated in the TWRS EIS for the Phased Implementation Alternative.

C.8.4.12 Accidents

The accident analysis considers human health risks from (1) nonradiological/nontoxicological occupational accidents and (2) radiological and toxicological accidents. Accidents could potentially result from current Tank Farm operations and from construction and operations of pretreatment, treatment, and storage and disposal facilities to support the Phased Implementation Alternative.

Just-in-Time Shipping Scenario

Under this scenario INEEL waste would be transported to Hanford just in time for vitrification, and there would be no need to construct additional Canister Storage Buildings for interim storage. Therefore, only the Calcine Dissolution Facility and the vitrification facility are evaluated in the scenario as potential sources of accidents.

Nonradiological Nontoxicological Occupational Risk. The numbers of worker-years required to construct, operate, and decommission the Calcine Dissolution Facility were calculated from the data provided in Section C.8.5.2, to be 1,100; 52; and 620, respectively. The number of worker-years required to operate the vitrification facility was calculated from the data provided in Section C.8.5.3 to be 990. The total recordable cases, lost workday cases, and fatalities were calculated using the same incidence rates used in the TWRS EIS. The results of the calculations are presented in Table C.8-17. The supporting calculations are provided in Appendix E of Jacobs (1998). The Just-in-Time Shipping Scenario would result in an incremental worker risk of 4 percent for construction and 1 percent for operations as shown in the revised impacts to the Phased Implementation Alternative. It should be noted that decommissioning was added to construction.

Table C.8-17. Occupational accident risk.

Alternative		Construction			Operations		
		TRC	LWC	Fatality	TRC	LWC	Fatality
Phased Implementation Alternative		4,200	1,100	1.4	1,900	940	2.7
Minimum INEEL Processing Alternative	Just-in-Time Shipping Scenario	170	43	0	23	12	0
	Interim Storage Shipping Scenario	230	57	0	27	13	0
Total Impacts	Just-in-Time Shipping Scenario	4,400	1,100	1.4	1,900	950	2.7
	Interim Storage Shipping Scenario	4,400	1,200	1.4	1,900	950	2.7

LWC = lost workday cases; TRC = total recordable cases.

Radiological and Toxicological Accidents. The potential accidents evaluated in the TWRS EIS are those that could occur while storing, transferring, pretreating, and vitrifying the INEEL waste. The radiological and chemical constituents and concentrations in the INEEL waste inventory are not the same as the Hanford waste and for a given accident would result in lower dose consequences. To determine the dose consequences of comparable accidents evaluated in the TWRS EIS, a unit-liter dose was calculated for the INEEL waste and compared with the unit-liter dose that was used in the TWRS EIS analysis. Assuming the same atmospheric dispersion factors, respirable rates, fraction of respirable material released in the accident, and dose-to-risk conversion factors, scaling factors based on the difference in the unit-liter doses were developed for estimating the latent cancer fatality risk resulting from INEEL waste accidents. The scaling factors are presented in Table C.8-18 and the supporting calculations for the scaling factors are provided in Appendix E of Jacobs (1998).

Table C.8-18. Scaling factors for estimating latent cancer fatality risk for INEEL waste accidents.

Accident scenario	Scaling factor
Spray scenario	0.097
Hydrogen gas deflagration	0.012
Line break during pretreatment	0.58
Breached canister	3.7×10^{-3}
Beyond design basis earthquake	0.033

Applying the scaling factors in Table C.8-18 to the accident scenarios evaluated in the TWRS EIS for the Hanford waste would result in the latent cancer fatality risks presented in Table C.8-19. The INEEL waste spray release accident scenario would be bound by the comparable TWRS EIS accident by one order of magnitude. The INEEL waste deflagration scenario would be bound by the comparable TWRS EIS accident by two orders of magnitude. The INEEL waste line-break scenario would be bound by the comparable TWRS EIS by a factor of two. The INEEL waste breached canister of vitrified HLW scenario would be bound by the comparable TWRS EIS by two orders of magnitude. The INEEL waste beyond-design-basis earthquake would be bound by the comparable TWRS EIS by one order of magnitude. Retrieval accidents were not evaluated in this analysis. It was assumed that after the calcined waste has been dissolved and transferred to the storage tanks the condition of the waste would make it readily transferable to the separations facility and, as a result, would require a minimum amount of sluicing.

Table C.8-19. Radiological accident impacts for the Minimum INEEL Processing Alternative.[a]

Process title	Maximally-exposed individual dose (rem)	Noninvolved worker dose (rem)	Offsite population (person-rem)	Latent cancer fatalities to offsite population
Spray release from jumper pit	0.19	42	390	0.19
Hydrogen deflagration in waste storage tanks	0.050	21	44	0.022
Line break during pretreatment	2.6×10^{-4}	0.060	0.56	2.8×10^{-4}
Dropped canister of vitrified HLW	2.2×10^{-12}	1.5×10^{-9}	4.9×10^{-9}	2.5×10^{-12}
Beyond design basis earthquake	0.15	64	130	0.067
Breached calcine canister while unloading[b]	4.7×10^{-6}	3.3×10^{-3}	0.010	5.2×10^{-6}

a. Derived from Jacobs (1998).
b. This accident scenario is unique to the INEEL waste form (calcine). Impacts for this scenario were not scaled from the TWRS EIS.

The chemical risk from the postulated accident for the INEEL waste was based on the relatively large concentration of mercury in the waste. The organic constituents have been removed from the waste during the calcine process at INEEL. Mercury is the only chemical in the waste with a concentration that could exceed the American Industrial Hygiene Association Emergency Response Planning Guidelines (ERPG)-1 severity level. The mercury concentrations were calculated for the various receptors and the corresponding Emergency Response Planning Guideline levels are presented in Table C.8-20.

Table C.8-20. Toxicological accident impacts for the Minimum INEEL Processing Alternative.[a]

Process title	MEI[b] involved worker	MEI noninvolved worker	MEI general public	Involved worker population	Noninvolved worker population	General public population
Spray release from jumper pit	ERPG-2[c]	ERPG-3	<ERPG-1	ERPG-2	ERPG-3	<ERPG-1
Hydrogen deflagration in waste storage tanks	ERPG-2	ERPG-2	<ERPG-1	ERPG-2	ERPG-2	<ERPG-1
Line break during pretreatment	<ERPG-1	ERPG-2	<ERPG-1	<ERPG-1	ERPG-2	<ERPG-1
Dropped canister of vitrified HLW	<ERPG-1	<ERPG-1	<ERPG-1	<ERPG-1	<ERPG-1	<ERPG-1
Beyond design basis earthquake	ERPG-2	ERPG-3	<ERPG-1	ERPG-2	ERPG-3	<ERPG-1
Breached calcine canister while unloading[d]	<ERPG-1	<ERPG-1	<ERPG-1	<ERPG-1	<ERPG-1	<ERPG-1

a. Derived from Jacobs (1998).
b. MEI = maximally-exposed individual.
c. ERPG = Emergency Response Planning Guidelines.
d. This accident scenario is unique to the INEEL waste form (calcine). Impacts for this scenario were not scaled from the TWRS EIS.

Supporting calculations are provided in Appendix E of Jacobs (1998). The chemical accidents evaluated in the TWRS EIS would remain bounding for all accidents except for the line-break accident and the spray release accident scenarios. The INEEL waste line-break scenario would result in an ERPG-2 for the noninvolved worker receptor compared to ERPG-1 calculated in the comparable TWRS EIS accident. The INEEL waste spray release accident scenario would result in an ERPG-3 for the noninvolved worker receptor compared to ERPG-2 calculated in the comparable TWRS EIS accident.

In addition to the accidents evaluated in the TWRS EIS, a breached canister of calcine waste was analyzed. A dropped canister of calcine waste could potentially occur in the canister dissolution facility while the canister is being transferred from the transportation cask. The accident could occur as a result of mechanical failure or human error. It is assumed that 40 percent of the 1.17 cubic meters of waste in the canister is released and suspended in the air. It is further assumed that each stage of a two-stage high-efficiency particulate air filter system filters 99.95 percent of the suspended waste. The radiological and toxicological impacts to the various receptors are presented in Tables C.8-19 and C.8-20. Supporting calculations are provided in Appendix E of Jacobs (1998).

The radiological latent cancer fatality risk from accidents evaluated for the Just-in-Time Shipping Scenario are less than the risk from comparable accidents evaluated in the TWRS EIS. Only the chemical risk from the spray accident and line-break accident would exceed the chemical risk to the noninvolved worker evaluated for comparable accidents in the TWRS EIS. However, the spray accident and line-break accident are bound by other accidents evaluated in the TWRS EIS. The hydrogen gas deflagration, high-efficiency particulate air filter failure, and beyond-design-basis earthquake accidents evaluated in the TWRS EIS would exceed ERPG-3 for the noninvolved worker. Therefore, the Just-in-Time Shipping Scenario would not substantively change the understanding of impacts from radiological and chemical accidents presented in the TWRS EIS for the Phased Implementation Alternative.

Interim Storage Shipping Scenario

Under this scenario INEEL waste would be transported to the Hanford Site approximately 20 years prior to being vitrified. This would require additional Canister Storage Buildings to be built for storage of INEEL waste prior to vitrification. The Canister Storage Buildings, Calcine Dissolution Facility, and the vitrification facility are evaluated in this scenario as potential sources of accidents.

Nonradiological Nontoxicological Occupational Risk. The number of worker-years required to support the Calcine Dissolution Facility and vitrification facility would be the same as was previously discussed for the Just-in-Time Shipping Scenario. However, additional worker years would be required to construct, operate, and decommission the Canister Storage Buildings. The results of the calculations are presented in Table C.8-17. The Interim Storage Shipping Scenario would result in an incremental worker risk of 5.5 percent for construction and 1.5 percent for operations as shown in the revised impacts to the Phased Implementation Alternative.

Radiological and Toxicological Accidents. The radiological and toxicological accidents evaluated in the Just-in-Time Shipping Scenario would be common to the Interim Storage Shipping Scenario. The potential for a dropped canister of calcine waste could occur in a Canister Storage Building as the canister is being transferred from the transportation cask. However, this accident would be comparable to the canister accident in the Calcine Dissolution Facility and would result in the same radiological and chemical risk. As with the Just-in-Time Shipping Scenario, the Interim Storage Shipping Scenario would not substantively change the understanding of impacts from radiological and chemical accidents presented in the TWRS EIS for the Phased Implementation Alternative.

C.8.4.13 Cumulative Impacts

The National Environmental Policy Act (NEPA) implementation regulations define the term “cumulative impact” as the impact on the environment that results from the incremental impact of an action when added to other past, present, and reasonably foreseeable future actions, regardless of what agency undertakes those actions. Cumulative impacts result from individually minor but collectively significant actions taking place over time (40 CFR 1508.7).

This section describes potential cumulative impacts associated with implementing the Minimum INEEL Processing Alternative. Other actions that could impact the Hanford Site are also identified, and, when possible, a qualitative discussion of their potential cumulative impact is provided.

The Minimum INEEL Processing Alternative, as described in Section C.8.3, would involve treatment of INEEL waste at the Hanford Site. It would also require waste management activities at INEEL, transportation of the untreated waste to Hanford, and transportation of the treated waste from Hanford to INEEL. The activities analyzed in this appendix included only those that would take place at the Hanford Site. Implementation of the Minimum INEEL Processing Alternative would require additional offsite activities not analyzed here (e.g., waste transportation). Such activities would result in cumulative impacts that are not described.

There would be no long-term disposal of INEEL waste at Hanford as the result of the Minimum INEEL Processing Alternative and, therefore, there would be no cumulative long-term disposal impacts to the Hanford Site. Because the INEEL waste would be processed following completion of planned retrieval and treatment of the Hanford Site tank waste, many of the resource area impacts would not be cumulative.

Actions at the Hanford Site that could result in cumulative impacts with the Minimum INEEL Processing Alternative include the Hanford Site waste management and environmental restoration programs, operation of the Environmental Restoration and Disposal Facility, the management of spent nuclear fuel, and activities at the U.S. Ecology Site. The level of activity associated with many of the Hanford Site cleanup functions would be declining by the time treatment of the INEEL waste would begin. Among the cumulative impacts that would occur are impacts to land use and biological resources, human health, transportation, and socioeconomics.

Actions at Other DOE Sites or Facilities and Programmatic Actions that Could Potentially Impact the Hanford Site

Programs or actions at other DOE sites and DOE programmatic evaluations that could impact the Hanford Site are discussed in the TWRS EIS. Potential cumulative impacts would be similar to those identified for the TWRS waste treatment alternatives and include impacts on land use, habitat, health, air quality, transportation, and socioeconomic issues.

Actions Adjacent to the Hanford Site

In addition to DOE waste management activities, there are other nuclear facilities at, or near, the Hanford Site that could contribute to radioactive releases. These facilities include a commercial radioactive waste burial site, a commercial nuclear power plant, a nuclear fuel production plant, and a commercial low-level radioactive and low-level mixed waste treatment facility. These ongoing operations, combined with the proposed Minimum INEEL Processing Alternative, would cumulatively impact socioeconomics, air emissions, health, transportation, and land use.

Currently Planned or Reasonably Foreseeable DOE Actions at the Hanford Site

This section describes the currently planned and reasonably foreseeable actions at the Hanford Site having potential cumulative impacts. The activities are grouped into actions on the Central Plateau and actions in other Hanford Site areas. A number of proposed actions at the Hanford Site may contribute to the cumulative impacts from proposed actions under the Minimum INEEL Processing Alternative. Because the majority of the activity associated with the proposed action would occur approximately 30 years in the future, a quantitative analysis of cumulative impacts from all potential projects is not possible. A complete description of currently planned or reasonably foreseeable DOE actions at the Hanford Site is provided in the TWRS EIS.

The facilities and operations associated with the Minimum INEEL Processing Alternative would occur on the Central Plateau. Currently planned or reasonably foreseeable actions that would occur on the Central Plateau include:

- Closure of the single-shell tanks and double-shell tanks. Current planning includes closure of the Hanford Site Tank Farms following completion of waste retrieval actions. The end state for the Tank Farms is not currently defined. There is a potential for cumulative impacts on land use and habitat resources, air emissions, and socioeconomics.

- Waste Receiving and Processing Facility. The Waste Receiving and Processing Facility would be used to process alpha-contaminated waste for onsite disposal or transuranic waste for eventual shipment to the Waste Isolation Pilot Plant. No potentially cumulative impacts have been identified for this action.

- Effluent Treatment Facility and Liquid Effluent Retention Facility. These facilities would provide for collection, retention, treatment, and disposal of liquid waste, including liquid effluents from the TWRS treatment facilities. No potentially cumulative impacts have been identified for this action.

- U.S. Ecology Low-Level Radioactive Waste Disposal Facility. The U.S. Ecology Low-Level Radioactive Waste Disposal Facility occupies 100 acres of land leased by DOE to Washington state. The facility is located just southwest of the 200-East Area and receives low-level waste from commercial organizations. U.S. Ecology is assumed to continue to receive and emplace commercial low-level waste onsite through the year 2063. There is a potential for cumulative impacts on land use and transportation.

Other currently planned or reasonably foreseeable DOE actions at other Hanford Site areas are documented in the TWRS EIS. To the extent that some of these activities would take place during the same time as the Minimum INEEL Processing Alternative, they have the potential to result in cumulative impacts on land use, habitat, traffic, and socioeconomics.

Summary of Cumulative Impacts

Although many of the activities described previously would occur at the same general time as the Minimum INEEL Processing Alternative, few quantifiable cumulative impacts would be expected because of differences in the nature of the activities and their physical separation.

From a broader environmental perspective, cumulative impacts can be expected in such areas as land use and habitat resources. For example, multiple projects each impacting a small amount of sensitive shrub-steppe habitat eventually could have a more substantial impact by fragmenting the habitat and reducing the total amount of shrub-steppe habitat remaining on the Hanford Site. The cumulative population dose would increase slightly as a result of additional waste treatment operations. Other resource areas such as air quality, socioeconomics, and transportation would have less potential for cumulative impacts due to the schedule for the various activities. Retrieval and treatment of Hanford Site tank waste would be completed prior to initiating INEEL waste processing, so there would be no cumulative air quality impacts from waste processing. Finally, the baseline employment levels at the Hanford Site are projected to be approximately one-half of the current level by 2029 when treatment of the INEEL waste would take place.

The proposed activities would be carried out against the baseline of overall Hanford Site operations. Assuming the Hanford Site’s environmental restoration and waste management mission does not change, it is likely that the future range of operational impacts would not be greater than the current impacts associated with Hanford Site waste and operations.

C.8.4.14 Unavoidable Adverse Impacts

This section summarizes the potential unavoidable adverse impacts at the Hanford Site associated with the Minimum INEEL Processing Alternative. Identified herein are those unavoidable adverse impacts that would remain after incorporating all mitigation measures that were part of the development of the TWRS EIS alternatives. Potentially adverse impacts for the Minimum INEEL Processing Alternative are described in Sections C.8.4.1 through C.8.4.12. Additional practicable mitigation measures are identified in Section C.8.4.20 that could further reduce the impacts described in this section.

Geology and Soils

Total soil disturbance would be 52 acres for the Minimum INEEL Processing Alternative (Section C.8.4.1). Large volumes of borrow material would be excavated at the Pit 30 potential borrow site. Borrow material excavation would leave shallow terrain depressions at the excavation site.

Air Quality

Although no applicable air quality standards would be exceeded, substantial air emissions would occur, even with applicable implementation of additional practicable mitigation measures (Section C.8.4.3). Construction and operation activities would result in increased levels of air emissions. Construction activities would produce fugitive dust (particulates) and combustion emissions from the use of heavy equipment and motor vehicles. Operation activities would produce radionuclide emissions, combustion emissions, and hazardous air pollutants. Radionuclide emissions would include strontium-90, technetium-99, americium-241, plutonium isotopes, and cesium-137.

Water Resources

The vadose zone and groundwater aquifer beneath portions of the Hanford Site, including the 200 Areas, currently are contaminated at levels that exceed drinking water standards. Controls on the use of Hanford Site groundwater currently are in place and are expected to continue well into the future.

The Minimum INEEL Processing Alternative would not involve release of waste into the currently contaminated vadose zone beneath the 200 Areas, and eventually into the underlying groundwater aquifer. Therefore, this alternative would not result in levels that exceed water quality requirements (Section C.8.4.2)

Land Use

Permanent land-use commitments would be 3.9 acres for the Minimum INEEL Processing Alternative; however, the potential exists that permanent commitment of land in the 200 Areas to waste disposal uses could occur at the Hanford Site. While the TWRS EIS alternative land use would be compatible with current land use and current plans for future land use of the 200 Areas, the committed areas would be inaccessible for alternative land use. The amount of land involved would be small compared to the total Central Plateau waste management area of the Hanford Site (Section C.8.4.7).

Transportation

The Minimum INEEL Processing Alternative would involve additional motor vehicle traffic, mostly from employees commuting to and from TWRS sites. There would be an increased traffic congestion during daytime peak hours on Stevens Road north of Richland and on Route 4 west of the Wye Barricade. This congestion would especially occur during the period of peak employment (2028 to 2030), which is largely associated with operational activities. Potential transportation accidents, both onsite and offsite, could cause injuries, illness, and a small risk for a fatality (Section C.8.4.10).

Noise

Because the TWRS sites would be located in the interior of the Hanford Site and would be a long distance from populated offsite areas, the only unavoidable adverse noise impact would be temporary wildlife disturbances near construction sites from heavy equipment use (Section C.8.4.9).

Aesthetic and Scenic Resources

Constructing facilities and performing borrow site excavation activities would affect the visual environment, particularly from elevated locations onsite (e.g., Gable Mountain, Gable Butte, and Rattlesnake Mountain that are used by Native Americans for religious purposes). Facilities developed in the 200-East Area would be visible in the distant background from State Route 240 and from offsite elevated locations. Section C.8.4.8 provides more detail on unavoidable adverse impacts.

Biological and Ecological Resources

The Minimum INEEL Processing Alternative would affect shrub-steppe habitat in the 200 Areas and at least one of the three potential borrow sites (Section C.8.4.4). In the affected shrub-steppe habitat areas, there would be a loss of plants; loss or displacement of wildlife species (e.g., birds, small mammals); and a resulting loss of food supplies for birds of prey and predatory mammals.

A small percentage (less than one-half of 1 percent) of the Hanford Site's total shrub-steppe area would be affected, and only individual species members potentially would be impacted, rather than the species as a whole. However, a number of plant and wildlife species of concern (species that are classified as candidates for listing as threatened or endangered, or by the state as monitor or sensitive species) potentially would be affected.

Given that the sites proposed for HLW management facilities under the Minimum INEEL Processing Alternative all lie within the boundaries of 200 East Area, habitat fragmentation is not a concern. All of the proposed sites are in an area dedicated to industrial use since the 1940s that already contains a number of established facilities and is encircled by perimeter roads. Although some shrub-steppe habitat is present in undeveloped portions of 200 East Area, its value as wildlife habitat is diminished by the fact that it is effectively isolated from large, unbroken expanses of shrub-steppe to the north and south. One of the proposed facilities would be placed outside of 200 East Area, thus no unbroken tracts of shrub-steppe habitat (or any other habitat) would be affected.

Cultural Resources

Prehistoric and historical materials and sites in the 200 Areas are scarce, and the TWRS sites currently are heavily disturbed (the 18 Tank Farms) or partly disturbed (the proposed waste treatment facility sites) (Section C.8.4.5).

Socioeconomics

The Minimum INEEL Processing Alternative would involve short-term socioeconomic impacts that would stem largely from rapid fluctuations in employment during construction and operations (Section C.8.4.6). However, these impacts would not affect the on-going Phased Implementation Alternative and would not produce impacts on housing prices stemming from rapid increases in local population. The increases in local population also would not require hiring additional local police and fire department personnel. The increase in local population would lead to increased enrollment in schools but not to an adverse effect.

Health Effects

The Minimum INEEL Processing Alternative would pose some risks of adverse health effects. The risk of adverse health effects would be limited mainly to workers (Section C.8.4.11).

Accidents

The Minimum INEEL Processing Alternative would involve potential accidents. This would include occupational, radiological, and chemical accidents that could cause injuries, illness, and latent cancer fatalities. Occupational injuries, illnesses, and fatalities would be directly dependent on the number of person-years of labor required to complete the activity. Thus, the more person-years of labor the more injuries, illnesses, and fatalities (Section C.8.4.12 for accidents).

Committed Resources

The Minimum INEEL Processing Alternative would consume water, concrete, and electricity; would use borrow materials; and would consume process chemicals. Although all of these resource consumption impacts would be within existing capacity, the resources would be unavailable for alternative uses.

C.8.4.15 Relationship Between Short-Term Uses of the Environment and Maintenance and Enhancement of Long-Term Productivity

For the Minimum INEEL Processing Alternative, the short-term period was considered to be the construction, operation, and decontamination and decommissioning phases (scheduled to be completed by 2032). Most short-term environmental impacts would occur during the construction and operations phases. Over the short-term there would be increased air emissions and noise, solid and liquid waste generation, and increased risk of accidents and illness, primarily to workers involved with implementing the alternative compared to not performing remedial action. Implementing the alternative would consume both natural and human-made resources (e.g., fuels, concrete, steel, and chemicals) but would not be expected to cause shortages or price increases as a result of their resource consumption. Over the short term, land areas would be committed that would affect biological resources.

Compared with performing no Hanford Site tank waste remedial action, the Minimum INEEL Processing Alternative would increase expenditure of Federal funds in the Tri-Cities. These would result in increased employment and economic activity associated with these expenditures. The Minimum INEEL Processing Alternative would have short-term impacts on the human environment through short-term fluctuations in employment and population and the associated impacts on public services.

The long-term impacts on the natural environment of the Minimum INEEL Processing Alternative would be due in large part to how much waste would remain on the Hanford Site after the alternative was fully implemented, and how much of the remaining waste would be immobilized or left untreated. Since all the waste is shipped to the Hanford Site from INEEL and then returned to INEEL, no long-term impacts associated with disposal or storage would occur.

C.8.4.16 Irreversible and Irretrievable Commitment of Resources

Just-in-Time Shipping Scenario

Under this scenario, additional irreversible and irretrievable commitment of resources would be required to support the construction, operation, and decontamination and decommissioning of the Calcine Dissolution Facility and operations at the separations and vitrification facilities (Table C.8-21). Resource requirements for the Calcine Dissolution Facility and the separations and vitrification facilities are provided in Sections C.8.5.2 and C.8.5.3, respectively. Incremental impacts for most resource commitments would range from 1 to 32 percent but would be generally very small (less than 5 percent). The largest incremental impact (32 percent) would be for fossil fuel, which would result primarily from operations at the separations and vitrification facilities. This scenario would not substantially change the understanding of irreversible and irretrievable commitment of resources presented in the TWRS EIS for the Phased Implementation Alternative.

Interim Storage Shipping Scenario

This scenario would result in slightly greater irreversible and irretrievable commitments of resources than the Just-in-Time Shipping Scenario because of the additional resource requirements for construction, operation, and decontamination and decommissioning of three new Canister Storage Buildings (Table C.8-21). Resource requirements for the Canister Storage Buildings, the Calcine Dissolution Facility, and the separations and vitrification facilities are provided in Sections C.8.5.1, C.8.5.2, and C.8.5.3, respectively. Incremental impacts would be slightly larger than for the Just-in-Time Shipping Scenario but would still be small (generally less than 10 percent). The largest incremental impact (34 percent) would again be for fossil fuel, due primarily to operations at the separations and vitrification facilities. Although the incremental impacts for this scenario would be slightly greater, this scenario still would not substantially change the understanding of irreversible and irretrievable commitment of resources presented in the TWRS EIS for the Phased Implementation Alternative.

Table C.8-21. Revised irreversible and irretrievable commitment of resources – Minimum INEEL Processing Alternative.

Tank Waste Alternative		Component	Commitment
Phased Implementation Alternative[a]		Land permanently committed (acres)	120
		Sand/gravel/silt/rip rap (cubic meters)	4.1×10^{6}
		Steel (metric tons)	3.4×10^{5}
		Concrete (cubic meters)	1.1×10^{6}
		Total water usage (cubic meters)	1.9×10^{7}
		Electric power (GWh)	1.1×10^{4}
		Fossil fuel (cubic meters)	1.9×10^{5}
		Process chemicals (metric tons)	9.8×10^{5}
		Cost (billions of dollars[b])	30 to 38
Minimum INEEL Processing Alternative	Just-in-Time Shipping Scenario	Land permanently committed (acres)	3.9
		Sand/gravel/silt/rip rap (cubic meters)	3.4×10^{4}
		Steel (metric tons)	3.2×10^{3}
		Concrete (cubic meters)	2.6×10^{4}
		Total water usage (cubic meters)	1.6×10^{5}
		Electric power (GWh)	930
		Fossil fuel (cubic meters)	5.9×10^{4}
		Process chemicals (metric tons)	1.0×10^{5}
		Cost (millions of dollars)	360
	Interim Storage Shipping Scenario	Land permanently committed (acres)	3.9
		Sand/gravel/silt/rip rap (cubic meters)	2.9×10^{5}
		Steel (metric tons)	1.6×10^{4}
		Concrete (cubic meters)	7.0×10^{4}
		Total water usage (cubic meters)	1.7×10^{5}
		Electric power (GWh)	940
		Fossil fuel (cubic meters)	6.4
		Process chemicals (metric tons)	1.0×10^{5}
		Cost (millions of dollars)	820
Total impacts[c]	Just-in-Time Shipping Scenario	Land permanently committed (acres)	120
		Sand/gravel/silt/rip rap (cubic meters)	4.1×10^{6}
		Steel (metric tons)	3.4×10^{5}
		Concrete (cubic meters)	1.1×10^{6}
		Total water usage (cubic meters)	1.9×10^{7}
		Electric power (GWh)	1.2×10^{4}
		Fossil fuel (cubic meters)	2.5×10^{5}
		Process chemicals (metric tons)	1.1×10^{5}
		Cost (billions of dollars[b])	30 to 39
	Interim Storage Shipping Scenario	Land permanently committed (acres)	120
		Sand/gravel/silt/rip rap (cubic meters)	4.4×10^{6}
		Steel (metric tons)	3.6×10^{5}
		Concrete (cubic meters)	1.2×10^{6}
		Total water usage (cubic meters)	1.9×10^{7}
		Electric power (GWh)	1.2×10^{4}
		Fossil fuel (cubic meters)	2.5×10^{5}
		Process chemicals (metric tons)	1.1×10^{6}
		Cost (billions of dollars[b])	31 to 39

a. Estimates include remediation and closure as landfill (Phase 1 and 2).
b. Total estimated cost range including repository fee.
c. Total impact estimates include the total Phased Implementation Alternative (Phase 1 and 2) plus the Minimum INEEL Processing Alternative.

C.8.4.17 Conflict Between the Proposed Action and the Objectives of Federal, Regional, State, Local, and Tribal Land-Use Plans, Policies or Controls

All activities proposed for the Hanford Site, under both the Just-in-Time Shipping Scenario and the Interim Storage Shipping Scenario of the Minimum INEEL Processing Alternative, would occur with the 200 Areas. Thus there would be no conflicts between land use plans associated with construction andoperations of waste storage and treatment facilities under this alternative and Federal, state, or local plans and policies. However, the Minimum INEEL Processing Alternative would present similar conflicts with land use plans and policies of Tribal Nations as presented in the TWRS EIS for the Phased Implementation Alternative. These conflicts are summarized in Sections C.8.4.5 and C.8.4.19.

C.8.4.18 Pollution Prevention

The Minimum INEEL Processing Alternative would be required to incorporate pollution prevention into their planning and implementation activities as would be required by the Phased Implementation Alternative. This includes reducing the quantity and toxicity of hazardous, radioactive, mixed, and sanitary waste generated at the Hanford Site; incorporating waste recycle and reuse into program planning and implementation; and conserving resources and energy.

C.8.4.19 Environmental Justice

For each area of technical analysis presented in the TWRS EIS, a review of impacts to the human and natural environment was conducted to determine whether any potentially disproportionately high and adverse impacts on minority populations or low-income populations would occur. The review included potential impacts on land use; socioeconomics (e.g., employment, housing prices, public facilities, and services); water quality; air quality; health effects; accidents; and biological and cultural resources. For each of the areas of analysis, impacts were reviewed to determine whether there would be any potential high and adverse impacts to the population as a whole due to construction, routine operations, or accident conditions. If an adverse impact was identified, a determination was made as to whether minority populations or low-income populations would be disproportionately affected.

For the purposes of that assessment, disproportionate impacts were defined as impacts that would affect minority and Native American populations or low-income populations at levels appreciably greater than their effects on non-minority populations or non-low-income populations. Adverse impacts were defined as negative changes to the existing conditions in the natural environment (e.g., land, air, water, wildlife, vegetation) or in the human environment (e.g., employment, health, land use).

During consultation with affected tribal nations on the TWRS EIS, representatives of the Yakama Indian Nation and the Confederated Tribes of the Umatilla Indian Reservation expressed the view that impacts associated with the alternatives could adversely impact the cultural values of affected tribal nations to the extent that they involve disturbance or destruction of ecological and biological resources, alter land forms, or pose a noise or visual impact to sacred sites. The level of impact to cultural values associated with natural resources would be proportional to the amount of land disturbed under each alternative.

A similar concern to Native American populations may be raised by the Minimum INEEL Processing Alternative. This concern would involve continued restrictions on access to portions of the 200 Areas that could restrict access to the 200 Areas by all individuals, including the Confederated Tribes and Bands of the Yakama Indian Nation and the Confederated Tribes of the Umatilla Indian Reservation. The Tribes have expressed an interest in access to and unrestricted use of the Hanford Site. Land use restrictions under the Minimum INEEL Processing Alternative would last until 2032. The Department has concluded that the Minimum INEEL Processing Alternative would not result in high and adverse impacts on the population as a whole, but recognizes that Native American tribes in the Hanford region consider the continuation of restrictions on access to lands at Hanford to have an adverse impact on all elements of the natural and physical environment and to their way of living within that environment.

C.8.4.20 Mitigation Measures

In the TWRS EIS, measures were addressed to mitigate potential impacts of the Phased Implementation Alternative, including (1) measures to prevent or mitigate environmental impacts and (2) additional measures that could further reduce or mitigate potential environmental impacts described previously in other portions of the TWRS EIS, if deemed necessary. The TWRS EIS focused on measures to mitigate potential impacts during remediation and indicated that future NEPA documentation would specifically address in detail impacts and mitigation of post-remediation tank closure where, for example, most of the borrow site activity impacts would occur.

The type of impacts resulting from the Minimum INEEL Processing Alternative would be similar to those evaluated in the TWRS EIS for the Phased Implementation Alternative. Therefore, the same type of mitigation measures would be included for the Minimum INEEL Processing Alternative.

C.8.5 CALCINE PROCESSING PROJECT DATA

C.8.5.1 Canister Storage Buildings

Overview

This project describes the costs and impacts of the Canister Storage Buildings (Canister Storage Buildings) necessary to store INEEL calcined waste under the Interim Storage Shipping Scenario. Under this scenario, the INEEL calcine would be shipped to the Hanford Site for storage in a Canister Storage Building beginning in 2012. Each year, approximately 260 canisters (308 cubic meters) of calcine would be shipped from INEEL to the Hanford Site. Additional Canister Storage Buildings would be constructed as needed. A total of three Canister Storage Buildings would be required to store the INEEL calcine. Shipments to the Hanford Site would be completed in 2025, and the INEEL waste would remain in storage pending the availability of the Calcine Dissolution Facility (Section C.8.5.2) and TWRS separations/vitrification facilities (Section C.8.5.3).

General Project Objectives

The project described in this Project Summary is part of the Interim Storage Shipping Scenario under the Minimum INEEL Processing Alternative of this Idaho HLW & FD EIS. The Interim Storage Shipping Scenario involves shipments of calcine from INEEL to the Hanford Site for storage in Canister Storage Buildings prior to the availability of the TWRS treatment facilities. The project addresses the costs and provides data to support the impacts analysis for the Canister Storage Buildings.

Process Description

The Canister Storage Buildings receive solid calcine from the INEEL. Calcine would be packaged in Hanford Site HLW canisters, each with a capacity of approximately 1.17 cubic meters. The calcine canisters would be stored until the calcine dissolution processes begin in 2028 (timed to coincide with the availability of double-shell tank storage space in the AP Tank Farm).

Facility Description

The Canister Storage Building presented is based upon a three-bay facility currently under construction at the Hanford Site to store spent nuclear fuel canisters. Over the last 10 years, several design packages have been developed for Canister Storage Buildings at both the Hanford Site and the Savannah River Site. The following three design documents were reviewed as part of this analysis:

- Project W-379 Spent Nuclear Fuel Canister Storage Building Detail Design Report August 1996
- Project W-464 Conceptual Design Report for Immobilized High-Level Waste Interim Storage Facility (Phase 1) HNF-2298, Revision 1
- DWPF Sludge Plant CAC Cost Estimate, dated December 14, 1983

Each Canister Storage Building would be approximately 3,700 cubic meters in plan area and would consist of a large subsurface vault with three individual bays. Each bay could hold 440 Hanford HLW canisters [the Hanford canisters are 0.61 meter (2 feet) in diameter by 4.5 meter (14 feet and 9 inches) long], for a total of approximately 1,320 Hanford HLW canisters per Canister Storage Building.

The Canister Storage Buildings consist of below grade concrete vaults accessed through a grade level operating deck. The operating deck is enclosed by a prefabricated metal structure. The operating deck is designed to support a 160,000 pound shielded canister transporter. The canister load-in/load-out area, operating deck, and support building are equipped with a HVAC system with high-efficiency particulate air filters. The Canister Storage Building vault areas are cooled by a natural convection cooling system that utilizes once-through unfiltered air, which exits through a common stack. The Canister Storage Building has a material service/design life of 75 years.

The cost data for this project are based upon current Hanford conceptual design information presented in Hanford Project W-464 for a three-bay Canister Storage Building constructed in the 200-East Area of the Hanford Site. The cost of the shielded canister transporter and other canister handling equipment was not included in the cost estimate for this project. It is assumed that all HLW canister handling equipment would have been purchased previously by the Hanford TWRS program and can be utilized for the INEEL waste. Construction and operations project data appear in Table C.8-22; decontamination and decommissioning data appear in Table C.8-23.

C.8.5.2 Calcine Dissolution Facility

Overview

This project describes the costs and impacts of the Calcine Dissolution Facility. The Calcine Dissolution Facility receives solid calcine from the Canister Storage Buildings (under the Interim Storage Shipping Scenario) or directly from INEEL (under the Just-in-Time Shipping Scenario). The calcine is received in Hanford Site HLW canisters, which are emptied and the solids dissolved using nitric acid. Undissolved solids (gamma-emitting alumina and zirconia) are removed and the resultant solution is neutralized using sodium hydroxide to a pH of 7. The dissolved calcine product is stored in existing double-shell tanks (specifically the AP Tank Farm which is well within its 50-year design life). The solution is then transferred to the existing TWRS separations/vitrification facilities (see Section C.8.5.3) for final treatment.

General Project Objectives

The project described in this Project Summary is part of the Minimum INEEL Processing Alternative of this Idaho HLW & FD EIS. INEEL waste would be received at the Hanford Site in a solid (calcine) form and would be dissolved at the Calcine Dissolution Facility to produce a material compatible with the existing double-shell tanks and TWRS separations/vitrification processes. This project addresses the costs and provides data to support the impacts analysis for the Calcine Dissolution Facility.

Process Description

Canisters containing calcine would be transported from a Canister Storage Building to the Calcine Dissolution Facility in a shielded canister transporter (under the Interim Storage Shipping Scenario), or unloaded from rail cars shipped from the INEEL (under the Just-in-Time Shipping Scenario). The Calcine Dissolution Facility would process the calcine over 27 months, starting in February 2028 and ending in April 2030. It is assumed that the calcine would be processed as a mixed alumina/zirconium calcine at average concentrations. At 80-percent operating efficiency, the facility has the capacity to handle six Hanford (1.17-cubic meters) canisters per day. This is also the feed rate necessary to meet the TWRS vitrification plant operating capacities.

The Calcine Dissolution Facility processing zones are Unloading/Loading, Air Lock/Decon, and Hot Cell with Inter Zone Transfer.

Unloading/Loading. Calcine is delivered into the unloading/loading bay by a shielded canister transporter, which contains the canister enclosed within a shielded cask. This cask is centered over a receiving plug within the unloading/loading building. The transporter removes the plug and lowers the canister into the transfer cage located below ground level which moves the canister through the rest of the process. The transporter then replaces the plug and returns to retrieve another canister.

Air Lock/Decon. Calcine canisters are moved into the air lock in preparation for hot cell entry. This area is also used for decontamination during normal operation and also for maintenance operations on cranes and equipment within the hot cell. Normal decontamination occurs within this area on empty canisters and cages. Empty calcine canisters are decontaminated for reuse in the HLW vitrification process.

Hot Cell. Canisters are delivered through the air lock into the hot cell. The first operation is to cut open the canister. The cutting operation also bevels the edge to allow for rewelding and reuse of the canisters. This operation is required to be under a negative pressure relative to the surroundings and provide positive dust control and total spark control. Cutting waste is directed to a grinder to granularize the cutting waste for subsequent processing.

After opening, the canister contents are removed using a vacuum-assisted auger design which transfers the calcine to one of two bins. The canister is then pre-cleaned to remove or stabilize the remainder of the powder. The entire operation of cutting, vacuuming, and pre-cleaning the canister is within a constant dust controlled process, sealed to prevent dust migration.

The calcine is delivered by vacuum to a cyclone separator which discharges into one of two feed bins. The feed bins are equipped with 0.03 micron sintered metal filters. Exhaust from the feed bin filters is routed through dual high-efficiency particulate air filters prior to discharging to the atmosphere.

Calcine is delivered from the feed bins to the dissolving tanks using rotary feeders. The dissolving tanks are operated using 6 molar nitric acid and are heated by steam for 2 hours prior to discharge. The dissolving tanks are agitated using a bottom rake and propeller design with a thorough mixing level of agitation. The concentration of the nitric acid is monitored during the cooking stage to keep above a 1-molar concentration. This should dissolve the majority (approximately 97 weight percent) of the calcine solids. Once the cooking stage is completed, any undissolved solids are separated and the solution is transferred to pH adjustment tanks where the pH is adjusted to basic conditions (above a pH of 7) with sodium hydroxide. This solution is then pumped into the double-shell tanks of the AP Tank Farm for lag storage pending further processing in the TWRS separations/vitrification facility. Assuming the calcine can be placed in solution using 10 liters (2.6 gallons) of nitric acid per kilogram of calcine, dissolution and neutralization of the INEEL HLW calcine would result in approximately 19.8 million gallons of calcine solution over a 17-month period of operations. Although the volume of the dissolved calcine is relatively large, the total radioactivity of this material is small in comparison to the Hanford tank wastes. The undissolved solids are transferred to the TWRS vitrification facility for processing into HLW glass.

Inter Zone Transfer. The transfer cage is mounted on wheels and is transported by gravity on an inclined track. Stops are installed at each key point to hold the cage in place while undergoing different handling steps. After the calcine is unloaded, the canister is returned through a continuous track to the unloading/loading building. The empty canister is removed by a transporter vehicle in a similar manner as the unloading operation and the cage is returned to its original position for processing another canister. Up to five canisters would be in process at any one time.

Double-Shell Tanks Lag Storage

The eight 1-million gallon double-shell tanks in the AP Tank Farm would be used for lag storage of the dissolved calcine solution prior to separations and vitrification. This would require that the Calcine Dissolution Facility be located close to the double-shell tanks. The solution from the Calcine Dissolution Facility pH control tanks would be pumped into the tanks for lag storage. While in storage, the slurry would be continuously mixed to prevent sludge settling. Once sufficient waste had accumulated in the tanks to support operations of the TWRS separations/vitrification facilities, the waste would be slurried using a mixer pump and pumped to the separations facility through the waste transfer lines.

Facility Description. This project addresses the costs and impacts of the Calcine Dissolution Facility. The Calcine Dissolution Facility includes three operating levels with floor space of 16,256 square feet on the Main Floor, 9,640 square feet on the Lower Floor, and 14,567 square feet on the Upper Floor. The Calcine Dissolution Facility is designed to house the equipment and systems for receiving the INEEL calcine canisters, dissolving the calcine, transferring the neutralized calcine solution to the double-shell tanks, and collecting any undissolved solids for processing in the HLW vitrification facility.

The Calcine Dissolution Facility building consists of four potentially contaminated zones and a clean zone for normal office and control operations. Zone 1, Hot Cell and the Crane Maintenance area, is kept at -0.75 inch W.C.; Zone 2 is at -0.25 inch W.C.; Zone 3 is a -0.1 inch W.C.; and Zone 4 is at -0.05 inch W.C. The clean zone is at 0.1 inch W.C.

Zone 1 is supplied with high-efficiency particulate air filtered air from an incoming air handler as well as air from Zone 3 which is not required for Zone 2. Negative pressure is maintained and the exhaust air is filtered through two high-efficiency particulate air filters prior to exhausting to outside air environment.

Zone 2, which is made up of the Air Lock/Decon area and the transport trenches, receives air from Zone 3 and pressure is maintained negative to Zone 3. Exhaust air is filtered by two high-efficiency particulate air filters prior to exhausting to the outside air environment.

Zone 3 contains the Direct Operations, Motor Gallery, and Mechanical Room. Zone 3 supplies air to Zone 1 and Zone 2 is kept negative to outside air and to Zone 4. Because this is air is completely used by other zones it is also filtered by two high-efficiency particulate air filters prior to exhausting to the outside air environment.

Zone 4 is the canister incoming and outgoing area. It has its own air supply and provides an air lock between the building and outside air for incoming and outgoing materials. It is maintained negative to outside air, and the exhaust air is filtered by two high-efficiency particulate air filters prior to exhausting to the outside air environment.

The clean zone is maintained positive to outside air and contains offices, change rooms, control room and storage. This space is separately heated and air conditioned from the rest of the space. The construction and operations project data for the Calcine Dissolution Facility appear in Table C.8-24; the decontamination and decommissioning data appear in Table C.8-25.

C.8.5.3 Calcine Separations and Vitrification

Overview

This project describes the costs and provides data to support the impacts analysis associated with the processing of dissolved calcine from the Calcine Dissolution Facility in the TWRS separations/vitrification facilities. The separations/vitrification facilities are existing TWRS facilities as described in the TWRS EIS under the Phased Implementation Alternative. The separations/vitrification facilities would process INEEL calcine waste for 17 months. This project provides covers operational impacts only; construction and decontamination and decommissioning of the TWRS separations/vitrification facilities are covered in the TWRS EIS.

General Project Objectives

The project described in this Project Summary is part of the Minimum INEEL Processing Alternative of this Idaho HLW & FD EIS. This project addresses the costs and impacts of operating the TWRS separations/vitrification facilities to process the INEEL waste.

Process Description

Separations and vitrification of the INEEL waste would require operation of the existing TWRS equipment, transfer line(s) from the double-shell tanks to the separations/vitrification facilities, and continuous mixing of the double-shell tanks.

The separations process would involve the following steps:

- Solids washing and solid-liquid separations
- Separations processing to remove cesium, technetium, strontium, and transuranics from the liquid stream
- Vitrification of the solid fraction and any undissolved solids from calcine dissolution in the Calcine Dissolution Facility in the TWRS HLW vitrification facility
- Vitrification of the liquid fraction in the TWRS low activity waste vitrification facility

After washing and separations processing, the waste would be stored in tanks within the vitrification facilities where it would be characterized and evaporated to remove excess water. The concentrated liquid or slurry waste would then enter the melter feed section of the vitrification facility.

The low-activity waste stream would be combined with glass formers. In order to produce a glass product with acceptable properties, the low-activity waste glass formulation is limited to 15 weight percent sodium oxide in the glass. Glass formers would be added to the melter feed to maintain the required sodium oxide loading. Following vitrification, the molten low-activity waste glass would be poured into 1.8 meters long by 1.2 meters wide by 1.2 meters high (2.6 cubic meters) steel boxes. A total of 14,400 cubic meters or 5,550 containers of vitrified low-activity waste would be produced.

The HLW stream would also be combined with glass formers. The limiting constituent in the HLW stream is zirconium. In order to produce a glass product with properties acceptable for disposal in the proposed geologic repository, the HLW glass formulation is limited to 13 weight percent zirconium oxide in the glass. Glass formers would be added to the melter feed to maintain the required zirconium oxide loading. Following vitrification, the molten HLW glass would be poured into 1.17 cubic meters canisters. A total of 730 cubic meters or 625 canisters of vitrified HLW would be produced.

The vitrification processes would generate large off-gas streams that would be treated to minimize air emissions. The off-gas treatment systems would capture and partially recycle contaminants in the off-gas streams back to the melter feed streams.

Liquid effluents from both the HLW and low-activity waste vitrification facilities would be treated at the existing Effluent Treatment Facility. The liquid effluent from processing the INEEL waste would be similar to Hanford's 242-A Evaporator condensate stream, which meets the current waste acceptance criteria for the Effluent Treatment Facility.

Facility Description

This project addresses the cost and impacts of the operation of the TWRS separations/vitrification facilities to process the INEEL calcine waste. The separations/vitrification facilities and support facilities would be constructed as described for the Phased Implementation Alternative in the TWRS EIS. The HLW vitrification facility would be designed to produce 20 metric tons of HLW glass per day. The low-activity waste facility would be designed to produce 185 metric tons per day of low-activity waste glass. Vitrified low-activity waste and HLW would be placed on pads in the 200-East Area or returned to Canister Storage Buildings until it can be transported back to INEEL. Construction and operations project data appear in Table C.8-26.

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Table C.8-22. Construction and operation project data for Canister Storage Building (HCSB-1).

Generic Information		**Construction Information (continued)**	
Description/function and EIS Project number:	Interim storage of INEEL Calcine	Air emissions:	
EIS alternatives:	Min. INEEL Proc. Alternative	Construction total: (tons/yr)	1,022
Project type or waste stream:	Calcine	Dust: (tons/yr)	216
Action type:	New	Major gas (CO_2) from diesel exhaust: (tons/yr)	764
Structure type:	Concrete and steel buildings	Contaminants[a] from diesel exhaust: (tons/yr)	42
Size: (m^2)	11,710		
Other features: (e.g., pits, ponds, power/water/sewer lines)	None	Effluents: Sanitary wastewater: (L/yr)	1,943,598
Location: Inside/outside of fence: Inside/outside of building:	Hanford 200 Area	Solid wastes: Construction trash: (m^3/yr)	936
Construction Information		Hazardous/toxic chemicals and wastes	
Schedule start/end:		Generation (used lube oil): (m^3/yr)	3
Preconstruction:		Storage/inventory: (m^3/yr)	0.2
CSB #1	January 2009-January 2010	Pits/ponds created: (m^2)	465 (per CSB)
CSB #2	January 2014-January 2015	Water usage: Dust control: (L/yr)	151,400
CSB #3	January 2019-January 2020	Domestic water: (L/yr)	1,943,598
Construction:		Energy requirements:	
CSB #1	January 2010-January 2012	Electrical: (MWH/yr)	2,850
CSB #2	January 2015-January 2017	Fossil fuel: (L/yr)	354,276
CSB #3	January 2020-January 2022	**Operational Information**	
Number of workers: (new/existing)	79/0 each yr	Schedule start/end:	
Nonradiation	79	CSB #1	January 2012-Apr 2030
Number of radiation workers	None	CSB #2	January 2017-April 2030
Average annual worker radiation dose (rem/yr)	None	CSB #3	January 2022-April 2030
Transportation mileage		Number of workers each year of operation (new/existing)	
Truck: (km/yr)	200,000	Total:	9/0
Rail:	0	Radiation workers:	9/0
Employees: (km/yr)	2,130,074	Average annual worker radiation dose: (person-rem/yr)	1.8
Heavy equipment:		Transportation mileage	
Equipment used	Excavator, grader, crane, delivery trucks	Truck:	0
Hours of operation: (hr/yr)	15,600	Rail:	0
Acres disturbed (per CSB)		Employees: (km/yr)	242,667
New (acres)	15	Heavy equipment:	Canister transporter, occasional delivery trucks
Previous (acres)	None		
Revegetated (acres)	None	Hours of operation: (hrs/yr)	5,840
		Air emissions: Fossil fuel emissions: (tons/yr)	302

Table C.8-22. (Continued).

Operational Information (continued)			
Effluents:		Pits/ponds used: (m^2)	None
Sanitary wastewater: (L/yr)	221,423	Water usage	
Solid wastes:		Process water: (L/yr)	0
Sanitary/industrial trash: (m^3/yr)	50	Domestic water: (L/yr)	221,423
Radioactive wastes:	None	Energy requirements	
Hazardous/toxic chemicals and wastes		Electrical: (MWH/yr)	44
Generation: (m^3/yr)	1.11	Fossil fuel: (L/yr)	132,626

a. CO, NO_x, SO_2, hydrocarbons, particulates.

Table C.8-23. Decontamination and decommissioning project data for Canister Storage Building (HCSB-1).

Decontamination and Decommissioning (D&D) Information			
Schedule start/end:	June 2030-June 2031	Air emissions:	
Number of workers each year of D&D (new/existing):	84/0 per year	Dust: (tons/yr)	0
Number of radiation workers (D&D):	None	Gases (CO_2): (tons/yr)	2,445
Average annual worker radiation dose:	0 (person-rem/yr)	Contaminants[a]: (tons/yr)	134
Transportation mileage		Effluents:	
Truck: (km/yr)	390,000	Non-radioactive sanitary wastewater (L/yr)	2,066,610
Rail:	0	Solid wastes:	
Employee: (km/yr)	2,264,889	Non-radioactive (industrial): (m^3/yr)	996
Heavy equipment:		Hazardous/toxic chemicals and wastes	
Equipment used:	Mobile cranes, roll-off trucks, dozers, loaders	Generation (used lube oil): (m^3/yr)	9.45
		Storage/inventory: (m^3/yr)	0.73
Hours of operation: (hr/yr)	49,920	Pits/Ponds created:	None
Acres disturbed:		Water usage	
		Process water: (L/yr)	151,400
New (acres)	None	Domestic water: (L/yr)	2,066,610
Previous (acres)	None	Energy requirements	
Revegetated (acres)	45	Electrical: (MWH/yr)	1,500
		Fossil fuel: (L/yr)	1,133,683

a. CO, NO_x, SO_2, hydrocarbons.

Table C.8-24. Construction and operation project data for the Calcine Dissolution Facility (CALDIS-001).

Generic Information	
Description/function and EIS project number:	Facility to unload INEEL calcine containing canisters and separate waste into HAW and LAW
EIS alternatives:	Minimum INEEL Processing Alternative
Project type or waste stream:	INEEL Aluminum and Zirconium Calcine and SBW Ion Exchange Resin
Action type:	New
Structure type:	Concrete and steel building
Size: (m^2)	3,761
Other features (e.g., pits, ponds, power/water/sewer lines)	Extension to existing underground utilities
Location:	Hanford 200 Area
Construction Information	
Schedule start/end:	
Construction:	Dec. 2023 - Dec. 2027
Number of workers: (new/existing)	
Nonradiation	286/0 each yr
Radiation workers (construction)	None
Average annual worker radiation dose (rem/yr)	None
Transportation mileage	
Truck: (km/yr)	67,500
Rail:	0
Employees: (km/yr)	7,711,407
Heavy equipment:	
Equipment used	Excavators, graders, cranes, Concrete trucks, material delivery trucks, and water trucks
Hours of operation (hr/yr)	2,080
Acres disturbed and duration:	August 2010 – December 2037
New (acres)	6.80
Previous (acres)	None
Revegetated (acres)	None
Air emissions:	
Construction total: (tons/yr)	83
Dust: (tons/yr)	56
Construction Information (continued)	
Major gas (CO_2) from diesel exhaust: (tons/yr)	25
Contaminants[a]: (tons/yr)	1.4
Effluents:	
Sanitary wastewater: (L/yr)	7,035,679
Solid wastes:	
Construction trash: (m^3/yr)	3,384
Hazardous/toxic chemicals and wastes	
Generation (used lube oil): (m^3/yr)	0.39
Storage/inventory (m^3/yr)	0.36
Pits/ponds created (m^2)	465
Water usage	
Dust control (L/yr)	151,400
Domestic water (L/yr)	7,035,679
Energy requirements	
Electrical: (MWH/yr)	208
Fossil fuel: (L/yr)	47,237
Operational Information	
Schedule start/end:	February 2028-April 2030
Number of workers each year of operation (new/existing)	
Operations	15/0
Maintenance	6/0
Support	2/0
Total	23/0
Number of radiation workers	23 (included in above total)
Average annual worker radiation dose (person-rem/yr)	4.6 (200 millirem/worker)
Transportation mileage	
Truck: (km/yr)	662,990
Rail: (km/yr)	0
Employees: (km/yr)	620,148
Heavy equipment	
Hours of operation (hrs/yr)	3,650
Air emissions	
CO_2 from diesel exhaust (tons/yr)	3,431
Contaminants[a]: (tons/yr)	187
Process radioactive air emissions: (Ci/yr)	1.99×10^{-4}
Other oxide air emissions: (kg/yr)	
B_2O_3	6.52×10^{-7}
BaO	2.44×10^{-8}

Table C.8-24. (Continued).

Operational Information (continued)			
CaO	1.12×10^{-6}	Hazardous/toxic chemicals and wastes:	
CdO	2.40×10^{-7}	Generation (hazardous wastes) (m^3/yr)	1
Cr_2O_3	9.41×10^{-8}	Process chemicals (nitric acid, sodium	
Fe_2O_3	1.50×10^{-7}	hydroxide): (m^3/yr)	31,371
$MgCO_3$	6.79×10^{-7}	Pits/ponds used:	None
MnO	3.48×10^{-9}	Water usage:	
Effluents		Process water: (L/yr)	26,750,511
Sanitary wastewater (L/yr)	565,858	Domestic water: (L/yr)	565,858
Solid wastes		Energy requirements	
Sanitary/industrial trash (m^3/yr)	127	Electrical: (MWH/yr)	13,615
Process output		Equivalent fuel oil to generate required	
Dissolved calcine to TWRS treatment		steam: (L/yr)	670,197
system: (L/yr)	33,288,889	Equipment/vehicle fuel: (L/yr)	82,892
Radioactive wastes		Total fossil fuel: (L/yr)	753,089
HEPA filters: (m^3/yr)	8		
Misc. radioactive wastes: (m^3/yr)	34		
Total: (m^3/yr)	42		

a. CO, NO_x, SO_2, hydrocarbons.

Table C.8-25. Decontamination and decommissioning project data for the Calcine Dissolution Facility (CALDIS-001).

Decontamination and Decommissioning (D&D) Information			
Schedule start/end:	April 2030-April 2032	Effluents:	
Number of workers each year of D&D (new/existing)	312/0 each yr	Radioactive:	
Number of radiation workers (D&D)	312	Spent decontamination solution: (L/yr)	295,264
Average annual worker radiation dose (rem/yr)	62 (200 mrem/worker)	(Ci/yr)	132,860
		Non-radioactive:	
		Sanitary wastewater: (L/yr)	7,669, 763
Transportation mileage		Radioactive wastes	
Truck: (km/yr)	42,500	Radioactive waste quantity[b]: (m^3/yr)	3,679
Rail: (km/yr)	0	(Ci/yr)	37
Employees: (km/yr)	8,405,631	Solid waste	
Heavy equipment:		Industrial trash: (m^3/yr)	3,689
Equipment used	Dozers, dump trucks, loaders, cranes, concrete trucks	Hazardous/toxic chemicals and wastes	
		Generation (used lube oil): (L/yr)	394
Hours of operations (all heavy equip.) (hr/yr)	2,080	Storage/inventory: (m^3/yr)	0.02
		Pits/ponds created: (m^2)	None
Acres disturbed		Water usage	
New (acres)	None	Dust control water: (L/yr)	151,400
Previous (acres)	None	Process water: (L/yr)	295,264
Revegetated (acres)	6.80	Domestic water: (L/yr)	7,669,763
Air emissions		Total water: (L/yr)	8,116,427
Non-radioactive:		Source of water:	Columbia River
Gases (CO_2) (tons/yr)	51	Energy requirements	
Contaminants[a]: (tons/yr)	2.78	Electrical: (MWh/yr)	156
Radioactive		Fossil fuel: (L/yr)	47,237
HEPA filtered off-gas: (Ci/yr)	0.80		

a. CO, particulates, NO_x, SO_2, hydrocarbons.

b. All tanks, pipes, vessels, pumps, filters and other equipment in immediate contact with process stream.

Table C.8-26. Project data for Calcine Separations/Vitrification (CALVIT-001).

Generic Information	
Description/function and EIS Project number:	Separation and Vitrification of HAW and LAW component at Hanford Treatment Facilities
EIS alternatives:	Min. INEEL Proc. Alternative
Project type or waste stream:	INEEL Aluminum and Zirconium Calcine and SBW Ion Exchange Resin
Structure type:	Existing facility
Size: (plain view)	
Other features: (e.g., pits, ponds, power/water/sewer lines)	None
Location:	Hanford 200 Area
Inside/outside of fence:	Inside
Inside/outside of building:	Inside
Operational Information	
Schedule start/end:	January 2029-April 2030
Number of workers (new/existing)	
Total	708/0 each yr
Number of radiation workers	657/0 each yr
Average annual worker radiation dose (person-rem/yr)	131 (200 millirem/worker)
Heavy equipment	
Hours of operation	0
Transportation mileage (km/yr)	
Truck: (km/yr)	250,000
Rail: (km/yr)	283,000
Employees: (km/yr)	19,089,778
Air emissions from vitrification	
HAW component	
Radionuclides (Ci/yr)	
Cs-137	2.36×10^{-5}
Sr-90	2.57×10^{-5}
Y-90	2.57×10^{-5}
Tc-99	8.99×10^{-10}
Am-241	2.02×10^{-8}
Pu-238	1.73×10^{-7}
Pu-239 and 240	6.125×10^{-9}
Pu-241	8.40×10^{-8}
Operational Information (continued)	
LAW Component	
Chemicals (g/sec)	
SO_2	4.98×10^{-1}
NO_2	5.63×10^{-1}
CdO	3.80×10^{-12}
Cr_2O_3	1.21×10^{-12}
Cl_2	8.02×10^{-4}
B_2O_3	2.90×10^{-11}
CaO	7.52×10^{-10}
Fe_2O_3	2.99×10^{-12}
UO_2	7.04×10^{-15}
BaO	3.94×10^{-13}
Radionuclides (Ci/yr)	
Cs-137	1.79×10^{-7}
Sr-90	4.62×10^{-7}
Y-90	4.62×10^{-7}
Tc-99	3.98×10^{-9}
Am-241	1.84×10^{-8}
Pu-238	1.14×10^{-8}
Pu-239 and 240	4.16×10^{-10}
Pu-241	1.69×10^{-9}
Effluents	
Sanitary wastewater: (L/yr)	17,418,570
Solid wastes	
Sanitary/industrial trash: (m^3/yr)	3,925
Radioactive wastes	
Vitrified waste output:	
LAW volume (m^3/yr)	10,417
LAW boxes (2.6 m^3/box) per year	4,019
HAW volume (m^3/yr)	530
HAW glass canisters (1.17 m^3/canister) per year	453
HEPA filters: (m^3/yr)	8
(Ci/yr)	23
Misc. radiological waste: (m^3/yr)	966
(Ci/yr)	966
Hazardous/toxic chemicals and wastes	
Generation (hazardous wastes): (m^3/yr)	0

Table C.8-26. (Continued).

Operational Information (continued)			
Pits/ponds used	None	Energy requirements	
Water usage		Electrical: (MWH/yr)	642,857
Process (HAW and LAW processing): (L/yr)	1,826,200,000	Fossil fuel: (L/yr)	4,140,000
Domestic (HAW and LAW processing): (L/yr)	17,418,570		

APPENDIX C.9

FACILITY DISPOSITION MODELING

TABLE OF CONTENTS

List of Tables

TABLE OF CONTENTS (Continued)

List of Tables (Continued)

List of Figures

TABLE OF CONTENTS (Continued)

List of Figures (Continued)

C.9 Facility Disposition Modeling

C.9.1 INTRODUCTION

This appendix describes the methodology and results of the fate and transport modeling that DOE performed as part of its analysis of the facility disposition alternatives. As discussed in Chapter 3 of this EIS, DOE considered multiple conditions in which the facilities could be readied for ultimate disposition. Some of these alternatives would result in an estimated amount of residual radioactivity and nonradiological constituents that would remain in the facilities after disposition and would be leached to the environment at some point in the future. The analysis in this appendix applies to INTEC HLW facilities (current and proposed). Assessment for facilities other than HLW is beyond the scope of this EIS. Section 5.4 of this EIS presents the long-term INTEC cumulative risk, including previous facility closures and decisions to be made in the Operable Unit 3-13 Remedial Investigation/Feasibility Study (Rodriguez et al. 1997). Any future environmental restoration or facility closure actions at INTEC would consider the long-term risk presented in this EIS.

As discussed in Section 3.2 of this EIS, DOE identified the following alternatives that could be implemented for disposition of some or all of the INTEC facilities:

- No Action
- Clean Closure
- Performance-Based Closure
- Closure to Landfill Standards
- Class A and Class C Grout Disposal
  - Performance-Based Closure with Class A Grout Disposal
  - Performance-Based Closure with Class C Grout Disposal
  - Disposal of Class A Grout in a Low-Activity Waste Disposal Facility
  - Disposal of Class C Grout in a Low-Activity Waste Disposal Facility

Implementation of any of these alternatives would have short-term impacts that are evaluated in Section 5.3 of this EIS. Long-term impacts of these alternatives are evaluated in this appendix and are based on the following assumed activities associated with the alternatives:

No Action – In the No Action waste processing alternative, the calcine in the bin sets and the liquid sodium-bearing waste in the Tank Farm would not be processed and would remain in those facilities.

During the period of active institutional control through 2095, surveillance and maintenance necessary to protect the environment and safety and health of workers would be performed in the normal course of INTEC operations. Beyond the period of institutional control, these materials could migrate into the environment.

Clean Closure - Under this alternative, facilities would have the hazardous wastes and radiological contaminants, including contaminated equipment, removed from the site or treated so that the hazardous and radiological contaminants would be indistinguishable from background concentrations. Clean Closure could require total dismantlement and removal of facilities. Use of the facilities (or the facility sites) after Clean Closure would present no risk to workers or the public from contaminants from previous activities.

Performance-Based Closure - Closure methods would be dictated on a case-by-case basis depending on risk associated with radiological and chemical hazards. The facilities would be decontaminated such that residual waste and contaminants no longer pose an unacceptable exposure or risk to workers or to the public. For the Tank Farm and bin sets, DOE anticipates using a specially engineered grout mixture to be placed in these facilities as a stabilization method. The grout would be designed to provide favorable characteristics that would provide long-term structural support and that would bind contaminants to reduce leaching to groundwater.

Closure to Landfill Standards - The facility would be closed in accordance with the state and federal requirements for closure of landfills. Closure to landfill standards is intended to protect the health and safety of the workers and the public from releases of contaminants from the facility. This could be accomplished by installing an engineered cap, establishing a groundwater monitoring system, and providing post-closure monitoring and care of the waste containment system, depending on the type of contaminants. As with the Performance-Based Closure, DOE anticipates using a specially engineered grout mixture to be placed in these facilities as a stabilization method for the Tank Farm and bin sets. The grout would be designed to provide favorable characteristics that would provide long-term structural support and that would bind contaminants to reduce leaching to groundwater.

Class A and Class C Grout Disposal - As discussed in Chapter 3 of this EIS, several of the waste processing options would result in production of a low-activity waste stream which would then be grouted and disposed of in (1) a near-surface disposal facility on the INEEL, (2) an offsite disposal facility, or (3) the Tank Farm and bin sets. Based on its content, the grout would be categorized either Class A or Class C low-level waste and would contain residual radioactivity that could be leached to the groundwater. For purposes of analysis in this appendix, DOE considered the following alternatives for onsite disposal of this grout:

- Performance-Based Closure with Class A Grout Disposal – The facilities would be closed as described above for the Performance-Based Closure Alternative. Following completion of these activities, the Tank Farm and bin sets would be used to dispose of Class A grout produced under the Full Separations Option under the Separations Alternative.

- Performance-Based Closure with Class C Grout Disposal – The facilities would be closed as described above for the Performance-Based Closure Alternative. Following completion of these activities, the Tank Farm and bin sets would be used to dispose of Class C grout produced under the Transuranic Separations Option under the Separations Alternative.

- Disposal of Class A Grout in a Low-Activity Waste Disposal Facility – The Class A grout produced under the Full Separations Option under the Separations Alternative would be placed in a low-activity waste disposal facility. For purposes of calculating the total impact of this alternative, the other INTEC HLW facilities addressed in this appendix are assumed to be closed under the Performance-Based Closure Alternative.

- Disposal of Class C Grout in a Low-Activity Waste Disposal Facility – The Class C grout produced under the Transuranic Separations Option under the Separations Alternative would be placed in a low-activity waste disposal facility. For purposes of calculating the total impact of this alternative, the other INTEC HLW facilities addressed in this appendix are assumed to be closed under the Performance-Based Closure Alternative.

C.9.2 SCENARIOS AND ASSUMPTIONS

Because analyzing the potential impacts requires projection of events that would occur in the future, DOE developed scenarios and assumptions to provide a quantitative basis for evaluating the impacts. DOE believes it has used reasonable judgment to develop scenarios that will allow a meaningful comparison of the impacts among alternatives rather than attempting to calculate an upper bound for the impacts through the use of overly conservative assumptions.

The major assumptions that DOE made in its assessment of impacts are as follows:

- The land in question is the general vicinity of the current INTEC. Institutional control would be maintained over this area until the year 2095. After that time, it is assumed for purposes of analysis that the land would not be controlled, and might be used for residential, industrial, or recreational purposes for a period of roughly 10,000 years.

- For alternatives other than the No Action and Clean Closure alternatives, DOE assumed that a grout material would be used to fill the Tank Farm and bin sets to provide long-term structural stability. DOE also assumed that this grout would be specially engineered to provide favorable characteristics that would inhibit the leaching of some contaminants to the aquifer. For purposes of analysis, DOE assumed that the grout would be similar to that used in high-level waste tank closure activities at the Savannah River Site.

- Future human receptors who use or work on this land may be exposed to radionuclides, or to carcinogenic or non-carcinogenic contaminants. As a result of the screening assessment described in Section C.9.3.6, intakes from the groundwater pathway were assessed in detail for the following contaminants of potential concern:

  - The long-lived radionuclides technetium-99 (Tc-99) and iodine-129 (I-129)
  - Cadmium, a chemical contaminant which is associated with both cancer and noncancer health effects
  - Fluorides and nitrates, which are non-carcinogenic toxic substances.

- Exposure to direct radiation from radionuclides in closed facilities was assessed using estimated radionuclide inventories. The reference inventory for each facility applies to the year 2016; these were decay-corrected to apply to the time frame of the specific cases assessed.

- Except for the case of No Action for the bin sets, there would be no credible scenario under which significant amounts of radionuclides from closed facilities would be released to air.

- Surface water exposure scenarios were not considered credible events for the setting and time frames analyzed.

- All residual contaminants would reside on the floor of the tanks or facilities. For those alternatives that use Class A and Class C grout, the contaminants in the grout would be uniformly distributed throughout the grout instead of being deposited on the floor. However, to be conservative, the residual facility contaminants would still be assumed to reside on the floor.

- At 500 years, the concrete and grout in the tanks and facilities assumes the same hydrogeologic transport characteristics as the surrounding soil; however, chemical properties of grout and concrete would remain unchanged. This assumption is consistent with the NRC draft position that no credit can be taken for engineered physical components after at most 500 years (NRC 1994). In addition, the design life of the bin sets is estimated to be 500 years.

- The present environmental conditions in and around the dispositioned facilities (i.e., meteorology, infiltration rates, geologic conditions) would remain constant throughout the entire 10,000-year period of analysis.

- The analytical endpoints of the assessment were as follows:

  – Radiation (radionuclide intake and direct radiation exposure) – Total effective dose equivalent and lifetime excess total cancer risk

  – Cadmium – Intake rate (mg/kg-d), associated cancer risk (chance per million), and hazard quotient, which is the ratio of the chronic intake rate to the reference dose (RfD)

  – Fluorides and nitrates – Intake rate (mg/kg-d) and hazard quotient

- Risk assessment results are presented and discussed primarily for purposes of comparison between closure scenarios, and do not include results of baseline risk assessments performed for other INTEC sources.

Assumptions related to specific alternatives are described in the following sections.

No Action Alternative

As discussed in Chapter 3, under the No-Action waste processing alternative, waste would remain in the Tank Farm and bin sets. Therefore, in this appendix, DOE has evaluated the potential long-term consequences of failure of the Tank Farm and bin sets that contain this material. In its evaluation of impacts, DOE has assumed that no fill material is placed in the facilities. Section C.9.3.1 describes DOE's assumptions on the source material.

Clean Closure

As described above, this alternative would involve removing all residual contaminants so as to be indistinguishable from background. Because there would be no source term to evaluate over the period of analysis, long-term modeling for this alternative was not performed.

Performance-Based Closure

Under this alternative, the facilities would be cleaned to meet performance-based objectives. Following cleaning, the facilities would be closed. For the Tank Farm and bin sets, a clean grout material would be used to fill the volume of these facilities. As discussed above, DOE assumed, for purposes of analysis, that the grout to be used would be similar in composition and properties as that used for high-level waste tank closure activities at the Savannah River Site (DOE 1997). Although studies have shown that cementitious materials (such as grout or concrete) can be expected to last for extended periods of time approaching 1000 years or more (Poe 1998), DOE assumed that the grout and concrete structure of the bin sets and tanks will fail structurally at 500 years post-closure. The grout was assumed to completely cover the contaminants, which were assumed to reside on the floor of the facilities.

The major mechanism for contaminant transport in these facilities would be leaching by water. Because the facilities are above the aquifers underlying INTEC, the primary source of water for leaching would be precipitation that moves vertically through the facilities and transports contaminants to the aquifer system. Precipitation in the region of INTEC averages approximately 9 inches per year. However, due to evaporation and runoff, the actual infiltration rate into soils in this area is about 1.6 inches per year (Rodriguez et al. 1997).

During the 500 years prior to structural failure of the facilities, a minimal amount of leaching was assumed to occur, and DOE took no credit for the presence of steel liners in the Tank Farm. The hydraulic conductivity of the grout and the concrete in the facilities would limit the actual amount of water that can move through the facilities. However, after the assumed failure occurs, the cementitious materials were assumed to have a much higher hydraulic conductivity, allowing more water to pass through the facilities and leach contaminants to the aquifer system. The chemical characteristics of the grout, however, are expected to persist long after the analysis period of 10,000 years (DOE 1998). Therefore, DOE believes that the chemical characteristics of the water passing through the grout would continue to inhibit the amount of leaching that would occur after failure. Section C.9.6 discusses the input parameters and assumptions in more detail.

Closure to Landfill Standards

The assumptions for this alternative were identical to those for Performance-Based Closure. As discussed in Section C.9.3, DOE assumed the same inventory of contaminants for this alternative and the Performance-Based Closure Alternative. Therefore, DOE relied on calculations for the Performance-Based Closure Alternative to be representative of impacts for this alternative.

Class A and Class C Grout Disposal

As discussed earlier, a Class A or Class C grout mixture would be generated as a result of the waste processing alternatives described in Chapter 3. DOE assumed for purposes of analysis that this grout would be similar in chemical composition to that described above for the Performance-Based Alternative except that the grout in this alternative would have contaminants in it from implementing the waste processing alternatives.

Performance-Based Closure with Class A or Class C Grout Disposal

This alternative was analyzed in a similar manner as the Performance-Based Closure Alternative, except in this instance, the grout that would be used to fill the Tank Farm and bin sets was assumed to contain additional contaminants beyond that already present in the facilities to be closed. Therefore, there would be two sources of contaminants in the Tank Farm and bin sets: the residual contamination following cleaning activities and the contamination in the grout to be poured into the facilities.

Disposal of Class A or Class C Grout in a Low-Activity Waste Disposal Facility

If DOE selected this alternative, the Class A or Class C Grout would be disposed of in a low-activity waste disposal facility specially constructed to minimize leaching. The other facilities would be closed in accordance with alternatives selected by the decisionmaker. For presentation of impacts, DOE has assumed that the Tank Farm and bin sets would be closed under the Performance-Based Alternative.

Under this alternative, the grout was assumed to remain intact for 500 years, after which time the grout would fail in a similar fashion as that described for the Performance-Based Closure Alternative. The increased hydraulic conductivity would allow more water to flow through the grout, but the chemical properties of the grout were assumed to remain unchanged over the period of analysis.

C.9.3 FACILITY CONTAMINANT SOURCE TERMS

This section describes the methodology and assumptions used by DOE to estimate the amount of material remaining in INTEC HLW facilities after closure for each of the facility disposition alternatives described in Section C.9.2. The amount of contaminants within the waste affects the quantity that could ultimately be transferred to the aquifer. Larger initial amounts would generally lead to greater fluxes to the aquifer while lower initial amounts would cause lower fluxes and hence lower concentrations of contaminants in the aquifer. The exception to this occurs for contaminants that are limited by their solubility in solution. Plutonium is an example of such a contaminant in that the initial amount in the source layer may far exceed the ability of the interstitial solution to dissolve the plutonium. In this case, a higher initial amount would not necessarily cause a greater flux to the aquifer, but the transfer to the aquifer would be protracted due to plutonium’s limited solubility.

DOE performed engineering studies to estimate the amount of contaminants that could be left in facilities following disposition. Table C.9-1 lists these values by facility and alternative. As discussed in Section C.9.2, for purposes of analysis, DOE assumed that the amount and character of the residual inventory would be the same for both Performance-Based Closure and Closure to Landfill Standards (for those facilities for which both facility disposition alternatives are applicable).

For all pathways except external irradiation, the source inventories in Table C.9-1 were used because the entire inventories were available for transport to the receptor location. The values in Table C.9-1 for radionuclides have been decayed to the year 2016 to provide a consistent basis for analysis. For external irradiation, however, DOE postulated that the receptor would be closer to a particular facility than the others. Consequently, the receptor would not be exposed to all the contaminants in all the facilities to the same degree.

C.9.3.1 No Action Alternative

Tank Farm

DOE developed Tank Farm inventory and source terms for the No Action Alternative (Beck 1999b) using the following assumptions:

- The New Waste Calcining Facility calciner would operate until June 2000 then would be closed
- The High-Level Liquid Waste Evaporator would operate from September 2000 until all the dilute waste is concentrated and the pillar and panel vaulted tanks are empty in FY-2003

- Cease use of pillar and panel tank would be achieved by June 30, 2003
- Five tanks would remain in service to be filled by future waste generation
- Tanks WM-180, WM-188, & WM-189 would be at capacity in FY-2003
- Tank WM-187 and WM-181 would continue to receive waste until full
- Tank WM-190 would remain as the spare tank
- Newly generated liquid wastes would have a typical SBW composition when added to the Tank Farm

Based on the assumptions, DOE estimated the contents of each of the five 300,000-gallon storage tanks and the eventual date they would be filled. The estimated tank volumes are listed in Table C.9-2. These results were then used to generate an estimated source term. The source terms are described in Beck (1999c) and are listed in Table C.9-1.

Table C.9-2. Estimated Tank Farm volumes under the No Action Alternative[a].

Tank	Volume (gallons)
WM-180	262,000
WM-187	285,000
WM-188	285,000
WM-189	285,000
WM-181	285,000
Total	1,402,000

a. Source. Beck (1999b).

Bin Sets

Since December 1963, fluid-bed calcining has been employed at INTEC to convert aqueous wastes to granular solids. The wastes are processed in a heated fluidized-bed calciner where they undergo thermal decomposition to metallic oxides or fluorides, water vapor, and nitrogen oxides. The solids are transported to stainless steel bins for interim storage. A summary of the volumes of liquid wastes calcined over the years is presented in Table C.9-3. Detailed operational chronologies for the various calcination campaigns are presented by Staiger (1999).

The characteristics of the calcine in the bin sets are described in detail by Staiger (1999). An accurate quantitative inventory of the solids stored in the bin sets is not available. Staiger (1999) presents the

Table C.9-3. Summary of calcination campaigns[a].

Campaign	Date	Liquid to Calciner (gal)	Solids Stored (m^3)
WCF 1	Nov. 1963 – Oct. 1964	512,000	217
WCF 2	March 1966 – March 1968	989,000	422
WCF 3	Aug 1968 – Jun 1969	329,000	170
WCF 4	May 1970 – Jan 1971	225,000	139
WCF 5	Sep 1971 – Apr 1972	300,000	164
WCF 6	May 1973 – May 1974	386,000	196
WCF 7	May 1975 – Jan 1977	375,000	257
WCF 8	Sep 1977 – Sep 1978	469,500	256
WCF 9	Jun 1979 – Mar 1981	476,000	327
NWCF 1	Aug 1982 – Jun 1984	1,553,000	813
NWCF 2	Sep 1987 – Dec 1988	797,800	445
NWCF 3	Dec 1990 – Nov 1993	752,500	386
NWCF 4	May 1997 – May 1999[b]	661,300	480

a. Source. Staiger (1999).
b. Through Batch 489 and 252,900 gallons of evaporation by the High-Level Liquid Waste Evaporator.

results of a comprehensive search of many sources of information summarized in the appendices to that report.

Individual bin inventories have been estimated from calciner liquid feed information. Information that is of current interest, particularly the concentration of long-lived radioactive isotopes and RCRA metals, was not routinely collected at the time of waste generation. To fill this information gap for long lived radioactive species, the inventories were estimated based on evaluation of the available information and process knowledge.

Chemical

Chemical information was assembled from original Tank Farm and calciner feed tank sample analysis reports; transcribed analysis information found in reports, letters, and data sheets; as well as knowledge of process; and miscellaneous notes. These data were adjusted to account for dilution and chemical adjustment, where appropriate. Where analytical determinations were not made and the constituent was known to be present, estimates were made of the chemical content. Additives to feed batches were determined from individual feed make up sheets where available and were estimated when sheets were not available.

Total quantities of material in individual bins have been estimated. The filling sequence was estimated using thermocouple measurements. This information was used to determine how the calcine was distributed between the several bins in the storage facility. Chemical amounts are reported in Table C.9-1.

The quantity of mercury in the calcine product was adjusted to reflect observed mercury retention in the calcine product. It was assumed that 70 percent of the mercury was retained in the product for campaigns one, two, and three, which operated at a 400°C fluidizing temperature. During subsequent campaigns, operating at 500°C, a 1.0 percent retention of mercury in the product was assumed. This assumption is supported by the following work:

- Dissolution of calcine resulting from processing of mercury containing feed during New Waste Calcining Facility campaign H-4 showed approximately 50 parts per million mercury present.

- For dilute zirconium feed, only an insignificant fraction (approximately 0.5 percent) of feed stream mercury was present with the fines and this fraction is even less for the calcine product.

- For SBW, 1.7 percent of the mercury was found in the fines when aluminum nitrate was used as a calcination additive and 0.13 percent was found when dilute zirconium feed is the additive. The retention was substantially lower for bed material.

Radiochemical

The concentrations of radionuclides are estimates. Limited definitive information was provided for radionuclides at the time fuel was shipped to INTEC. The estimation methodology predicted fission product inventories using a well known computer code, "ORIGEN2.1, Isotope Generation and Depletion Code Matrix Exponential Method." Resultant radionuclide concentrations in the calcine are presented in Table C.9-1, which was compiled by the following method. First a list of nuclides of interest was generated using Table 1 and Table 2 in 10 CFR 61.55. Those species that are volatile/combustible during calcination, H-3 and C-14, are not expected to be present in the calcine and are not shown. Activated metal species were eliminated because there is no activated metal sorted with the calcine. Measurements have confirmed that only a small fraction of the iodine present in the reprocessed fuel is potentially sent to calcine storage, therefore, I-129 is not included in the list for the calcine storage bins (Staiger 1999).

The nuclide concentration in the various feed streams shown were estimated based on decay to 2016 of the laboratory measured concentration for Cs-137. It was assumed that the cesium is not preferentially concentrated in plant waste and that the ratios in the wastes are the same as those in the parent fuel prior to reprocessing.

C.9.3.2 Performance-Based Closure/Closure to Landfill Standards

Tank Farm

The residual source terms remaining in the Tank Farm after closure (for Performance-Based Closure or Closure to Landfill Standards) were derived based on the following assumptions, which are further described in Beck (1999a).

- Starting tank heel volumes would be per historic heel volume data adjusted as in Table C.9-4.

Table C.9-4. Tank Farm heel volume estimates.[a]

Tank	Historical	Adjusted Estimate	Comments
WM-180	9,500 gal.	10,000 gal.	
WM-181	7,500 gal.	10,000 gal.	
WM-182	3,600 gal.	5,000 gal.	
WM-183	----	5,000 gal.	Never Emptied
WM-184	----	5,000 gal.	Never Emptied
WM-185	4,600 gal.	5,000 gal.	
WM-186	----	5,000 gal.	Never Emptied
WM-187	13,700 gal.	12,000 gal.	Should be lower (instrument calibration)
WM-188	13,700 gal.	12,000 gal.	Should be lower (instrument calibration)
WM-189	5,000 gal.	5,000 gal.	
WM-190	----	5,000 gal.	Never Filled

a. Source. Beck (1999a).

- When a tank is jetted down during flushing (flush water would be removed by using existing jets and not submersible pumps), the diluted liquid would be transferred to another large Tank Farm tank along with any solids that are carried out with the liquid.
- Every heel (before closure flushes) would be assumed to be a SBW heel.
- Tank heels would be flushed to pH=1.5 - 2.0. For the purposes of calculating source terms, pH would be assumed to be 2.0.
- Complete mixing of flush water with heel by using a mixing ball during the wall washing process would be achieved.
- There would be no precipitation due to pH adjustment.

- Solids on walls of tanks would rinse off and would not significantly add to the solids and source term load.

- All of the original mass of tank solids would remain in each tank.

- Vault contamination is insignificant compared to the levels left in the tanks (except for sand under tanks WM-185 & WM-187).

- Each tank has a very limited pedigree with respect to radionuclides in either the liquid or solid wastes. To overcome this deficiency, inventories for typical waste types at INTEC have been prepared. These residual calculations assume that the waste existing in the individual tank heels is represented by SBW. The inventories were calculated by normalizing the calculated inventories to the activity of the Cs-137 (decayed to 2016) measured in the tank.

- Tank solids are estimated to be one inch thick with a porosity of 34 percent. The thickness of the solid layer is a conservative estimate based on the recent video inspections of the inside of tank WM-188. The porosity conforms to the voids observed in loose packed uniform sand. The solids are assumed to be completely removed from the internal surfaces except the tank bottom. It was assumed that the solids radioactivity is derived from a variety of sources and is best represented by the constituents associated with SBW. Again radionuclide distributions were calculated by normalizing to the measured Cs-137 concentration, based on the empirical data from the sampling of tank WM-188. Concentrations of Pu-238, Pu-239, Np-237, and Am-241 were corrected to agree with sample results.

- Interstitial liquid in the heel solids is assumed to be the liquid filling the particular tank after dilution to pH 2.

- Flushing operations would disturb most of the solids on the bottom of the tank thus achieving dilution of the activity trapped in the interstices. However, a 10 percent fraction is assumed to be shielded from agitation and therefore does not experience dilution of the interstitial liquid.

- Interstitial liquid radiochemical concentrations are calculated from Wenzel (1997) normalized to the Cs-137 concentration.

- The heel solids are assumed to be the same for all tanks and have a bulk density of 1.22 g/cm^3. This wet bulk density was corrected to a dry particle density of 1.65 g/cm^3 assuming that the porosity is 34 percent and that the interstices were filled to 30 percent by 1.28 specific gravity solution.

- The tank support sand pads under WM-185 and WM-187 were significantly contaminated with aluminum type waste during siphoning incidents in March 1962. The interstitial volume of the sand pad under tanks WM-185 and WM-187 is calculated at 2100 gallons assuming a porosity factor of 0.34. Infiltration water (from surface water run-off) flushing of the sand pad has occurred since the siphon event. Periodic removal of the infiltrating water is assumed to have flushed some of the activity from the sand. The residual activity for these species is added to their respective tanks.

- The residual liquid heel is jet pumped to 400 gallons at the time of grouting.

Bin Sets

The volume of the solids in the emptied bin set vessels is assumed to be 0.5 percent of the filled volume (Staiger 1998). The concentrations of radiological and chemical constituents in the emptied vessels is assumed to be the same as for the filled bin sets under the No Action Alternative, described above. The residual activity in the bin sets after closure is listed in Table C.9-1.

Other Facilities

Other existing INTEC HLW facilities evaluated in this appendix are the Process Equipment Waste Evaporator (CPP-604) and the New Waste Calcining Facility (CPP-659). DOE assumed (Beck 1998) that the residual inventory in these facilities after closure would be less than the amount remaining in the Waste Calcining Facility (CPP-633) after it was closed. DOE conservatively assumed that the residual inventory in the Process Equipment Waste Evaporator and New Waste Calcining Facility would be equal to the Waste Calcining Facility. The characteristics of the residual remaining in the Waste Calcining Facility are described by Demmer and Archibald (1995). The residual activity in the Process Equipment Waste Evaporator and New Waste Calcining Facility after closure is listed in Table C.9-1.

C.9.3.3 Class A or Class C Grout Disposal in a New INEEL Disposal Facility

As described in Chapter 3, approximately 27,000 cubic meters of Class A grout would be produced under the Full Separations Option and approximately 22,700 cubic meters of Class C grout would be produced under the Transuranic Separations Option. One method evaluated for disposal of this grout is disposal in a new Low-Activity Waste Disposal Facility, an engineered near-surface disposal facility. The characteristics of the radioactive and chemical constituents in this Class A or Class C grout are described by Russell et al. (1998) and are listed in Table C.9-1.

C.9.3.4 Performance-Based Closure with Class A or Class C Grout Disposal

In addition to disposal in a new Low-Activity Waste Disposal Facility, as described in Section C.9.3.3, DOE evaluated a second onsite method for disposal of the Class A or Class C grout produced under the Full Separations and Transuranic Separations Options. This second onsite disposal method is disposal in the Tank Farm and bin sets, after these facilities have undergone performance-based closure. The Class A or Class C grout would serve to bind residual contaminants remaining in these facilities and provide structural stability in the closed facilities.

DOE assumed that the Class A or Class C grout would be divided equally between the Tank Farm and bin sets (i.e., one-half of the volume in each facility). The Class A or Class C grout would be in addition to the residual contamination remaining in the Tank Farm and bin sets after performance-based closure (as discussed in Section C.9.3.2). Table C.9-1 lists the characteristics of the radioactive and chemical constituents in Tank Farm and bin sets under the Performance-Based Closure with Class A Grout Disposal and the Performance-Based Closure with Class C Grout Disposal alternatives.

C.9.3.5 Direct Radiation Exposure

The assessment of exposure scenarios includes cases where future receptors are exposed to direct radiation from either (a) radionuclides in contaminated soil; (b) residual radioactivity in closed facilities including the Tank Farm, bin sets, and other INTEC facilities used for high-level waste management; or (c) facilities that could be used for radioactive waste disposal, including the Tank Farm, bin sets, or a new Low-Activity Waste Disposal Facility. External dose factors were developed for soil and closed facilities using the IDF code, which is part of the GENII package (Napier et al. 1988). DOE developed exposure scenarios for soil and closed facilities for the same categories of receptors as described previously. These scenarios and the associated data and assumptions are described below. Separate sections are provided for closed facility and soil contamination assessments since there are major differences in the methodology between the two. A section is also provided to explain the manner in which dose results from individual cases are summed to arrive at total external dose.

Dispositioned Facilities

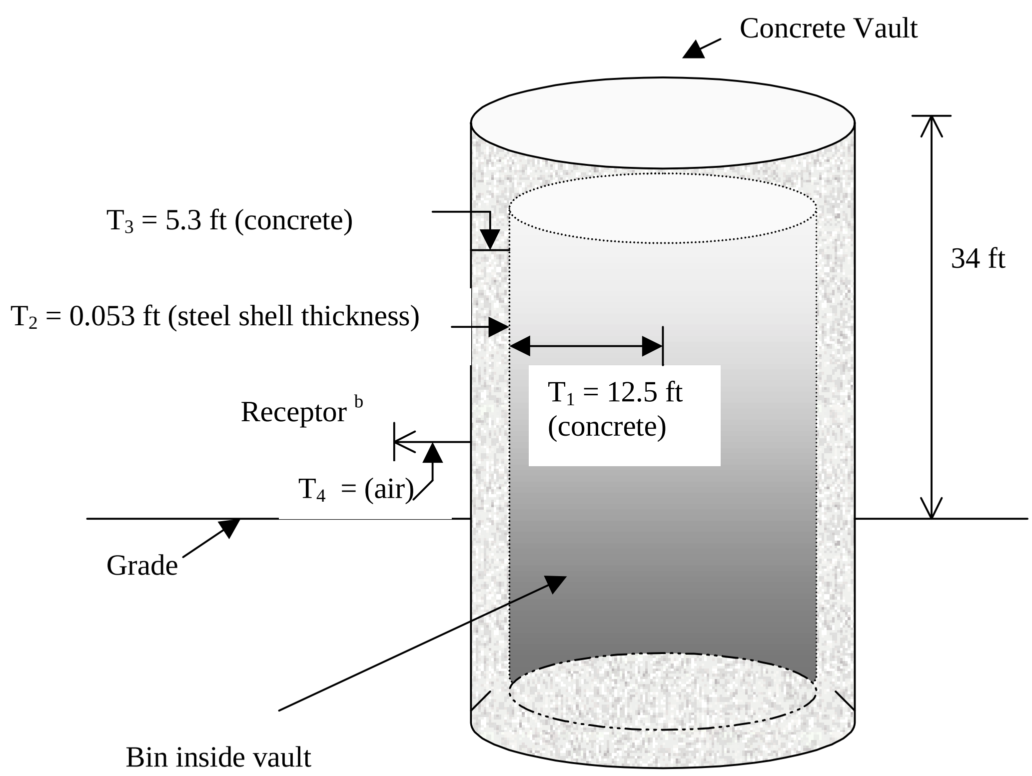
The approach for modeling external dose from radionuclides in dispositioned (closed) facilities began with the development of a conceptual model which defines the source geometry, dimensions, and shielding materials for each source facility. For some existing facilities, this model is closely patterned after the actual construction of the facility under evaluation, while for others simplifying assumptions were necessary. For example, the source geometry and construction materials used for the Tank Farm model closely approximate those of existing storage tanks, whereas a simplified geometry is used to approximate the more complex array of calcine storage bins within a bin set. DOE then made conservative estimates for the average distance between receptor and source for each category of receptor and source facility. These conceptual models and source-receptor distances are illustrated in Figures C.9-1 through C.9-4.

The initial source term for each facility is the estimated radionuclide contents decay-corrected to the Year 2016. For the Tank Farm and bin set modeling, the single tank or bin set with the highest inventory was selected as the source facility to be used for the residual contamination and No Action cases. For cases in which the tank or bin sets are filled with Class A or C grout, the dose from both residual activity and radionuclides in the waste materials are included. Table C.9-5 identifies the specific radionuclides and the estimated activity levels used for each source facility. Although other radionuclides are present in these facilities, the radionuclides listed account for more than 99 percent of the external dose rate over the period of evaluation. The 2016 inventory is used as the source term for all exposure scenarios that occur during the period of institutional control (specifically, the INEEL worker or unauthorized intruder exposure scenarios). For all other scenarios, the radionuclide inventory is decay-corrected to 2095, which is assumed to be the earliest date at which institutional control could be lost.

The next step involved using the IDF model to generate external dose factors (millirem per hour per Ci or millirem per hour per Ci/m^3). The dose factor was then multiplied by the appropriate inventory values (Ci or Ci/m^3) to obtain a dose rate in millirem per hour, which was in turn multiplied by the receptor exposure time (Section C.9.6.4, Table C.9-9) to obtain external dose in millirem.

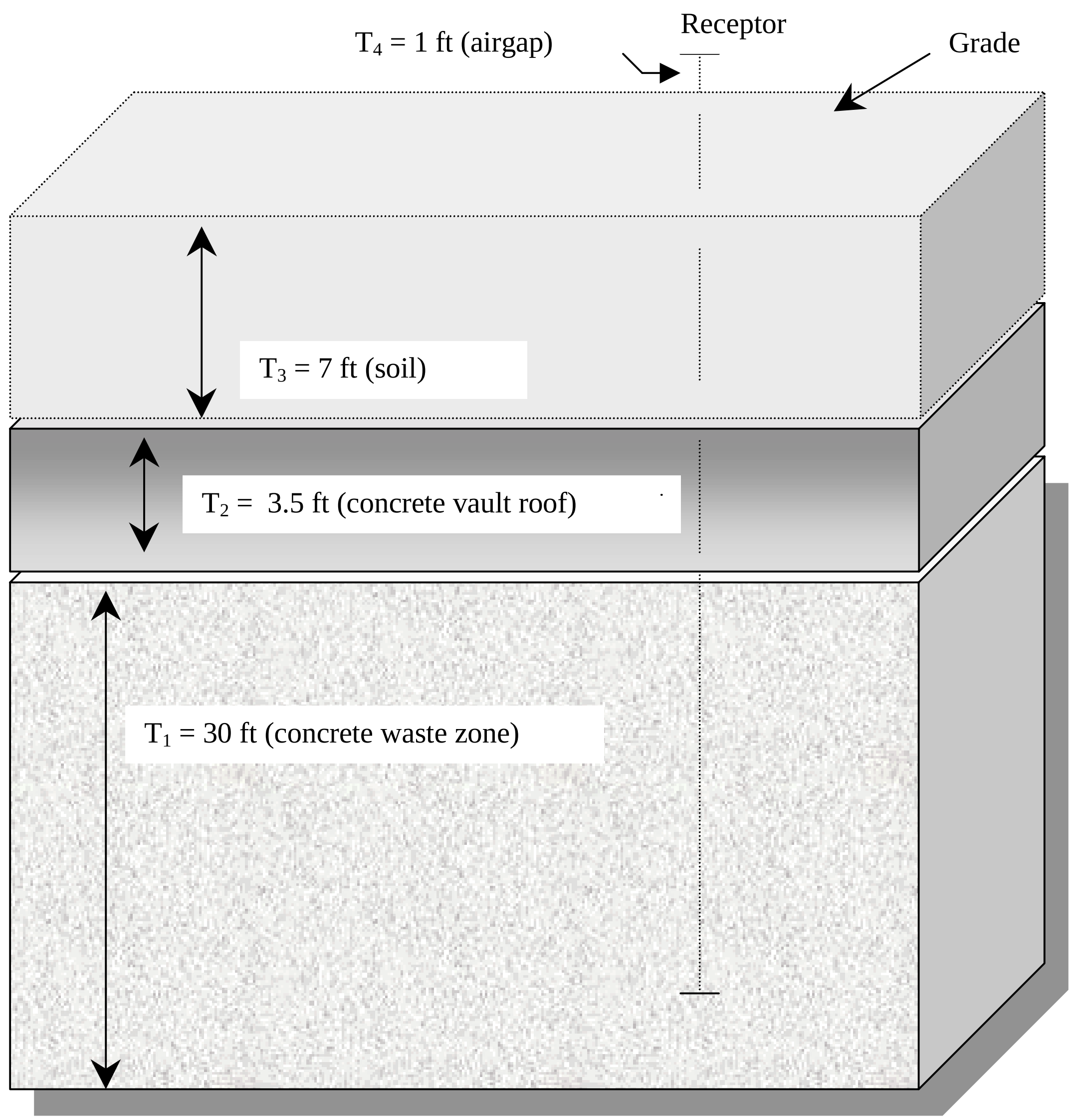
Soil

External dose is also calculated for receptors located over ground that has become contaminated from irrigation with contaminated groundwater. DOE performed these evaluations only for the radionuclides that were quantitatively assessed for the groundwater pathway, namely Tc-99 and I-129 (see Section C.9.3.6). In these evaluations, the Tc-99 and I-129 soil concentration is calculated using the



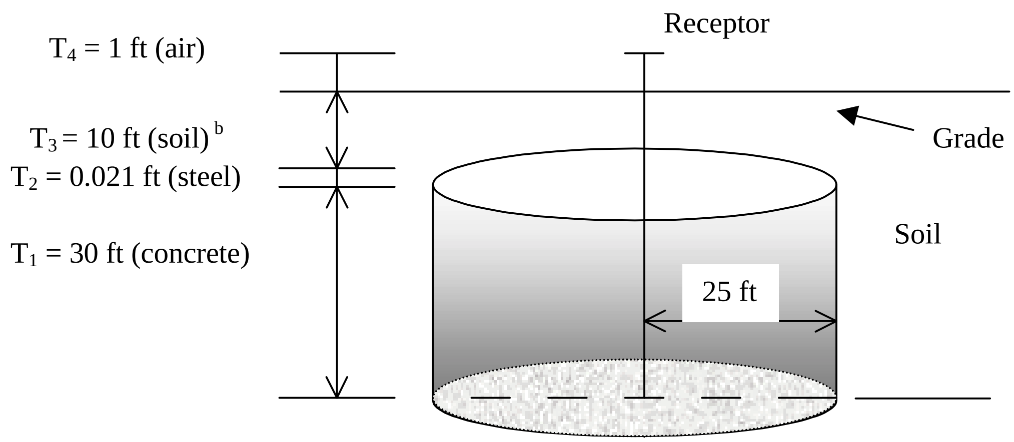
a. Figure not to scale.
b. Distance (air gap) is 3 ft for intruder and 10 ft for other receptors.

Figure C.9-1. Model of bin set with either residual activity or Class A or C grout fill.[a]



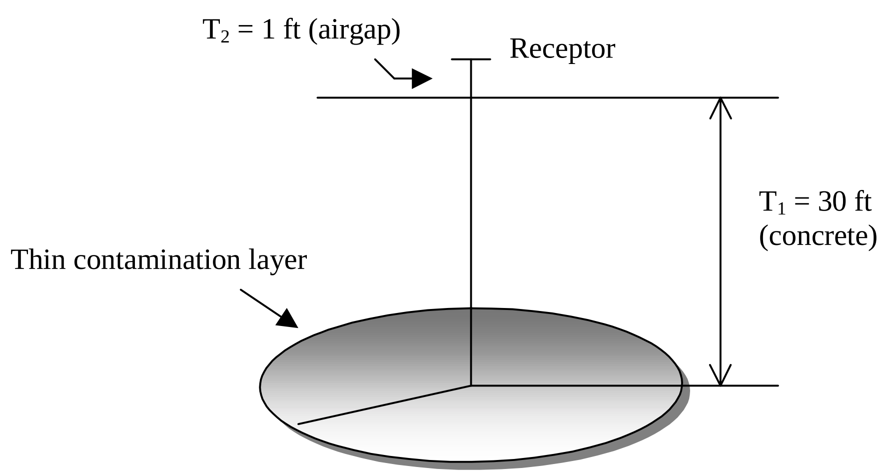
a. Figure not to scale.

Figure C.9-2. Model of low-activity waste disposal facility.[a]



a. Figure not to scale.
b. Not present for intruder scenarios.

Figure C.9-3. Model of Tank Farm storage tank with either residual activity or Class A or C grout fill.[a]



a. Figure not to scale.

Figure C.9-4. Model of New Waste Calcining Facility and Process Equipment Waste Evaporator.[a]

following equations, which are the same as those employed for the groundwater-soil-food product ingestion pathway:

$$C_s(t) = \frac{\frac{\dot{I}_v \cdot CF}{L_i}\left(t_e + \frac{e^{-(L_i + t_e)}}{L_i}\right) + \frac{C_{so}}{L_i}\left(1 - e^{-(L_i \cdot t_e)}\right) - \frac{\dot{I}_v \cdot CF}{L_i{}^2}}{t_e}$$

where:

$C_s(t)$ = average concentration of radionuclide in soil for the exposure period t_e (mg/kg)
t_e = exposure period (30 y = 10,950 d)

$\dot{I}_v$ = radionuclide input rate from irrigation (mg/g-d)
L_i = leach rate constant (d^{-1})
C_{so} = concentration of radionuclide in soil at the start of the residential exposure period (assumed to be 0 mg/kg)
CF = conversion factor for grams per kilogram (1,000 g/kg)

The radionuclide input rate is estimated by:

$$\dot{I}_v = C_w \frac{I_R}{\rho T}$$

where:

$\dot{I}_v$ = contaminant of potential concern input rate from irrigation (mg/g-d or pCi/g-d)

C_w = average concentration of contaminant of potential concern in groundwater during the exposure period (mg/liter or pCi/liter)

I_R = irrigation rate $\left[2.09 \frac{liter}{m^2 \cdot d} = \frac{8.47 \frac{liter}{m^2 \cdot d} \cdot 90d}{365d}\right]$
ρ = soil density (1.5 x 10^6 g/m^3)
T = thickness of root zone (0.2 m).

The leach rate constant (L_i) was estimated as:

$$L_i = \frac{P \cdot CF}{\theta_c \left(1 + \frac{K_d \rho}{\theta_c}\right) T}$$

where:

L_i	=	leach rate constant (d^{-1})
P	=	net water percolation rate (0.86 m/y), which includes contribution from precipitation (0.1 m/y) and irrigation (0.76 m/y)
θ_c	=	volumetric water constant in source volume (0.41 m^3/m^3)
K_d	=	contaminant of potential specific soil-to-water partition coefficient (cm^3/g)
ρ	=	soil density (1.5 g/cm^3)
T	=	thickness of root zone (0.2 m)
CF	=	conversion factor for years per day (0.00274 y/d).

For external dose modeling, the radionuclides of concern are assumed to be evenly distributed in a 15 cm-thick source layer which is modeled as an infinite slab. (This is the default method in GENII for evaluating external dose from soil contamination.) The dose rate is evaluated at a point 1 foot above the slab, and is converted to dose by multiplying by the exposure time that applies to each receptor category.

Summation of External Doses

The final process in the external dose assessment involves the adding of doses from various individual sources to estimate total dose. There are two stages to this process. The first involves adding external doses from each source facility. This assumes that the receptor in question is simultaneously exposed to each source facility that exists under a given exposure scenario at the maximum calculated exposure rate. For example, a receptor that is exposed under the scenario for Class A or Class C grout disposal in the Tank Farm and bin sets is assumed to be simultaneous exposed to the following:

- A Tank Farm storage tank (residual activity plus Class A or Class C grout)
- A bin set (residual activity plus Class A or Class C grout)
- Other dispositioned facilities (New Waste Calcining Facility, Process Equipment Waste Evaporator)

This summation is conservative since a receptor cannot be located in more than one maximum dose location at the same time. However, the cumulative external dose does not include dose from simultaneous exposure to multiple storage tanks or bin sets.

The second stage involves adding the maximum external doses from dispositioned facilities to those calculated for contaminated soil. This summation is also conservative since these maximum doses would occur over different time frames. For example, the dispositioned facility dose rate applies to the Year 2095, while the I-129 and Tc-99 contaminated soil dose rates apply about 1,000 and 10,000 years later, respectively. The source term for the dispositioned facility dose includes all the radionuclides listed in

Table C.9-5, while the contaminated soil source term includes only I-129 or Tc-99. Therefore, the result is not given a specific time.

C.9.3.6 Groundwater Pathway Screening

Unlike the external radiation dose discussed above, the impacts attributable to contaminant transport through groundwater do include the contributions from all tanks and bins. The original list of contaminants present in HLW facilities to be closed included a very long list of radiological and chemical constituents. For example, the initial Tank Farm inventory data included 143 radionuclides and 20 chemical constituents (plus numerous other chemicals present in only trace amounts). Therefore, DOE developed and applied a method (referred to here as "screening") to identify those contaminants of potential concern (COPC) that warrant detailed quantitative analysis. The screening method that was applied to the Tank Farm and bin sets closure scenarios is described below.

Radionuclide Screening

An illustration of the general process used for radionuclide screening is presented in Figure C.9-5. The screening for both the Tank Farm and bin sets started with total decay-corrected residual inventory for the Year 2016. The "first cut" involved all radionuclides that either (a) had a half-life that was less than 10 years, or (b) were present in very low amounts. For the latter, a nominal value of one-billionth (1×10^{-9}) of the total activity was used as a cutoff. The short half-life criterion was used since for even the most mobile species the migration time through the tank or bin structures (tanks, vaults, etc.) and the underlying vadose (unsaturated) zone to the aquifer is expected to be on the order of hundreds of years (i.e., concrete and grout in the tanks and facilities are assumed to maintain their integrity for 500 years).

The next step was to apply a radionuclide-specific "ground burial screening factor" from NCRP Report No. 123, *Screening Models for Releases of Radionuclides to Atmosphere, Surface Water, and Ground* (NCRP 1996). This screening factor is ideally suited for this purpose, in that it considers a range of factors, including half-life, migration time, and potential dose to receptors by inhalation, ingestion and external exposure modes. This screening step was performed by multiplying the amount of each radionuclide remaining in the inventory by the screening factor. The radionuclides were then ranked by this product and the products were summed. Radionuclides whose product was greater than a nominal one-millionth of the sum were considered candidates for further evaluation. The radionuclides surviving these initial screens are identified in Table C.9-6.

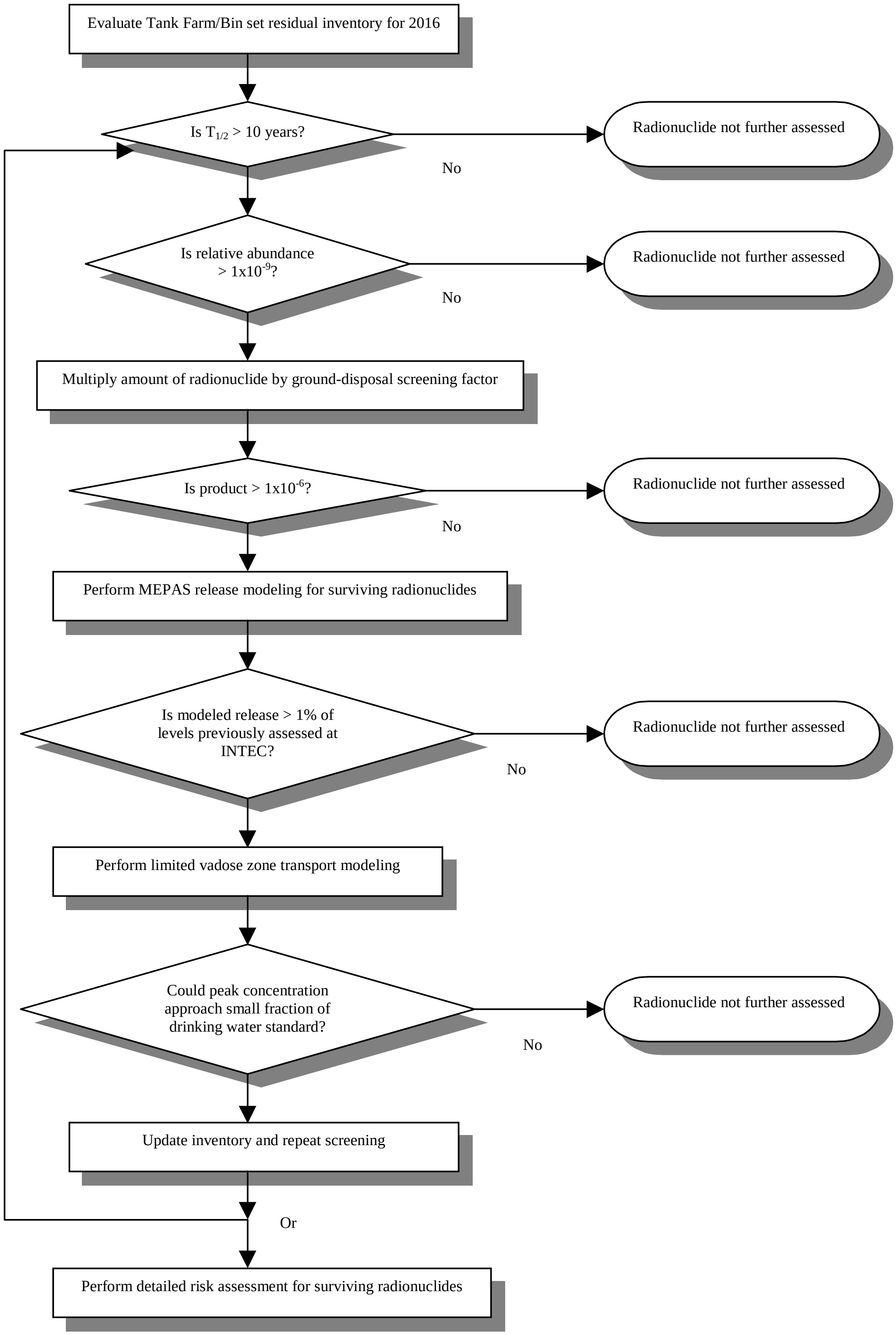


Figure C.9-5. General process used for radionuclide screening for groundwater pathway assessment.

DOE then performed release modeling using the MEPAS code (Buck et al. 1995) and compared the results to those of other modeling evaluations previously performed for INTEC activities. Specifically, in order for the radionuclide to be further evaluated, the estimated total activity released to the vadose zone under any closure scenario (including landfill scenarios) must be greater than 1 percent of the release evaluated for that same radionuclide in the INTEC baseline risk assessment (Rodriguez et al. 1997). That study established the health risk to future human receptors for releases which are generally much larger than those projected under the facility disposition alternatives. This enabled DOE to apply this comparison step to screen out those radionuclides that previous analysis has clearly shown will not pose a risk via the groundwater pathway at the projected level of release.

Finally, DOE performed limited transport modeling to indicate whether any of the surviving radionuclides could be eliminated based on (a) travel time to the aquifer, or (b) very low aquifer concentrations compared to drinking water standards. Cs-137 and Sr-90 were eliminated from further consideration on these bases. DOE estimated the travel time for Cs-137 at about 9,800 years. With a half-life of only 30 years, virtually all of the Cs-137 would have decayed after such a long duration. Sr-90, which has a half-life of about 28 years, requires much less transport time to reach the aquifer; however, the activity would still decay to levels such that the peak estimated concentration at the vadose zone-aquifer interface (5.4×10^{-14} pCi/l) would be an exceedingly small fraction of the drinking water standard (8 pCi/l).

As a result of this process, DOE selected two radionuclides for detailed quantitative analysis: Tc-99 and I-129. The dose and heath risk impacts associated with these long-lived radionuclides were then quantitatively assessed for all facility disposition alternatives scenarios (not just those which met the 1 percent release criterion).

After the initial screening was performed, DOE revised the residual radionuclide inventory estimates for the Tank Farm and bin sets and developed initial inventory estimates for the No Action alternative. DOE also revised the estimates for radionuclide releases from the Tank Farm and bin sets under the performance-based closure or closure to landfill standards alternatives, as well as under the No Action closure alternative for these facilities. Following these updates, the screening process was repeated and DOE confirmed that none of the radionuclides previously screened out would qualify for further analysis based on revised inventory and release rate estimates.

Nonradiological Contaminant Screening

The approach used in identifying chemical COPCs warranting further analysis was based primarily on inventory estimates, toxicity, and results of previous evaluations.

The first step was to identify all chemicals that are both (a) potentially toxic or carcinogenic, and (b) present in the inventory in greater than trace quantities. For the latter, a nominal value of 1 kilogram was used as a threshold. (There is no particular significance to this value; it was used simply as a rough indicator of relative hazard potential). Only two carcinogens – cadmium and nickel – and several noncarcinogenic toxic chemicals met these criteria.

Next, DOE developed a screening parameter based on inventory and potential toxicity. The screening parameter is the inverse of the product of the inventory and the oral reference dose (RfD), which was obtained from the Environmental Protection Agency's *Integrated Risk Information System* (IRIS) database (EPA 1998). If an oral RfD was not available, the contaminant was not selected for further evaluation since ingestion is by far the most important exposure mode for the groundwater pathway. Additionally, if an RfD was not available for a specific compound, the available value for a closely related compound was used (e.g., the RfD for nitrate was used for KNO_3 and $NaNO_3$). The screening products were then summed and chemicals that accounted for 1 percent or more of the total were considered for further evaluation.

For the Tank Farm, mercury and cadmium account for about 98 percent of the screening product sum, while nitrate and fluoride collectively amount to about 1.5 percent of the total. For the bin sets, the majority of the contribution is again from mercury and cadmium (77 percent), while fluoride contributes about 21 percent and nitrate a much lesser amount. Nickel constituted a very small fraction of this total (0.05 percent for the bin sets and 0.02 percent for the Tank Farm) and was therefore eliminated from further evaluation. These four species–cadmium, mercury, fluoride and nitrate–were selected for further evaluation. For both the Tank Farm and bin sets, the combined dose for these four species would be about 99 percent of the total dose.

The final screening step was the same as that used in radionuclide screening, namely, a comparison of release rates to those previously analyzed in the baseline risk assessment. This final step eliminated mercury from further evaluation, as the maximum projected release rate under facilities disposition is only a very small fraction of the release rate previously assessed. The results of the nonradiological screening are presented in Table C.9-7.

C.9.4 CONCEPTUAL AND CALCULATIONAL MODELS FOR ANALYSIS OF IMPACTS

DOE has identified three general mechanisms by which individuals could be impacted by residual contamination as follows:

- Contaminants could be transported to the aquifer under the facilities and moved to a location where humans could remove the contaminated water (through wells) that could be used for drinking, irrigation, and other purposes.
- Contaminants could be released to the environment through airborne pathways due to weathering of the bin sets under the No Action Alternative.
- Contaminants in closed facilities could emit gamma radiation which would irradiate humans in the vicinity.

The following sections discuss the conceptual model used in assessing impacts that arise from these pathways.

C.9.4.1 <u>Groundwater Pathways</u>

Figure C.9-6 illustrates the conceptual model used by DOE in evaluating the impacts to individuals following facility closure. As shown in the figure, the movement of contaminants down to the aquifer would be accomplished via infiltration of rainwater, which leaches contaminants from the residual radioactivity in the facilities and transports it down through the unsaturated zone to the aquifer.

The physical and hydrogeologic setting of INTEC is highly complex, consisting of layered basalt and sediment units. Perched water zones exist within the vadose zone and several large water sources at the surface contribute to them. Chapter 4 describes the hydrogeology in and around the INTEC areas, and that discussion will not be repeated here.

To calculate the impacts to groundwater, DOE used two computer codes. The domains over which these codes were used are illustrated in Figure C.9-6. The leaching of contaminants out of the facilities to the unsaturated zone would be primarily one-dimensional movement in the downward direction; therefore, DOE used the MEPAS (Buck et al. 1995) code developed at Pacific Northwest National Laboratories (PNNL) to calculate the flux of contaminants from the facilities. DOE used TETRAD, an INTEC-specific groundwater model, to calculate the groundwater concentrations after release from the facilities.

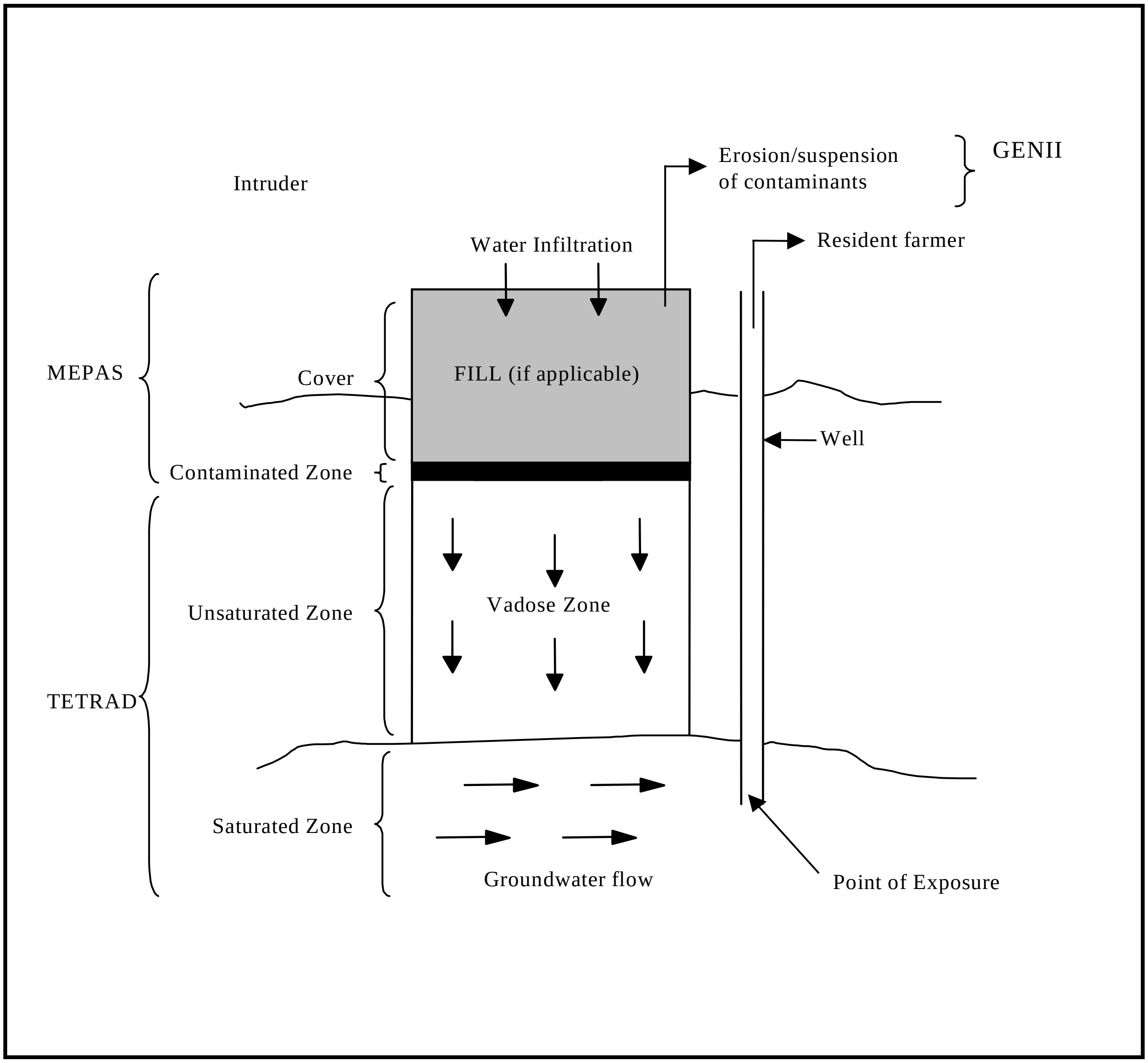


Figure C.9-6. Conceptual site model for facility closure modeling and model domains.

The calculational methodology for MEPAS was developed by PNNL in the 1980s and is based on active transport in one dimension with dispersion allowed in three dimensions. MEPAS uses analytical solutions incorporating partitioning coefficients expressed as K_d values, the porosity and hydraulic conductivity of the media, the water infiltration rate, and a dispersivity coefficient to calculate the amount of leaching that occurs in the source zone and ultimately the flux from the facility. Due to the one-dimensional nature of MEPAS, the solutions are based on the assumption that precipitation will move through the residual contaminants based on the infiltration rate and hydraulic conductivity of the intervening layers between the surface and the residual contaminants, leach material as determined by the partitioning coefficient, and move the contaminants downward to the aquifer. Because MEPAS was used only for flux calculations from the facilities, the groundwater modeling portions of this code were not used, and the flux results were coupled with results from TETRAD to determine the groundwater concentrations.

DOE calculated the fluxes assuming that the facilities would remain intact until structural failure occurs at 500 years post-closure. Therefore, the flux from the facilities is expected to leach only a small amount of contaminants prior to the assumed failure time, after which the structural failure increases the water flow through the facilities and provides greater volumes of leachate to the underlying aquifer.

TETRAD is a three-dimensional model that incorporates site-specific features of the local area, such as transient fluctuations and spatial fluctuations in transport velocities, lithology, and water sources. In addition to infiltration by precipitation, TETRAD can account for other water ingress into the aquifer due to irrigation, the Big Lost River, and other water sources. Therefore, TETRAD was the code of choice for groundwater simulation in the areas around the INTEC.

For modeling purposes, the contaminant sources were defined and incorporated into the simulation model at a grid block or a set of grid blocks, similar to the methodology used during the Waste Area Group-3 Remedial Investigation/Feasibility Study at INEEL (Rodriguez et al. 1997). In the numerical simulation model, the horizontal grid block locations for all sources were defined by overlaying the numerical grid on a map of the INTEC area. Each contaminant source was identified by a grid block and source input parameters were applied for the corresponding block. The simulation model was then used to calculate the transport of contaminants through the vadose zone and to compute a mass flux curve. The cumulative mass flux to the aquifer was then used as input to simulate transport of contaminants in the aquifer and to estimate the resulting groundwater concentrations.

For analysis in this EIS, the results from an extensive TETRAD calculation (Schafer 1999) were used as a scaling tool which could be applied to the flux results from MEPAS to determine the groundwater concentration. DOE adopted this approach to have maximum flexibility in calculating concentrations in the groundwater as estimates of the contaminant inventory in the facilities were refined.

After the groundwater concentrations were calculated, DOE evaluated the impacts from pathways that depend on groundwater as follows:

- Drinking contaminated groundwater
- Using groundwater to irrigate food crops and to water animals used for food
- Inadvertent ingestion of soil contaminated by groundwater irrigation

- Breathing air containing contaminated soil particles
- Absorption through skin contact with contaminated soil or water

The method used for estimating intakes of contaminants from ingestion of contaminated groundwater or crops grown on contaminated site soils or irrigated with groundwater is based on the methodology developed for baseline risk assessments previously performed for INTEC (DOE 1994). DOE evaluated these exposure routes by assuming that the contaminants in soil and groundwater (irrigation water) are transferred to various food crops by means of deposition (from overhead irrigation) and root uptake. The soil concentrations used for root uptake (as well as inadvertent soil ingestion) were calculated under the assumption that the only significant pathway for soil contamination was through irrigation with contaminated groundwater.

C.9.4.2 Airborne Pathways

In addition to the groundwater pathways, DOE evaluated the potential for long term airborne releases and concluded that the only scenario in which such a release is credible involves degradation and ultimate failure of one or more bin sets. The environmental impacts associated with long term failure of one or more bin sets is estimated by assuming that bin set failures become more likely toward the end of the designed performance lifetime of the bin set systems, eventually (after a much longer period of time) becoming a certainty.

In a bounding calculation described in Section 5.2.14, DOE assumed that one bin set could fail shortly after the end of its design life (500 years). Since the likelihood of more than one bin set failing in the same year is remote, this EIS assumes that subsequent failures would occur randomly over the next 1,000 years. Therefore, the bounding calculation conservatively uses the worst case accident scenario involving the bin set with the highest inventory, decayed only to 2095, which is the date DOE has assumed for loss of institutional control.

The bounding event is an air release because calcine released during a failure of a bin set is unlikely to impact the groundwater. Calcine must be dissolved to impact groundwater and would not be mobile as a solid. Dissolution of calcine in an aqueous environment would be very difficult because calcine is only dissolved in a highly acidic solution. No naturally occurring scenario can be envisioned that would result in conditions conducive to dissolution of calcine. Thus, calcine released during a bin set failure would most likely result in an air release.

C.9.4.3 Direct Radiation Exposure

The assessment of exposure scenarios includes cases where future receptors are exposed to direct radiation from either (a) radionuclides in contaminated soil; (b) residual radioactivity in closed facilities; or (c) facilities used for radioactive waste disposal. The latter include the Tank Farm, bin sets, and other facilities that could have a significant inventory of radioactive materials after closure. External dose factors were developed for soil and facilities using the IDF code, which is part of the GENII package (Napier et al. 1988). For contaminated soil, the radionuclides of concern were assumed to be evenly distributed in a 15 cm-thick source layer which is modeled as an infinite slab. The dose is evaluated at a point 1 foot above the slab. For closed facilities, dose rate factors were determined using geometry and shielding thicknesses which approximated the system under evaluation.

C.9.5 RECEPTOR IDENTIFICATION

In its consideration of disposition activities, DOE recognized that certain types of receptors are the most likely to be impacted by these activities. To identify the specific receptors for which analyses would be performed, DOE considered real receptors (known individuals and populations) that could be impacted in the present or near-term time frame, as well as hypothetical receptors that could be exposed under bounding conditions at any time throughout the 10,000 year period of analysis. In postulating these receptors, DOE assumed that certain activities, such as construction of residences or industrial complexes, could occur on the land where the dispositioned facilities are located.

Because it is impossible to predict the future use of the land after the period of institutional control, DOE has chosen a spectrum of receptors to identify representative impacts as follows:

- Maximally exposed resident – a resident farmer who lives in a dwelling constructed on the site after the period of institutional control, and who uses the land for subsistence. This receptor would obtain all of his domestic and agricultural water supply from a well drilled into the aquifer, which is assumed to be affected by contaminant releases from compromised or dispositioned facilities. The average exposed resident is assumed to be exposed both during childhood and as an adult.

- Average resident – like the maximally exposed resident, a resident who lives on the site after the period of institutional control. This receptor would be exposed via the same pathways as the maximally exposed resident, but the consumption rates, exposure duration and frequency would be less. The average exposed resident is assumed to be exposed only as an adult.

- INEEL worker – an adult who would have authorized access to the site during the period of institutional control, and who would work in the vicinity of closed facilities on a full-time basis. This receptor was assessed only for external radiation exposure.

- Future industrial worker – an adult who would have authorized access to the site after the period of institutional control but who is considered to be a member of the public for compliance purposes.

- Unauthorized intruder – a person who could gain unauthorized access to the site during the period of institutional control and would be potentially exposed to contaminants. This receptor was assessed only for external radiation exposure.

- Uninformed intruder – a person who could gain access to the site after the period of institutional control and would be potentially exposed to radionuclides in closed facilities. This receptor was assessed for exposure to external radiation sources (with compromised shielding) and media which have been contaminated with radionuclides released to groundwater.

- Recreational user – a person who routinely would visit the affected area after the period of institutional control and use the area for recreational activities, including camping, hiking, and hunting.

C.9.6 INPUT PARAMETERS

The calculations involved in determining the long-term impacts of the facility disposition alternatives require values to be assigned to numerous parameters. Where possible, DOE used values that are consistent with those used in past analyses at the INEEL or other values that are generally accepted in the nuclear industry.

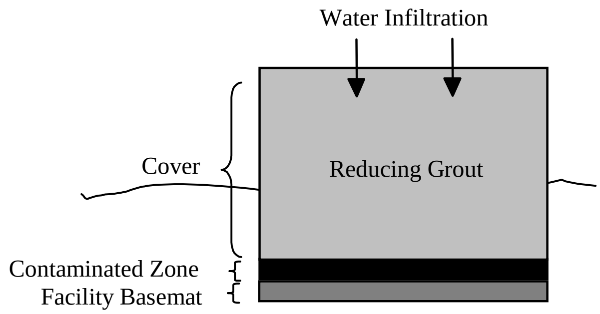
C.9.6.1 Input Parameters Related to Source Term

DOE presented source term information in Section C.9.3 of this appendix and used this information in the evaluation of long-term impacts.

C.9.6.2 Input Parameters Related to Flux Calculations from Facilities

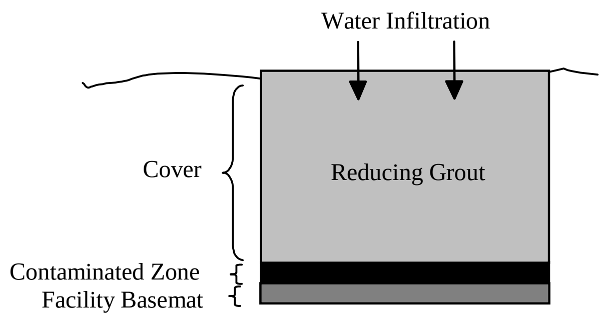
Conceptual diagrams for each of the facility disposition alternatives are provided in Figures C.9-7 through C.9-15. These diagrams indicate the various layers that DOE assumed for purposes of long-term fate and transport modeling. These layers include, where appropriate, (1) the fill material that would be placed on top of the residual contamination, (2) the contaminated zone that contains the residual material remaining after facility closure, and (3) the facility basemat, which is the concrete floor and subfloor portion of the facility below the contaminated zone and above the vadose zone. Table C.9-8 presents the distribution coefficient (K_d) used for each layer in the analysis.

In performing the long-term fate and transport modeling, DOE assumed that each of these layers would have certain properties that would result in differences in parameters such as distribution coefficient (K_d), conductivity, infiltration rate, and porosity. For example, as discussed in Section C.9.1, DOE assumes, for purposes of analysis, that the grout would be formulated specifically to bind contaminants with the grout (i.e., a “reducing” grout). These values assume that the reducing environment designed in the grout would also be present in the contaminated zone. DOE considers this to be a reasonable assumption since the grout layer is very thick compared to the estimated thickness of the source layer such that the pore water that moves from the grout through the source layer would have dissolved the chemical species that would enable a reducing environment to be present in the source layer. DOE further assumes that the



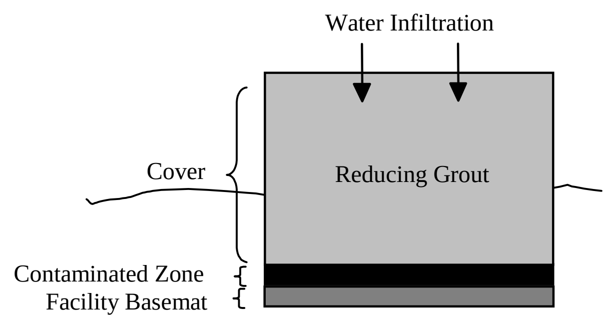
	Fill Material (Reducing Grout)		Contaminated Zone		Facility Basemat	
	0-500 years	500-10,000 years	0-500 years	500-10,000 years	0-500 years	500-10,000 years
K_d (cm^3/g)	NA	NA	Table C.9-8, Column IV	Table C.9-8, Column IV	Table C.9-8, Column III	Table C.9-8, Column III
Conductivity (cm/s)	9.6×10^{-9}	6.6×10^{-3}	9.6×10^{-9}	6.6×10^{-3}	9.6×10^{-9}	6.6×10^{-3}
Infiltration rate (in/year)	1.6	1.6	1.6	1.6	1.6	1.6
Porosity (%)	15	38	15	38	15	38

Figure C.9-7. Conceptual diagram of facility layers analyzed for the New Waste Calcining Facility and Process Equipment Waste Evaporator



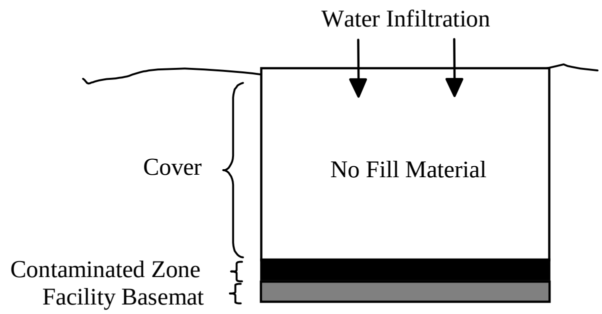
	Fill Material (Reducing Grout)		Contaminated Zone		Facility Basemat	
	0-500 years	500-10,000 years	0-500 years	500-10,000 years	0-500 years	500-10,000 years
K_d (cm^3/g)	NA	NA	Table C.9-8, Column IV	Table C.9-8, Column IV	Table C.9-8, Column III	Table C.9-8, Column III
Conductivity (cm/s)	9.6×10^{-9}	6.6×10^{-3}	9.6×10^{-9}	6.6×10^{-3}	9.6×10^{-9}	6.6×10^{-3}
Infiltration rate (in/year)	1.6	1.6	1.6	1.6	1.6	1.6
Porosity (%)	15	38	15	38	15	38

Figure C.9-8. Conceptual diagram of facility layers analyzed for the Tank Farm - Performance-Based Closure or Closure to Landfill Standards.



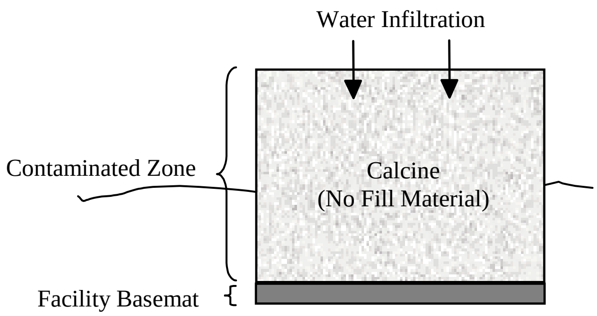
	Fill Material (Reducing Grout)		Contaminated Zone		Facility Basemat	
	0-500 years	500-10,000 years	0-500 years	500-10,000 years	0-500 years	500-10,000 years
K_d (cm^3/g)	NA	NA	Table C.9-8, Column IV	Table C.9-8, Column IV	Table C.9-8, Column III	Table C.9-8, Column III
Conductivity (cm/s)	9.6×10^{-9}	6.6×10^{-3}	9.6×10^{-9}	6.6×10^{-3}	9.6×10^{-9}	6.6×10^{-3}
Infiltration rate (in/year)	1.6	1.6	1.6	1.6	1.6	1.6
Porosity (%)	15	38	15	38	15	38

Figure C.9-9. Conceptual diagram of facility layers analyzed for the bin sets - Performance-Based Closure or Closure to Landfill Standards.



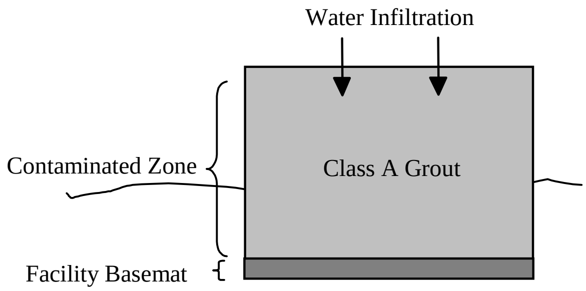
	Contaminated Zone		Facility Basemat	
	0-500 years	500-10,000 years	0-500 years	500-10,000 years
K_d (cm^3/g)	Table C.9-8, Column V	Table C.9-8, Column V	Table C.9-8, Column II	Table C.9-8, Column II
Conductivity (cm/s)	9.6×10^{-9}	9.6×10^{-9}	9.6×10^{-9}	6.6×10^{-3}
Infiltration rate (in/year)	1.6	1.6	1.6	1.6
Porosity (%)	15	15	15	38

Figure C.9-10. Conceptual diagram of facility layers analyzed for the Tank Farm – No Action.



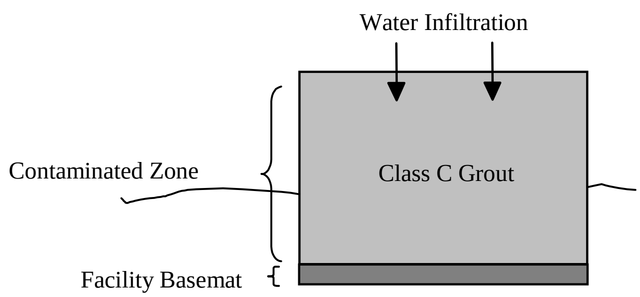
	Contaminated Zone		Facility Basemat	
	0-500 years	500-10,000 years	0-500 years	500-10,000 years
K_d (cm^3/g)	Table C.9-8, Column I	Table C.9-8, Column I	Table C.9-8, Column II	Table C.9-8, Column II
Conductivity (cm/s)	6.6×10^{-3}	6.6×10^{-3}	9.6×10^{-9}	6.6×10^{-3}
Infiltration rate (in/year)	1.6	1.6	1.6	1.6
Porosity (%)	38	38	15	38

Figure C.9-11. Conceptual diagram of facility layers analyzed for the bin sets – No Action.



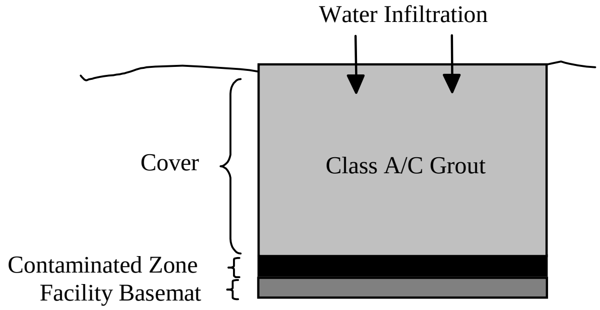
	Contaminated Zone (Class A Grout)		Facility Basemat	
	0-500 years	500-10,000 years	0-500 years	500-10,000 years
K_d (cm^3/g)	Table C.9-8, Column IV	Table C.9-8, Column IV	Table C.9-8, Column III	Table C.9-8, Column III
Conductivity (cm/s)	9.6×10^{-9}	6.6×10^{-3}	9.6×10^{-9}	6.6×10^{-3}
Infiltration rate (in/year)	1.6	1.6	1.6	1.6
Porosity (%)	15	38	15	38

Figure C.9-12. Conceptual diagram of facility layers analyzed for Class A Grout Disposal in New Disposal Facility.



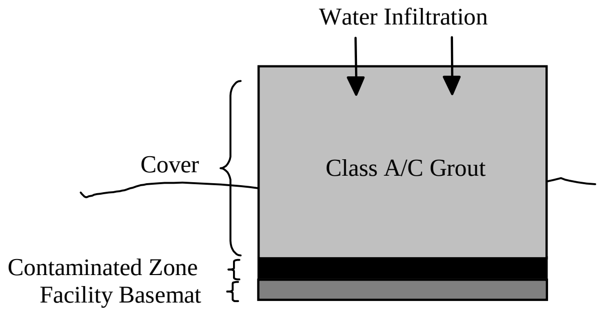
	Contaminated Zone (Class C Grout)		Facility Basemat	
	0-500 years	500-10,000 years	0-500 years	500-10,000 years
K_d (cm^3/g)	Table C.9-8, Column IV	Table C.9-8, Column IV	Table C.9-8, Column III	Table C.9-8, Column III
Conductivity (cm/s)	9.6×10^{-9}	6.6×10^{-3}	9.6×10^{-9}	6.6×10^{-3}
Infiltration rate (in/year)	1.6	1.6	1.6	1.6
Porosity (%)	15	38	15	38

Figure C.9-13. Conceptual diagram of facility layers analyzed for Class C Grout Disposal in New Disposal Facility.



	Fill Material (Class A/C Grout)		Contaminated Zone		Facility Basemat	
	0-500 years	500-10,000 years	0-500 years	500-10,000 years	0-500 years	500-10,000 years
K_d (cm^3/g)	Table C.9-8, Column IV	Table C.9-8, Column IV	Table C.9-8, Column IV	Table C.9-8, Column IV	Table C.9-8, Column III	Table C.9-8, Column III
Conductivity (cm/s)	9.6×10^{-9}	6.6×10^{-3}	9.6×10^{-9}	6.6×10^{-3}	9.6×10^{-9}	6.6×10^{-3}
Infiltration rate (in/year)	1.6	1.6	1.6	1.6	1.6	1.6
Porosity (%)	15	38	15	38	15	38

Figure C.9-14. Conceptual diagram of facility layers analyzed for the Tank Farm – Performance-Based Closure with Class A or Class C Grout Disposal.



	Fill Material (Class A/C Grout)		Contaminated Zone		Facility Basemat	
	0-500 years	500-10,000 years	0-500 years	500-10,000 years	0-500 years	500-10,000 years
K_d (cm^3/g)	Table C.9-8, Column IV	Table C.9-8, Column IV	Table C.9-8, Column IV	Table C.9-8, Column IV	Table C.9-8, Column III	Table C.9-8, Column III
Conductivity (cm/s)	9.6×10^{-9}	6.6×10^{-3}	9.6×10^{-9}	6.6×10^{-3}	9.6×10^{-9}	6.6×10^{-3}
Infiltration rate (in/year)	1.6	1.6	1.6	1.6	1.6	1.6
Porosity (%)	15	38	15	38	15	38

Figure C.9-15. Conceptual diagram of facility layers analyzed for the Bin sets – Performance-Based Closure with Class A or Class C Grout Disposal.

chemical characteristics of the grout would persist long after the analysis period of 10,000 years (DOE 1998). Therefore, DOE believes that the grout would continue to inhibit the amount of leaching that would occur after failure. Figures C.9-7 through C.9-15 present the assumed values for the following parameters for each of the layers: distribution coefficient (K_d), conductivity, infiltration rate, and porosity.

As described in Section C.9.2, DOE assumes that at 500 years, the tanks and facilities would undergo complete structural failure and then would assume the same hydrogeologic transport characteristics as the surrounding soil (however, chemical properties of grout and concrete would remain unchanged). Therefore, some of the parameter values associated with each of the facility layers would be different after the assumed failure. Figures C.9-7 through C.9-15 present parameter values for two time periods: 0 – 500 years (before failure), and 500 – 10,000 years (after failure). While Figures C.9-7 through C.9-15 present infiltration rates which are assumed the same as the natural soil rate, infiltration of water is controlled by the low hydraulic conductivity of the facility basemat prior to structural failure.

C.9.6.3 <u>Input Parameters Related to Groundwater Calculations</u>

As discussed earlier, TETRAD was used in the WAG-3 Remedial Investigation/Feasibility Study (Rodriguez et al. 1997), and the same modeling methodology was used in this EIS. Therefore, rather than repeating the parameterizations for that computer model, the reader is referred to the Remedial Investigation/Feasibility Study and the summary report prepared for this EIS (Schafer 1999) for further information.

C.9.6.4 <u>Input Parameters Related to Receptor Impact Calculations</u>

As discussed earlier, DOE calculated impacts to receptors using the methodology embodied in previous baseline risk assessments performed at the INTEC. Understandably, the calculations involve the use of many constants that account for transfer of contaminants to media that serve as intake sources for the postulated receptors and for individual habits of these postulated receptors. These constants may be either generic (as in the case of receptor body weight), or they may be specific to receptors, scenarios or contaminants. Solving the equations is facilitated by the use of summary intake factors, which have been developed for each receptor and exposure mode. These summary intake factors provide a simple but effective means of calculating contaminants of potential concern intake from media concentration. For example, the summary intake factor for intake of radionuclides via groundwater ingestion by the maximally exposed resident has a value of 2.1×10^4 in units of liters. Multiplying this value by the groundwater concentration in picocuries per liter yields the estimated intake of the radionuclide, in picocuries, by this receptor. Tables C.9-9 and C.9-10 show the values of the assumed parameters used in this EIS.

C.9.7 RESULTS OF IMPACT ANALYSIS

This section describes the potential human health risk posed by contaminants remaining in INTEC high-level waste management facilities over the long term (10,000 years) following ultimate dispositioning of those facilities. This section is organized such that a summary of the main risk assessment findings is presented first. Summary results are presented by facility closure scenario for each receptor category and principal exposure pathway. Detailed results are then presented separately for the radionuclides I-129 and Tc-99, and for the nonradiological contaminants of potential concern cadmium, fluoride and nitrate. These results also specify the dose for each receptor category from each source facility by principal exposure pathway, with supplemental detail provided for specific types or modes of exposure.

C.9.7.1 Summary

A summary of radiation dose is presented for each receptor and facility closure scenario in Table C.9-11. The doses reported in this table are lifetime doses in millirem. Table C.9-12 presents estimates of cancer risk resulting from the doses reported in Table C.9-11. These risks represent the number of excess cancer fatalities expected in a population of 1,000 people if all individuals in the population were exposed to the doses listed in Table C.9-11.

Doses are highest for receptor categories under the scenarios that involve either exposure to air releases from a bin set system under the No Action alternative, or exposure to groundwater releases after disposal of Class C grout in INEEL facilities (either in the Tank Farm and bin sets or in a new low-activity waste disposal facility). For all receptors except the INEEL worker and intruders, doses from the groundwater pathway are primarily due to I-129 intake via groundwater and food product ingestion. Even under very conservative assumptions (i.e., the maximally exposed resident), these doses are small fractions of those received from natural background sources (typically about 360 millirem per year). Intruder and INEEL worker doses and risks result mainly from external exposure to radionuclides in closed facilities. For intruders, the dose would be highest under the alternative involving disposal of Class C grout in the Tank Farm and bin sets, while for INEEL workers it would be very low in all cases but highest under the No Action scenario. The magnitude of these external dose estimates is highly influenced by assumed occupancy times and proximity to the bin sets. Under the conditions assumed here, the maximum intruder dose is estimated at about 3 millirem, while the maximum INEEL worker dose would be a small fraction of a millirem.

Table C.9-9. Parameter values and summary intake factors used in the facility disposition human health risk assessment.

Exposure parameter	Units	Maximum resident farmer	Average resident farmer	Future construction worker	Indoor worker	Uninformed intruder[a]	Recreational user
Receptor characteristics							
Body weight – adult	kg	70	70	70	70	70	70
Body weight – adolescent	kg	-[b]	-	-	-	-	-
Body weight – child	kg	15	-	-	-	-	-
Averaging time: carcinogens	y	70	70	70	70	70	70
Groundwater ingestion							
Exposure duration	y	30	9	25	25	-	24
Exposure period	d/y	350	280	250	250	-	14
Averaging time: noncarcinogens	y	30	9	25	25	-	24
Groundwater intake rate	liter/d	2	1.4	1	1	-	2
SIF[c] – carcinogens	liter/kg-d	0.012	2.0×10^{-3}	3.0×10^{-3}	3.0×10^{-3}	-	3.8×10^{-4}
SIF – noncarcinogens	liter/kg-d	0.027	0.015	0.01	0.01	-	1.1×10^{-3}
SIF – radionuclides	liters	2.1×10^{4}	3.5×10^{3}	6.3×10^{3}	6.3×10^{3}	-	672
Soil ingestion							
Exposure duration - as adult	y	24	9	25	25	1	24
Exposure duration - as child	d/y	6	-	-	-	-	-
Exposure frequency	d/y	350	275	250	250	1	14
Averaging time: noncarcinogens	y	30	9	25	25	25	24
Soil intake rate - adult	mg/d	100	100	100	50	1.0×10^{-4}	1.0×10^{-4}
Soil intake rate - child	mg/d	200	-	-	-	-	-
SIF – carcinogens	kg/kg-d	$1.6.\times10^{-6}$	$1.4.\times10^{-7}$	$3.5.\times10^{-7}$	$1.7.\times10^{-7}$	1.1×10^{-5}	$1.9.\times10^{-8}$
SIF – noncarcinogens	kg/kg-d	3.7×10^{-6}	1.1×10^{-6}	9.8×10^{-7}	4.9×10^{-7}	1.0×10^{-3}	5.5×10^{-8}
SIF – radionuclides	kg	1.3	0.25	0.63	0.31	1.0×10^{-4}	0.034
Fugitive dust inhalation							
Exposure duration	y	30	9	25	25	1	24
Exposure frequency	d/y	350	275	250	250	1	14
Averaging time: noncarcinogens	y	30	9	25	25	25	24
Inhalation rate - outdoors	m^3/d	20	20	20	7.2	20	20
Particulate loading factor	kg/m^3	1.4×10^{-8}	1.4×10^{-8}	1.4×10^{-8}	1.4×10^{-8}	1.4×10^{-8}	1.4×10^{-8}
SIF – carcinogens	m^3/kg-d	0.12	0.028	0.07	0.05	0.10	3.8×10^{-3}
SIF – noncarcinogens	m^3/kg-d	0.27	0.22	0.20	0.15	1.4×10^{-7}	0.011
SIF – radionuclides	m^3	2.1×10^{5}	5.0×10^{4}	1.3×10^{5}	4.5×10^{4}	20	6.7×10^{3}
Dermal absorption							
Soil							
Exposure duration - child	y	6	-	-	-	-	-
Exposure duration - adult	y	24	9	25	-	-	24
Exposure frequency	d/y	350	275	250	-	-	14
Averaging time: noncarcinogens	y	30	9	25	-	-	24
Contact rate - child	mg/cm^2	0.30	-	-	-	-	-
Contact rate - adult	mg/cm^2	0.08	0.08	0.08	-	-	0.08
Skin surface area - child	cm^2	3.9×10^{3}	-	-	-	-	-
Skin surface area - adult/summer	cm^2	5.0×10^{3}	5.0×10^{3}	5.0×10^{3}	-	-	5.0×10^{3}
Skin surface area - adult/winter	cm^2	1.9×10^{3}	1.9×10^{3}	1.9×10^{3}	-	-	1.9×10^{3}
Skin surface area – adult weighted average	cm^2	2.7×10^{3}	2.7×10^{3}	2.7×10^{3}	-	-	2.7×10^{3}
Correction factor	kg/mg	1.0×10^{-6}	1.0×10^{-6}	1.0×10^{-6}	-	-	1.0×10^{-6}

Table C.9-9. Parameter values and summary intake factors used in the facility disposition human health risk assessment (continued).

Exposure parameter	Units	Maximum resident farmer	Average resident farmer	Future construction worker	Indoor worker	Uninformed intruder[a]	Recreational user
Dermal absorption (Continued)							
Soil (Continued)							
SIF – carcinogens	kg/kg-d	7.4×10^{-7}	3.0×10^{-8}	7.5×10^{-8}	-	-	4.0×10^{-9}
SIF – noncarcinogens	kg/kg-d	1.7×10^{-6}	2.3×10^{-7}	1.7×10^{-7}	-	-	9.4×10^{-9}
SIF – radionuclides	kg	0.92	0.4	1.7	-	-	-
Groundwater							
Exposure duration	y	30	9	25	25	-	24
Exposure frequency	d/y	350	280	250	250	-	14
Averaging time: noncarcinogens	y	30	9	25	25	-	24
Contact rate	hr	0.17	0.12	0.17	0.17	-	0.17
Skin surface area	cm^2	2.0×10^{4}	2.0×10^{4}	2.0×10^{4}	2.0×10^{4}	-	2.0×10^{4}
Permeability factor	cm/hr	1.0×10^{-3}	1.0×10^{-3}	1.0×10^{-3}	1.0×10^{-3}	-	1.0×10^{-3}
Correction factor	liter/cm^3	1.0×10^{-3}	1.0×10^{-3}	1.0×10^{-3}	1.0×10^{-3}	-	1.0×10^{-3}
SIF – carcinogens	liter/kg-d	2.0×10^{-5}	3.3×10^{-6}	1.2×10^{-5}	$1.2.\times10^{-5}$	-	6.4×10^{-7}
SIF – noncarcinogens	liter/kg-d	4.7×10^{-5}	2.6×10^{-5}	2.8×10^{-5}	$2.8.\times10^{-5}$	-	1.5×10^{-6}
SIF – radionuclides	liters	36	5.9	21	-	-	-
Food product consumption							
Exposure duration - as adult	y	24	9	-	-	-	24
Exposure duration - as child	d/y	6	-	-	-	-	-
Exposure frequency	d/y	350	280	-	-	-	30
Averaging time: noncarcinogens	y	30	9	-	-	-	24
Root crops and other vegetables and fruits							
Crop intake rate - adult	kg/d	0.39	0.39	-	-	-	-
Crop intake rate - child	kg/d	0.32	-	-	-	-	-
SIF – carcinogens	kg/kg-d	3.6×10^{-3}	5.4×10^{-4}	-	-	-	-
SIF – noncarcinogens	kg/kg-d	8.4×10^{-3}	4.2×10^{-3}	-	-	-	-
SIF – radionuclides	kg	3.9×10^{3}	960	-	-	-	-
Leafy vegetables							
Crop intake rate - adult	kg/d	0.05	0.05	-	-	-	-
Crop intake rate - child	kg/d	0.02	-	-	-	-	-
SIF – carcinogens	kg/kg-d	3.4×10^{-4}	6.9×10^{-5}	-	-	-	-
SIF – noncarcinogens	kg/kg-d	8.0×10^{-4}	5.4×10^{-4}	-	-	-	-
SIF – radionuclides	kg	460	120	-	-	-	-
Grains							
Grain intake rate - adult	kg/d	0.097	0.097	-	-	-	-
Grain intake rate - child	kg/d	0.087	-	-	-	-	-
SIF – carcinogens	kg/kg-d	9.3×10^{-4}	1.3×10^{-4}	-	-	-	-
SIF – noncarcinogens	kg/kg-d	2.2×10^{-3}	1.0×10^{-3}	-	-	-	-
SIF – radionuclides	kg	1.0×10^{3}	240	-	-	-	-
Meat							
Meat intake rate - adult	kg/d	0.23	0.23	-	-	-	0.23
Meat intake rate - child	kg/d	0.12	-	-	-	-	-
SIF - carcinogens	kg/kg-d	1.7×10^{-3}	3.2×10^{-4}	-	-	-	6.2×10^{-5}
SIF - noncarcinogens	kg/kg-d	4.1×10^{-3}	2.5×10^{-3}	-	-	-	1.4×10^{-4}
SIF - radionuclides	kg	2.2×10^{3}	570	-	-	-	170

Table C.9-9. Parameter values and summary intake factors used in the facility disposition human health risk assessment (continued).

Exposure parameter	Units	Maximum resident farmer	Average resident farmer	Future construction worker	Indoor worker	Uninformed intruder[a]	Recreational user
Food product consumption (Continued)							
Poultry							
Poultry intake rate - adult	kg/d	0.026	0.026	-	-	-	-
Poultry intake rate - child	kg/d	0.018	-	-	-	-	-
SIF - carcinogens	kg/kg-d	2.2×10^{-4}	3.6×10^{-5}	-	-	-	-
SIF - noncarcinogens	kg/kg-d	5.2×10^{-4}	2.8×10^{-4}	-	-	-	-
SIF - radionuclides	kg	260	64	-	-	-	-
Milk and milk products							
Milk product intake rate - adult	liter/d	0.31	0.31	-	-	-	-
Milk product intake rate - child	liter/d	0.61	-	-	-	-	-
SIF - carcinogens	liter/kg-d	4.8×10^{-3}	4.2×10^{-4}	-	-	-	-
SIF - noncarcinogens	liter/kg-d	0.011	3.3×10^{-3}	-	-	-	-
SIF - radionuclides	liters	3.8×10^{3}	760	-	-	-	-
Eggs							
Egg intake rate - adult	kg/d	0.041	0.041	-	-	-	-
Egg intake rate - child	kg/d	0.025	-	-	-	-	-
SIF - carcinogens	kg/kg-d	3.3×10^{-4}	5.7×10^{-5}	-	-	-	-
SIF - noncarcinogens	kg/kg-d	7.7×10^{-4}	4.4×10^{-4}	-	-	-	-
SIF - radionuclides	kg	400	100	-	-	-	-
Direct radiation exposure							
Contaminated soil							
Exposure duration	y	30	30	25	25	1	24
Exposure frequency	d/y	350	350	250	250	1	14
Contact rate	h/d	24	24	8	8	24	24
Soil concentration	pCi/g	5.6×10^{-4}	5.6×10^{-4}	5.6×10^{-4}	5.6×10^{-4}	5.6×10^{-4}	5.6×10^{-4}
SIF - radionuclides	pCi-h/g	140	140	28	28	0.013	4.5
Closed facilities							
Exposure duration	y	30	30	25	30	1	24
Exposure frequency	d/y	350	350	250	350	1	14
Contact rate	h/d	24	24	8	8	24	24
SIF – radionuclides	h	2.0×10^{4}	2.0×10^{4}	5.0×10^{4}	8.4×10^{4}	24	8.1×10^{3}

a. Intruder after the period of institutional control over INEEL.
b. Dash indicates that the exposure parameter was not used in the case indicated.
c. SIF = Summary intake factor.

Table C.9-11. Summary of total lifetime radiation dose (millirem) from exposure to radionuclides according to receptor and facility disposition alternative.

	Facility disposition alternative					
Receptor	No Action	Performance-Based Closure/ Closure to Landfill Standards	Performance-Based Closure with Class A Grout Disposal	Performance-Based Closure with Class C Grout Disposal	Disposal of Class A grout in low-activity waste disposal facility	Disposal of Class C grout in low-activity waste disposal facility
Maximally exposed resident farmer	8.7[a]	13	18	50	21	51
Average resident farmer	4.8	2.7	3.7	10	4.2	10
INEEL worker	5.3	8.9×10^{-11}	9.0×10^{-11}	3.8×10^{-9}	8.9×10^{-11}	9.1×10^{-11}
Construction worker	1.4	1.4	2	5.4	2.2	5.4
Indoor worker	1.4	1.4	2	5.4	2.2	5.4
Unauthorized Intruder[b]	0.29	0.023	2.4×10^{-3}	1.5	0.023	0.023
Uninformed Intruder[c]	0.047	3.8×10^{-3}	7.7×10^{-3}	0.25	3.8×10^{-3}	3.8×10^{-3}
Recreational user	0.22	0.31	0.42	1.2	0.48	1.2

a. An air pathway dose of 170 millirem is calculated based on the maximally exposed individual dose due to failure of a single bin set system.
b. Time frame for receptor exposure is during period of institutional control.
c. Time frame for receptor exposure is distant future.

Table C.9-12. Summary of excess carcinogenic risk (cancer fatalities per thousand persons) from exposure to radionuclides according to receptor and facility disposition alternative.

	Facility disposition alternative					
Receptor	No Action	Performance-Based Closure/ Closure to Landfill Standards	Performance-Based Closure with Class A Grout Disposal	Performance-Based Closure with Class C Grout Disposal	Disposal of Class A grout in low-activity waste disposal facility	Disposal of Class C grout in low-activity waste disposal facility
Maximally exposed resident farmer	4.4×10^{-3}[a]	6.7×10^{-3}	9.2×10^{-3}	0.025	0.01	0.025
Average resident farmer	2.4×10^{-3}	1.4×10^{-3}	1.9×10^{-3}	5.1×10^{-3}	2.1×10^{-3}	5.1×10^{-3}
INEEL worker	2.7×10^{-3}	4.5×10^{-14}	4.5×10^{-14}	1.9×10^{-12}	4.5×10^{-14}	4.5×10^{-14}
Construction worker	6.9×10^{-4}	7.2×10^{-4}	9.8×10^{-4}	2.7×10^{-3}	1.1×10^{-3}	2.7×10^{-3}
Indoor worker	6.8×10^{-4}	7.2×10^{-4}	9.8×10^{-4}	2.7×10^{-3}	1.1×10^{-3}	2.7×10^{-3}
Unauthorized Intruder [b]	1.4×10^{-4}	1.1×10^{-5}	1.2×10^{-6}	7.5×10^{-4}	1.1×10^{-5}	1.1×10^{-5}
Uninformed Intruder [c]	2.4×10^{-5}	1.9×10^{-6}	3.9×10^{-6}	1.3×10^{-4}	1.9×10^{-6}	1.9×10^{-6}
Recreational user	1.1×10^{-4}	1.5×10^{-4}	2.1×10^{-4}	5.8×10^{-4}	2.4×10^{-4}	5.8×10^{-4}

a. The risk from radiation dose due to failure of a single bin set is calculated to be 0.085 latent cancer fatalities for an assumed population of 1000 persons.
b. Time frame for receptor exposure is during period of institutional control.
c. Time frame for receptor exposure is distant future.

Nonradiological risks are reported both for cancer and noncancer health effects. Cancer risk is reported in terms of probability of individual excess cancer resulting from lifetime exposure. In the cases assessed here, cancer risk results only from inhalation of cadmium entrained in fugitive dust. Noncancer effects are reported in terms of a health hazard quotient, which is the ratio of the contaminants of potential concern intake to the applicable inhalation or oral reference dose. A hazard quotient of greater than unity indicates that the intake is higher than the reference value. Noncancer risk is incurred from intake of cadmium via ingestion, inhalation and dermal absorption, and fluorides and nitrates via ingestion and dermal absorption.

For all receptors and scenarios, cancer risk from cadmium exposure is very low (less than one in a trillion). Noncancer risk would be higher for some receptors and scenarios, most notably those cases involving fluoride releases from landfill disposal of Class A or C grout. In those cases, a hazard quotient of 1.5 is estimated for the maximally exposed resident farmer, due mainly to ingestion of fluoride in groundwater and food products irrigated or raised with contaminated groundwater. The effect of concern for fluoride intake is objectionable dental fluorosis, which is considered more of a cosmetic effect than an adverse health effect (EPA 1998). Table C.9-13 presents a summary of noncancer hazard quotients for intakes of fluoride, nitrate, and cadmium.

Table C.9-13. Summary of estimated noncarcinogenic health hazard quotients from exposure to nonradiological contaminants according to receptor and facility disposition alternative.

Exposure scenario and pathway	No Action	Performance-Based Closure/ Closure to Landfill Standards	Performance -Based Closure with Class A Grout Disposal	Performance -Based Closure with Class C Grout Disposal	Disposal of Class A grout in low-activity waste disposal facility	Disposal of Class C grout in low-activity waste disposal facility
Health hazard quotient due to cadmium intake						
Maximally exposed resident farmer	4.3×10^{-7}	6.5×10^{-8}	4.6×10^{-7}	4.8×10^{-7}	1.5×10^{-5}	1.6×10^{-5}
Average resident farmer	6.7×10^{-8}	1.0×10^{-8}	7.1×10^{-8}	7.5×10^{-8}	2.3×10^{-6}	2.5×10^{-6}
Construction worker	7.0×10^{-8}	1.1×10^{-8}	7.5×10^{-8}	7.8×10^{-8}	2.4×10^{-6}	2.6×10^{-6}
Indoor worker	7.0×10^{-8}	1.1×10^{-8}	7.5×10^{-8}	7.8×10^{-8}	2.4×10^{-6}	2.6×10^{-6}
Recreational user	3.7×10^{-9}	1.2×10^{-9}	8.7×10^{-9}	9.1×10^{-9}	2.8×10^{-7}	3.1×10^{-7}
Health hazard quotient due to fluoride intake						
Maximally exposed resident farmer	0.08	5.2×10^{-4}	0.12	0.27	1.4	1.4
Average resident farmer	0.04	2.6×10^{-4}	0.058	0.13	0.69	0.71
Construction worker	6.4×10^{-3}	4.2×10^{-5}	9.4×10^{-3}	0.021	0.11	0.11
Indoor worker	6.4×10^{-3}	4.2×10^{-5}	9.4×10^{-3}	0.021	0.11	0.11
Recreational user	1.8×10^{-3}	1.2×10^{-5}	2.6×10^{-3}	4.1×10^{-3}	0.032	0.032
Health hazard quotient due to nitrate intake						
Maximally exposed resident farmer	6.5×10^{-3}	3.0×10^{-5}	1.1×10^{-4}	1.1×10^{-4}	3.0×10^{-5}	3.0×10^{-5}
Average resident farmer	2.9×10^{-3}	1.3×10^{-5}	5.0×10^{-5}	5.0×10^{-5}	1.3×10^{-5}	1.3×10^{-5}
Construction worker	4.0×10^{-4}	1.9×10^{-6}	7.1×10^{-6}	7.1×10^{-6}	1.9×10^{-6}	1.9×10^{-6}
Indoor worker	4.0×10^{-4}	1.9×10^{-6}	7.1×10^{-6}	7.1×10^{-6}	1.9×10^{-6}	1.9×10^{-6}
Recreational user	8.4×10^{-5}	3.9×10^{-7}	1.5×10^{-6}	1.5×10^{-6}	3.9×10^{-7}	3.9×10^{-7}

C.9.7.2 Radiological Risk

Radiation exposure and attendant risk could be incurred from three major pathways: radionuclide releases to, and subsequent use of, groundwater resources; exposure to sources of direct (external) radiation; and airborne radionuclide releases. The latter pathway is described in Section 5.2.14 and is not evaluated in this appendix. Exposures that ultimately result from groundwater releases represent the greatest contributor to risk for all cases except for a near-term intruder scenario, in which external radiation from the dispositioned Tank Farm or bin sets (through compromised shielding) becomes the predominant source. Within the groundwater release pathway, the main sources of radionuclide intake are:

- Ingestion of groundwater (which is assumed to be the primary source of drinking water)
- Consumption of food crops irrigated with groundwater
- Consumption of food products (meat, milk and eggs) from animals which are watered with groundwater and fed with grain irrigated with groundwater

The doses and risks are primarily due to I-129, and this exposure would occur about 1,000 years into the future. Intakes of Tc-99 are only feasible farther into the future (about 10,000 years), due to the longer migration period required for this nuclide to reach the aquifer. In general, doses and risks from Tc-99 are much lower than those from I-129. Doses from the groundwater release pathway are presented in Table C.9-14 for I-129 and Table C.9-15 for Tc-99.

C.9.7.3 Nonradiological Health Risk

The screening evaluation identified cadmium, fluorides and nitrates as the only nonradiological contaminants of potential concern that would be released to groundwater in quantities potentially approaching drinking water standards. Of these, fluoride and nitrate intakes would occur over the same time frame (a few to several hundred years hence). Cadmium would migrate through the vadose zone at a much slower pace, and credible human exposure scenarios are not credible until a few thousand years later, by which time the other contaminants are no longer present. The health risk assessment results for each of these contaminants of potential concern are presented and discussed in this section.

Cadmium is considered a human carcinogen if inhaled, but data are not available to support cancer risk quantitation for other intake modes such as ingestion or dermal absorption (EPA 1998). The inhalation

Table C.9-14. Lifetime radiation dose (millirem) by receptor and disposition alternative for I-129 released to groundwater.

Exposure scenario and pathway	No Action	Performance-Based Closure/ Closure to Landfill Standards	Performance-Based Closure with Class A Grout Disposal	Performance-Based Closure with Class C Grout Disposal	Disposal of Class A grout in low-activity waste disposal facility	Disposal of Class C grout in low-activity waste disposal facility
Maximally exposed resident farmer						
Groundwater ingestion	1.4	4.8	6.6	18	7.5	18
Soil ingestion	2.0×10^{-5}	7.0×10^{-5}	9.6×10^{-5}	2.6×10^{-4}	1.1×10^{-4}	2.6×10^{-4}
Food product consumption:						
Other vegetables and fruit	0.15	0.5	0.69	1.9	0.79	1.9
Leafy vegetables	0.15	0.51	0.7	1.9	0.8	1.9
Grain	0.085	0.29	0.4	1.1	0.46	1.1
Meat (beef)	0.59	2	2.8	7.7	3.2	7.7
Poultry	1.5×10^{-7}	5.1×10^{-7}	7.0×10^{-7}	1.9×10^{-6}	8.0×10^{-7}	1.9×10^{-6}
Milk and milk products	1.5	5.2	7.1	19	8.1	19
Eggs	0.036	0.12	0.17	0.46	0.19	0.46
Subtotal - food ingestion	2.5	8.7	12	32	13	33
Dermal contact with:						
Soil	1.5×10^{-5}	5.1×10^{-5}	7.0×10^{-5}	1.9×10^{-4}	7.9×10^{-5}	1.9×10^{-4}
Groundwater	2.4×10^{-3}	8.2×10^{-3}	0.011	0.031	0.013	0.031
Subtotal - skin absorption	2.4×10^{-3}	8.2×10^{-3}	0.011	0.031	0.013	0.031
Fugitive dust inhalation	3.0×10^{-8}	1.0×10^{-7}	1.4×10^{-7}	3.8×10^{-7}	1.6×10^{-7}	3.9×10^{-7}
Direct radiation exposure from:						
Soil concentration	5.3×10^{-11}	1.8×10^{-10}	2.5×10^{-10}	6.8×10^{-10}	2.8×10^{-10}	6.8×10^{-10}
Buried sources	4.8	6.4×10^{-11}	1.1×10^{-10}	2.8×10^{-9}	6.4×10^{-11}	6.5×10^{-11}
Subtotal - direct radiation	4.8	2.5×10^{-10}	3.6×10^{-10}	3.4×10^{-9}	3.5×10^{-10}	7.5×10^{-10}
Total scenario	8.7	13	18	50	21	51
Average resident						
Groundwater ingestion	0.23	0.79	1.1	3	1.2	3
Soil ingestion	4.0×10^{-6}	1.4×10^{-5}	1.9×10^{-5}	5.1×10^{-5}	2.1×10^{-5}	5.2×10^{-5}
Food product consumption:						
Other vegetables and fruit	0.036	0.12	0.17	0.46	0.19	0.46
Leafy vegetables	0.04	0.14	0.19	0.51	0.21	0.52
Grain	0.02	0.071	0.096	0.26	0.11	0.27
Meat (beef)	0.16	0.53	0.73	2	0.83	2
Poultry	3.7×10^{-5}	1.3×10^{-4}	1.8×10^{-4}	4.8×10^{-4}	2.0×10^{-4}	4.8×10^{-4}
Milk and milk products	0.3	1	1.4	3.8	1.6	3.8
Eggs	9.1×10^{-3}	0.031	0.043	0.12	0.049	0.12
Subtotal - food ingestion	0.56	1.9	2.6	7.2	3	7.2

Table C.9-14. Lifetime radiation dose (millirem) by receptor and disposition alternative for I-129 released to groundwater (continued).

Exposure scenario and pathway	No Action	Performance-Based Closure/ Closure to Landfill Standards	Performance-Based Closure with Class A Grout Disposal	Performance-Based Closure with Class C Grout Disposal	Disposal of Class A grout in low-activity waste disposal facility	Disposal of Class C grout in low-activity waste disposal facility
Dermal contact with:						
Soil	6.4×10^{-6}	2.2×10^{-5}	3.0×10^{-5}	8.2×10^{-5}	3.4×10^{-5}	8.3×10^{-5}
Groundwater	4.0×10^{-4}	1.4×10^{-3}	1.9×10^{-3}	5.1×10^{-3}	2.1×10^{-3}	5.1×10^{-3}
Subtotal - skin absorption	4.0×10^{-4}	1.4×10^{-3}	1.9×10^{-3}	5.2×10^{-3}	2.2×10^{-3}	5.2×10^{-3}
Fugitive dust inhalation	7.0×10^{-9}	2.4×10^{-8}	3.3×10^{-8}	9.1×10^{-8}	3.8×10^{-8}	9.1×10^{-8}
Direct radiation exposure from:						
Soil concentration	5.3×10^{-11}	1.8×10^{-10}	2.5×10^{-10}	6.8×10^{-10}	2.8×10^{-10}	6.8×10^{-10}
Buried sources	4	6.4×10^{-11}	1.1×10^{-10}	2.8×10^{-9}	6.4×10^{-11}	6.5×10^{-11}
Subtotal - direct radiation	4	2.5×10^{-10}	3.6×10^{-10}	3.4×10^{-9}	3.5×10^{-10}	7.5×10^{-10}
Total scenario	4.8	2.7	3.7	10	4.2	10
INEEL worker						
Direct radiation exposure from:						
Soil concentration	-	-	-	-	-	-
Buried sources	5.3	8.9×10^{-11}	1.8×10^{-10}	3.9×10^{-9}	8.9×10^{-11}	9.1×10^{-11}
Total scenario	5.3	8.9×10^{-11}	1.8×10^{-10}	3.9×10^{-9}	8.9×10^{-11}	9.1×10^{-11}
Construction worker						
Groundwater ingestion	0.42	1.4	2	5.4	2.2	5.4
Soil ingestion	1.0×10^{-5}	3.5×10^{-5}	4.7×10^{-5}	1.3×10^{-4}	5.4×10^{-5}	1.3×10^{-4}
Dermal contact with:						
Soil	2.7×10^{-5}	9.3×10^{-5}	1.3×10^{-4}	3.5×10^{-4}	1.4×10^{-4}	3.5×10^{-4}
Groundwater	1.4×10^{-3}	4.9×10^{-3}	6.7×10^{-3}	0.018	7.6×10^{-3}	0.018
Subtotal – skin absorption	1.4×10^{-3}	5.0×10^{-3}	6.8×10^{-3}	0.019	7.7×10^{-3}	0.019
Direct radiation exposure from:						
Soil concentration	1.0×10^{-11}	3.6×10^{-11}	4.9×10^{-11}	1.3×10^{-10}	5.6×10^{-11}	1.4×10^{-10}
Buried sources	0.96	1.3×10^{-11}	2.2×10^{-11}	5.5×10^{-10}	1.3×10^{-11}	1.3×10^{-11}
Subtotal - direct radiation	0.96	4.9×10^{-11}	7.1×10^{-11}	6.8×10^{-10}	6.9×10^{-11}	1.5×10^{-10}
Total scenario	1.4	1.4	2	5.4	2.2	5.4
Indoor worker						
Groundwater ingestion	0.42	1.4	2	5.4	2.2	5.4
Soil ingestion	5.0×10^{-6}	1.7×10^{-5}	2.4×10^{-5}	6.5×10^{-5}	2.7×10^{-5}	6.5×10^{-5}
Fugitive dust inhalation	6.4×10^{-9}	2.2×10^{-8}	3.0×10^{-8}	8.2×10^{-8}	3.4×10^{-8}	8.3×10^{-8}
Direct radiation exposure from:						
Soil concentration	1.0×10^{-11}	3.6×10^{-11}	4.9×10^{-11}	1.3×10^{-10}	5.6×10^{-11}	1.4×10^{-10}
Buried sources	0.95	1.5×10^{-11}	2.6×10^{-11}	6.6×10^{-10}	1.5×10^{-11}	1.6×10^{-11}
Subtotal - direct radiation	0.95	5.1×10^{-11}	7.5×10^{-11}	7.9×10^{-10}	7.1×10^{-11}	1.5×10^{-10}
Total scenario	1.4	1.4	2	5.4	2.2	5.4

Table C.9-14. Lifetime radiation dose (millirem) by receptor and disposition alternative for I-129 released to groundwater (continued).

Exposure scenario and pathway	No Action	Performance-Based Closure/ Closure to Landfill Standards	Performance-Based Closure with Class A Grout Disposal	Performance-Based Closure with Class C Grout Disposal	Disposal of Class A grout in low-activity waste disposal facility	Disposal of Class C grout in low-activity waste disposal facility
Unauthorized intruder						
Direct radiation exposure from:						
Soil concentration	-	-	-	-	-	-
Buried sources	0.29	0.023	0.025	1.5	0.023	0.023
Total scenario	0.29	0.023	0.025	1.5	0.023	0.023
Uninformed intruder						
Soil ingestion	1.6×10^{-9}	5.5×10^{-9}	7.6×10^{-9}	2.1×10^{-8}	8.6×10^{-9}	2.1×10^{-8}
Fugitive dust inhalation	2.8×10^{-12}	9.8×10^{-12}	1.3×10^{-11}	3.7×10^{-11}	1.5×10^{-11}	3.7×10^{-11}
Direct radiation exposure from:						
Soil concentration	5.0×10^{-15}	1.7×10^{-14}	2.4×10^{-14}	6.5×10^{-14}	2.7×10^{-14}	6.5×10^{-14}
Buried sources	0.047	3.8×10^{-3}	7.7×10^{-3}	0.25	3.8×10^{-3}	3.8×10^{-3}
Subtotal - direct radiation	0.047	3.8×10^{-3}	7.7×10^{-3}	0.25	3.8×10^{-3}	3.8×10^{-3}
Total scenario	0.047	3.8×10^{-3}	7.7×10^{-3}	0.25	3.8×10^{-3}	3.8×10^{-3}
Recreational user						
Groundwater ingestion	0.045	0.15	0.21	0.58	0.24	0.58
Soil ingestion	5.4×10^{-7}	1.9×10^{-6}	2.5×10^{-6}	7.0×10^{-6}	2.9×10^{-6}	7.0×10^{-6}
Meat ingestion	0.045	0.16	0.21	0.58	0.24	0.59
Fugitive dust inhalation	9.5×10^{-10}	3.3×10^{-9}	4.5×10^{-9}	1.2×10^{-8}	5.1×10^{-9}	1.2×10^{-8}
Direct radiation exposure from:						
Soil concentration	1.7×10^{-12}	5.8×10^{-12}	7.9×10^{-12}	2.2×10^{-11}	9.1×10^{-12}	2.2×10^{-11}
Buried sources	0.13	2.0×10^{-12}	3.5×10^{-12}	8.8×10^{-11}	2.0×10^{-12}	2.1×10^{-12}
Subtotal - direct radiation	0.13	7.9×10^{-12}	1.1×10^{-11}	1.1×10^{-10}	1.1×10^{-11}	2.4×10^{-11}
Total scenario	0.22	0.31	0.42	1.2	0.48	1.2

cancer slope factor is 6.3 (mg/kg-d)$^{-1}$. The limiting noncancer effect of cadmium intake is proteinuria (excessive excretion of protein in the urine), and EPA has established a Reference Dose (RfD) based on this effect, as well as an RfD for chronic inhalation of cadmium. The RfD for oral intake is 5.0×10^{-4} mg/kg-d, while the RfD for inhalation is 5.7×10^{-5} mg/kg-d. For all receptors and scenarios, the cancer risk from cadmium inhalation is very low (less than one in a trillion). Table C.9-16 lists the cadmium noncancer hazard quotient by receptor, principal pathway and closure scenario.

The effect of concern for fluoride intake is objectionable dental fluorosis. This effect, which is considered more of a cosmetic effect than an adverse health effect, can result from exposure to high fluoride levels during childhood. Dental fluorosis can involve mottling, discoloration, and in some cases pitting of the teeth. The EPA has established an oral RfD of 0.06 mg/kg-d, based on prevention of dental

Table C.9-15. Lifetime radiation dose (millirem) by receptor and facility disposition alternative for Tc-99 released to groundwater.

Exposure scenario and pathway	No Action	Performance-Based Closure/ Closure to Landfill Standards	Performance-Based Closure with Class A Grout Disposal	Performance-Based Closure with Class C Grout Disposal	Disposal of Class A grout in low-activity waste disposal facility	Disposal of Class C grout in low-activity waste disposal facility
Maximally exposed resident farmer						
Groundwater ingestion	7.5×10^{-3}	4.6×10^{-4}	4.7×10^{-4}	4.8×10^{-4}	1.4×10^{-3}	2.4×10^{-3}
Soil ingestion	2.0×10^{-6}	1.2×10^{-7}	1.2×10^{-7}	1.3×10^{-7}	3.7×10^{-7}	6.3×10^{-7}
Food product consumption:						
Other vegetables and fruit	0.25	0.015	0.016	0.016	0.046	0.079
Leafy vegetables	0.03	1.8×10^{-3}	1.9×10^{-3}	1.9×10^{-3}	5.5×10^{-3}	9.5×10^{-3}
Grain	0.063	3.9×10^{-3}	3.9×10^{-3}	4.0×10^{-3}	0.012	0.02
Meat (beef)	9.8×10^{-3}	6.0×10^{-4}	6.1×10^{-4}	6.2×10^{-4}	1.8×10^{-3}	3.1×10^{-3}
Poultry	6.1×10^{-8}	3.7×10^{-9}	3.8×10^{-9}	3.8×10^{-9}	1.1×10^{-8}	1.9×10^{-8}
Milk and milk products	0.014	8.6×10^{-4}	8.7×10^{-4}	8.8×10^{-4}	2.6×10^{-3}	4.4×10^{-3}
Eggs	9.4×10^{-3}	5.8×10^{-4}	5.9×10^{-4}	6.0×10^{-4}	1.7×10^{-3}	3.0×10^{-3}
Subtotal - food ingestion	0.38	0.023	0.023	0.024	0.069	0.12
Dermal contact with:						
Soil	4.8×10^{-6}	3.0×10^{-7}	3.0×10^{-7}	3.1×10^{-7}	8.9×10^{-7}	1.5×10^{-6}
Groundwater	1.3×10^{-5}	7.8×10^{-7}	8.0×10^{-7}	8.1×10^{-7}	2.4×10^{-6}	4.1×10^{-6}
Subtotal - skin absorption	1.8×10^{-5}	1.1×10^{-6}	1.1×10^{-6}	1.1×10^{-6}	3.3×10^{-6}	5.6×10^{-6}
Fugitive dust inhalation	2.6×10^{-8}	1.6×10^{-9}	1.6×10^{-9}	1.7×10^{-9}	4.9×10^{-9}	8.3×10^{-9}
Direct radiation exposure from:						
Soil concentration	8.4×10^{-6}	5.1×10^{-7}	5.2×10^{-7}	5.3×10^{-7}	1.6×10^{-6}	2.7×10^{-6}
Buried sources	4.8	6.4×10^{-11}	1.1×10^{-10}	2.8×10^{-9}	6.4×10^{-11}	6.5×10^{-11}
Subtotal - direct radiation	4.8	5.1×10^{-7}	5.2×10^{-7}	5.3×10^{-7}	1.6×10^{-6}	2.7×10^{-6}
Total scenario	5.2	0.023	0.024	0.024	0.071	0.12
Average resident						
Groundwater ingestion	1.2×10^{-3}	7.6×10^{-5}	7.8×10^{-5}	7.9×10^{-5}	2.3×10^{-4}	3.9×10^{-4}
Soil ingestion	3.9×10^{-7}	2.4×10^{-8}	2.4×10^{-8}	2.5×10^{-8}	7.2×10^{-8}	1.2×10^{-7}
Food product consumption:						
Other vegetables and fruit	0.061	3.7×10^{-3}	3.8×10^{-3}	3.8×10^{-3}	0.011	0.019
Leafy vegetables	8.0×10^{-3}	4.9×10^{-4}	5.0×10^{-4}	5.1×10^{-4}	1.5×10^{-3}	2.5×10^{-3}
Grain	0.015	9.3×10^{-4}	9.5×10^{-4}	9.6×10^{-4}	2.8×10^{-3}	4.8×10^{-3}
Meat (beef)	2.6×10^{-3}	1.6×10^{-4}	1.6×10^{-4}	1.6×10^{-4}	4.7×10^{-4}	8.1×10^{-4}
Poultry	1.5×10^{-5}	9.4×10^{-7}	9.5×10^{-7}	9.7×10^{-7}	2.8×10^{-6}	4.8×10^{-6}
Milk and milk products	2.8×10^{-3}	1.7×10^{-4}	1.7×10^{-4}	1.7×10^{-4}	5.1×10^{-4}	8.7×10^{-4}
Eggs	2.4×10^{-3}	1.5×10^{-4}	1.5×10^{-4}	1.5×10^{-4}	4.4×10^{-4}	7.6×10^{-4}
Subtotal - food ingestion	0.092	5.6×10^{-3}	5.7×10^{-3}	5.8×10^{-3}	0.017	0.029
Dermal contact with:						
Soil	6.3×10^{-7}	3.8×10^{-8}	3.9×10^{-8}	4.0×10^{-8}	1.2×10^{-7}	2.0×10^{-7}
Groundwater	2.1×10^{-6}	1.3×10^{-7}	1.3×10^{-7}	1.3×10^{-7}	3.9×10^{-7}	6.7×10^{-7}
Subtotal - skin absorption	2.8×10^{-6}	1.7×10^{-7}	1.7×10^{-7}	1.7×10^{-7}	5.1×10^{-7}	8.7×10^{-7}

Table C.9-15. Lifetime radiation dose (millirem) by receptor and facility disposition alternative for Tc-99 released to groundwater (continued).

Exposure scenario and pathway	No Action	Performance-Based Closure/ Closure to Landfill Standards	Performance-Based Closure with Class A Grout Disposal	Performance-Based Closure with Class C Grout Disposal	Disposal of Class A grout in low-activity waste disposal facility	Disposal of Class C grout in low-activity waste disposal facility
Fugitive dust inhalation	6.2×10^{-9}	3.8×10^{-10}	3.9×10^{-10}	3.9×10^{-10}	1.1×10^{-9}	2.0×10^{-9}
Direct radiation exposure from:						
Soil concentration	8.4×10^{-6}	5.1×10^{-7}	5.2×10^{-7}	5.3×10^{-7}	1.6×10^{-6}	2.7×10^{-6}
Buried sources	4	5.9×10^{-11}	1.0×10^{-10}	2.8×10^{-9}	5.9×10^{-11}	6.0×10^{-11}
Subtotal - direct radiation	4	5.1×10^{-7}	5.2×10^{-7}	5.3×10^{-7}	1.6×10^{-6}	2.7×10^{-6}
Total scenario	4.1	5.7×10^{-3}	5.8×10^{-3}	5.9×10^{-3}	0.017	0.029
INEEL worker						
Direct radiation exposure from:						
Soil concentration	-	-	-	-	-	-
Buried sources	5.3	8.9×10^{-11}	1.8×10^{-10}	3.9×10^{-9}	8.9×10^{-11}	9.1×10^{-11}
Total scenario	5.3	8.9×10^{-11}	1.8×10^{-10}	3.9×10^{-9}	8.9×10^{-11}	9.1×10^{-11}
Construction worker						
Groundwater ingestion	2.2×10^{-3}	1.4×10^{-4}	1.4×10^{-4}	1.4×10^{-4}	4.1×10^{-4}	7.1×10^{-4}
Soil ingestion	9.8×10^{-7}	6.0×10^{-8}	6.1×10^{-8}	6.2×10^{-8}	1.8×10^{-7}	3.1×10^{-7}
Dermal contact with:						
Soil	2.6×10^{-6}	1.6×10^{-7}	1.6×10^{-7}	1.7×10^{-7}	4.9×10^{-7}	8.3×10^{-7}
Groundwater	7.6×10^{-6}	4.7×10^{-7}	4.8×10^{-7}	4.8×10^{-7}	1.4×10^{-6}	2.4×10^{-6}
Subtotal – skin absorption	1.0×10^{-5}	6.3×10^{-7}	6.4×10^{-7}	6.5×10^{-7}	1.9×10^{-6}	3.2×10^{-6}
Fugitive dust inhalation	1.6×10^{-8}	9.6×10^{-10}	9.8×10^{-10}	9.9×10^{-10}	2.9×10^{-9}	5.0×10^{-9}
Direct radiation exposure from:						
Soil concentration	1.7×10^{-6}	1.0×10^{-7}	1.0×10^{-7}	1.1×10^{-7}	3.1×10^{-7}	5.3×10^{-7}
Buried sources	0.96	1.2×10^{-11}	2.1×10^{-11}	5.5×10^{-10}	1.2×10^{-11}	1.2×10^{-11}
Subtotal - direct radiation	0.96	1.0×10^{-7}	1.0×10^{-7}	1.1×10^{-7}	3.1×10^{-7}	5.3×10^{-7}
Total scenario	0.96	1.4×10^{-4}	1.4×10^{-4}	1.4×10^{-4}	4.2×10^{-4}	7.1×10^{-4}
Indoor worker						
Groundwater ingestion	2.2×10^{-3}	1.4×10^{-4}	1.4×10^{-4}	1.4×10^{-4}	4.1×10^{-4}	7.1×10^{-4}
Soil ingestion	4.9×10^{-7}	3.0×10^{-8}	3.1×10^{-8}	3.1×10^{-8}	9.1×10^{-8}	1.6×10^{-7}
Fugitive dust inhalation	5.6×10^{-9}	3.5×10^{-10}	3.5×10^{-10}	3.6×10^{-10}	1.0×10^{-9}	1.8×10^{-9}
Direct radiation exposure from:						
Soil concentration	1.7×10^{-6}	1.0×10^{-7}	1.0×10^{-7}	1.1×10^{-7}	3.1×10^{-7}	5.3×10^{-7}
Buried sources	0.95	1.4×10^{-11}	2.5×10^{-11}	6.6×10^{-10}	1.4×10^{-11}	1.4×10^{-11}
Subtotal - direct radiation	0.95	1.0×10^{-7}	1.0×10^{-7}	1.1×10^{-7}	3.1×10^{-7}	5.3×10^{-7}
Total scenario	0.95	1.4×10^{-4}	1.4×10^{-4}	1.4×10^{-4}	4.1×10^{-4}	7.1×10^{-4}
Unauthorized intruder						
Direct radiation exposure from:						
Soil concentration	-	-	-	-	-	-
Buried sources	0.29	0.023	0.025	1.5	0.023	0.023
Total scenario	0.29	0.023	0.025	1.5	0.023	0.023

Table C.9-15. Lifetime radiation dose (millirem) by receptor and facility disposition alternative for Tc-99 released to groundwater (continued).

Exposure scenario and pathway	No Action	Performance-Based Closure/ Closure to Landfill Standards	Performance-Based Closure with Class A Grout Disposal	Performance-Based Closure with Class C Grout Disposal	Disposal of Class A grout in low-activity waste disposal facility	Disposal of Class C grout in low-activity waste disposal facility
Uninformed intruder						
Soil ingestion	1.6×10^{-10}	9.7×10^{-12}	9.8×10^{-12}	1.0×10^{-11}	2.9×10^{-11}	5.0×10^{-11}
Fugitive dust inhalation	2.5×10^{-12}	1.5×10^{-13}	1.6×10^{-13}	1.6×10^{-13}	4.6×10^{-13}	7.9×10^{-13}
Direct radiation exposure from:						
Soil concentration	8.0×10^{-10}	4.9×10^{-11}	5.0×10^{-11}	5.1×10^{-11}	1.5×10^{-10}	2.5×10^{-10}
Buried sources	0.047	6.9×10^{-15}	3.9×10^{-3}	0.25	2.8×10^{-12}	4.3×10^{-9}
Subtotal - direct radiation	0.047	4.9×10^{-11}	3.9×10^{-3}	0.25	1.5×10^{-10}	4.6×10^{-9}
Total scenario	0.047	5.9×10^{-11}	3.9×10^{-3}	0.25	1.8×10^{-10}	4.6×10^{-9}
Recreational user						
Groundwater ingestion	2.4×10^{-4}	1.5×10^{-5}	1.5×10^{-5}	1.5×10^{-5}	4.5×10^{-5}	7.6×10^{-5}
Soil ingestion	5.3×10^{-8}	3.2×10^{-9}	3.3×10^{-9}	3.3×10^{-9}	9.8×10^{-9}	1.7×10^{-8}
Meat ingestion	7.4×10^{-4}	4.6×10^{-5}	4.6×10^{-5}	4.7×10^{-5}	1.4×10^{-4}	2.4×10^{-4}
Fugitive dust inhalation	8.4×10^{-10}	5.2×10^{-11}	5.3×10^{-11}	5.3×10^{-11}	1.6×10^{-10}	2.7×10^{-10}
Direct radiation exposure from:						
Soil concentration	2.7×10^{-7}	1.6×10^{-8}	1.7×10^{-8}	1.7×10^{-8}	5.0×10^{-8}	8.5×10^{-8}
Buried sources	0.13	1.9×10^{-12}	3.3×10^{-12}	8.8×10^{-11}	1.9×10^{-12}	1.9×10^{-12}
Subtotal - direct radiation	0.13	1.6×10^{-8}	1.7×10^{-8}	1.7×10^{-8}	5.0×10^{-8}	8.5×10^{-8}
Total scenario	9.8×10^{-4}	6.0×10^{-5}	6.1×10^{-5}	6.2×10^{-5}	1.8×10^{-4}	3.1×10^{-4}

fluorosis (EPA 1998). An RfD for fluoride inhalation has not been established. A more severe effect of excess fluoride intake is crippling skeletal fluorosis, but this effect would require higher intake rates. The EPA has estimated that the required intake rate for this effect is 0.28 mg/kg-d for adults (EPA 1998). Table C.9-17 presents the fluoride health hazard quotient, based on dental fluorosis, according to receptor, principal pathway and closure scenario.

The RfD for nitrate is based on the critical effect of methemoglobinemia, a serious medical condition in which the oxygen-carrying capacity of the blood is reduced as a result of a reaction with nitrate ions. The EPA has established an RfD of 1.6 mg/kg-d for oral intake, but an RfD value for nitrate intake by inhalation has not been established (EPA 1998). Table C.9-18 presents the nitrate health hazard quotient by receptor, principal pathway and closure scenario.

The combined effects of concurrent intakes of contaminants of potential concern are determined by adding the hazard quotients for chemicals that affect the same organ system. The sum of hazard quotients obtained in this manner is called the health hazard index. Of the chemicals assessed here, however, only

Table C.9-16. Noncarcinogenic health hazard quotient for cadmium by receptor category, principal intake pathway and facility disposition alternative.

Exposure scenario and pathway	No Action	Performance-Based Closure/ Closure to Landfill Standards	Performance-Based Closure with Class A Grout Disposal	Performance-Based Closure with Class C Grout Disposal	Disposal of Class A grout in low-activity waste disposal facility	Disposal of Class C grout in low-activity waste disposal facility
Maximally exposed resident farmer						
Groundwater ingestion	2.3×10^{-7}	3.6×10^{-8}	2.5×10^{-7}	2.6×10^{-7}	8.1×10^{-6}	8.8×10^{-6}
Soil ingestion	7.5×10^{-12}	1.2×10^{-12}	8.1×10^{-12}	8.4×10^{-12}	2.6×10^{-10}	2.8×10^{-10}
Food ingestion	1.9×10^{-7}	3.0×10^{-8}	2.1×10^{-7}	2.2×10^{-7}	6.7×10^{-6}	7.3×10^{-6}
Skin absorption	4.0×10^{-10}	6.1×10^{-11}	4.3×10^{-10}	4.5×10^{-10}	1.4×10^{-8}	1.5×10^{-8}
Fugitive dust inhalation	8.3×10^{-14}	1.3×10^{-14}	8.9×10^{-14}	9.3×10^{-14}	2.9×10^{-12}	3.1×10^{-12}
Sum from all pathways	4.3×10^{-7}	6.5×10^{-8}	4.6×10^{-7}	4.8×10^{-7}	1.5×10^{-5}	1.6×10^{-5}
Average resident farmer						
Groundwater ingestion	3.9×10^{-8}	5.9×10^{-9}	4.1×10^{-8}	4.3×10^{-8}	1.3×10^{-6}	1.5×10^{-6}
Soil ingestion	6.7×10^{-13}	1.0×10^{-13}	7.1×10^{-13}	7.5×10^{-13}	2.3×10^{-11}	2.5×10^{-11}
Food ingestion	2.8×10^{-8}	4.3×10^{-9}	3.0×10^{-8}	3.1×10^{-8}	9.7×10^{-7}	1.1×10^{-6}
Skin absorption	6.6×10^{-11}	1.0×10^{-11}	7.1×10^{-11}	7.4×10^{-11}	2.3×10^{-9}	2.5×10^{-9}
Fugitive dust inhalation	2.0×10^{-14}	3.0×10^{-15}	2.1×10^{-14}	2.2×10^{-14}	6.8×10^{-13}	7.4×10^{-13}
Sum from All Pathways	6.7×10^{-8}	1.0×10^{-8}	7.1×10^{-8}	7.5×10^{-8}	2.3×10^{-6}	2.5×10^{-6}
INEEL worker						
Groundwater ingestion	7.0×10^{-8}	1.1×10^{-8}	7.5×10^{-8}	7.8×10^{-8}	2.4×10^{-6}	2.6×10^{-6}
Soil ingestion	1.7×10^{-12}	2.6×10^{-13}	1.8×10^{-12}	1.9×10^{-12}	5.8×10^{-11}	6.4×10^{-11}
Skin absorption	2.4×10^{-10}	3.6×10^{-11}	2.5×10^{-10}	2.7×10^{-10}	8.2×10^{-9}	9.0×10^{-9}
Fugitive dust inhalation	5.0×10^{-14}	7.6×10^{-15}	5.3×10^{-14}	5.6×10^{-14}	1.7×10^{-12}	1.9×10^{-12}
Sum from All Pathways	7.0×10^{-8}	1.1×10^{-8}	7.5×10^{-8}	7.8×10^{-8}	2.4×10^{-6}	2.6×10^{-6}
Construction worker						
Groundwater ingestion	7.0×10^{-8}	1.1×10^{-8}	7.5×10^{-8}	7.8×10^{-8}	2.4×10^{-6}	2.6×10^{-6}
Soil ingestion	1.7×10^{-12}	2.6×10^{-13}	1.8×10^{-12}	1.9×10^{-12}	5.8×10^{-11}	6.4×10^{-11}
Skin absorption	2.4×10^{-10}	3.6×10^{-11}	2.5×10^{-10}	2.7×10^{-10}	8.2×10^{-9}	9.0×10^{-9}
Fugitive dust inhalation	5.0×10^{-14}	7.6×10^{-15}	5.3×10^{-14}	5.6×10^{-14}	1.7×10^{-12}	1.9×10^{-12}
Sum from All Pathways	7.0×10^{-8}	1.1×10^{-8}	7.5×10^{-8}	7.8×10^{-8}	2.4×10^{-6}	2.6×10^{-6}
Indoor worker						
Groundwater ingestion	7.0×10^{-8}	1.1×10^{-8}	7.5×10^{-8}	7.8×10^{-8}	2.4×10^{-6}	2.6×10^{-6}
Soil ingestion	8.4×10^{-13}	1.3×10^{-13}	9.0×10^{-13}	9.4×10^{-13}	2.9×10^{-11}	3.2×10^{-11}
Skin absorption	2.4×10^{-10}	3.6×10^{-11}	2.5×10^{-10}	2.7×10^{-10}	8.2×10^{-9}	8.9×10^{-9}
Fugitive dust inhalation	3.7×10^{-14}	5.7×10^{-15}	4.0×10^{-14}	4.2×10^{-14}	1.3×10^{-12}	1.4×10^{-12}
Sum from All Pathways	7.0×10^{-8}	1.1×10^{-8}	7.5×10^{-8}	7.8×10^{-8}	2.4×10^{-6}	2.6×10^{-6}
Unauthorized intruder						
Soil ingestion	3.8×10^{-16}	5.8×10^{-17}	4.0×10^{-16}	4.2×10^{-16}	1.3×10^{-14}	1.4×10^{-14}
Skin absorption	1.5×10^{-16}	2.3×10^{-17}	1.6×10^{-16}	1.7×10^{-16}	5.2×10^{-15}	5.7×10^{-15}
Fugitive dust inhalation	1.1×10^{-17}	1.7×10^{-18}	1.2×10^{-17}	1.2×10^{-17}	3.9×10^{-16}	4.2×10^{-16}
Sum from All Pathways	5.4×10^{-16}	8.2×10^{-17}	5.8×10^{-16}	6.0×10^{-16}	1.9×10^{-14}	2.0×10^{-14}

Table C.9-16. (continued).

Exposure scenario and pathway	No Action	Performance-Based Closure/ Closure to Landfill Standards	Performance-Based Closure with Class A Grout Disposal	Performance-Based Closure with Class C Grout Disposal	Disposal of Class A grout in low-activity waste disposal facility	Disposal of Class C grout in low-activity waste disposal facility
Uninformed intruder						
Soil ingestion	2.7×10^{-16}	4.1×10^{-17}	2.9×10^{-16}	3.0×10^{-16}	9.4×10^{-15}	1.0×10^{-14}
Skin absorption	1.1×10^{-16}	1.6×10^{-17}	1.2×10^{-16}	1.2×10^{-16}	3.7×10^{-15}	4.1×10^{-15}
Fugitive dust inhalation	7.9×10^{-18}	1.2×10^{-18}	8.5×10^{-18}	8.9×10^{-18}	2.8×10^{-16}	3.0×10^{-16}
Sum from All Pathways	3.9×10^{-16}	5.9×10^{-17}	4.1×10^{-16}	4.3×10^{-16}	1.3×10^{-14}	1.5×10^{-14}
Recreational user						
Groundwater ingestion	7.8×10^{-9}	1.2×10^{-9}	8.4×10^{-9}	8.7×10^{-9}	2.7×10^{-7}	2.9×10^{-7}
Soil ingestion	9.0×10^{-14}	1.4×10^{-14}	9.7×10^{-14}	1.0×10^{-13}	3.1×10^{-12}	3.4×10^{-12}
Food ingestion	3.0×10^{-10}	4.6×10^{-11}	3.2×10^{-10}	3.4×10^{-10}	1.0×10^{-8}	1.1×10^{-8}
Skin absorption	1.3×10^{-11}	2.0×10^{-12}	1.4×10^{-11}	1.5×10^{-11}	4.6×10^{-10}	5.0×10^{-10}
Fugitive dust inhalation	2.7×10^{-15}	4.1×10^{-16}	2.9×10^{-15}	3.0×10^{-15}	9.3×10^{-14}	1.0×10^{-13}
Sum from All Pathways	3.7×10^{-9}	1.2×10^{-9}	8.7×10^{-9}	9.1×10^{-9}	2.8×10^{-7}	3.1×10^{-7}

fluoride and nitrate intakes could be concurrent, and the health effects associated with these substances do not affect the same organ system. It is not appropriate, therefore, to assess the combined effects (hazard index) of these intakes.

In summary, the nonradiological health risk incurred under facility closure scenarios is dominated by fluoride intake. The estimated fluoride intake rate slightly exceeds the oral RfD for the maximally exposed resident; however this estimate is based on conservative assumptions and the limiting effect (objectionable dental fluorosis) is not considered an adverse health effect. DOE concludes, therefore, that no adverse nonradiological health effects are likely to arise under any of the closure scenario assessed here.

Table C.9-17. Noncarcinogenic health hazard quotient for fluoride by receptor category, principal intake pathway and facility disposition alternative.

Exposure scenario and pathway	No Action	Performance-Based Closure/ Closure to Landfill Standards	Performance-Based Closure with Class A Grout Disposal	Performance-Based Closure with Class C Grout Disposal	Disposal of Class A grout in low-activity waste disposal facility	Disposal of Class C grout in low-activity waste disposal facility
Maximally exposed resident farmer						
Groundwater ingestion	0.018	1.2×10^{-4}	0.026	0.06	0.31	0.32
Soil ingestion	5.8×10^{-7}	3.7×10^{-9}	8.5×10^{-7}	1.9×10^{-6}	1.0×10^{-5}	1.0×10^{-5}
Food ingestion	0.062	4.0×10^{-4}	0.091	0.21	1.1	1.1
Skin absorption	3.1×10^{-5}	2.0×10^{-7}	4.5×10^{-5}	1.0×10^{-4}	5.4×10^{-4}	5.5×10^{-4}
Fugitive dust inhalation	-	-	-	-	-	-
Sum from all pathways	0.08	5.2×10^{-4}	0.12	0.27	1.4	1.4
Average resident farmer						
Groundwater ingestion	9.8×10^{-3}	6.4×10^{-5}	0.014	0.033	0.17	0.18
Soil ingestion	1.7×10^{-7}	1.1×10^{-9}	2.5×10^{-7}	5.7×10^{-7}	3.0×10^{-6}	3.0×10^{-6}
Food ingestion	0.03	1.9×10^{-4}	0.044	0.099	0.52	0.53
Skin absorption	1.7×10^{-5}	1.1×10^{-7}	2.5×10^{-5}	5.6×10^{-5}	3.0×10^{-4}	3.0×10^{-4}
Fugitive dust inhalation	-	-	-	-	-	-
Sum from All Pathways	0.04	2.6×10^{-4}	0.058	0.13	0.69	0.71
INEEL worker						
Groundwater ingestion	6.4×10^{-3}	4.1×10^{-5}	9.4×10^{-3}	0.021	0.11	0.11
Soil ingestion	1.5×10^{-7}	1.0×10^{-9}	2.3×10^{-7}	5.1×10^{-7}	2.7×10^{-6}	2.8×10^{-6}
Skin absorption	1.8×10^{-5}	1.2×10^{-7}	2.7×10^{-5}	6.0×10^{-5}	3.2×10^{-4}	3.2×10^{-4}
Fugitive dust inhalation	-	-	-	-	-	-
Sum from All Pathways	6.4×10^{-3}	4.2×10^{-5}	9.4×10^{-3}	0.021	0.11	0.11
Construction worker						
Groundwater ingestion	6.4×10^{-3}	4.1×10^{-5}	9.4×10^{-3}	0.021	0.11	0.11
Soil ingestion	1.5×10^{-7}	1.0×10^{-9}	2.3×10^{-7}	5.1×10^{-7}	2.7×10^{-6}	2.8×10^{-6}
Skin absorption	1.8×10^{-5}	1.2×10^{-7}	2.7×10^{-5}	6.0×10^{-5}	3.2×10^{-4}	3.2×10^{-4}
Fugitive dust inhalation	-	-	-	-	-	-
Sum from All Pathways	6.4×10^{-3}	4.2×10^{-5}	9.4×10^{-3}	0.021	0.11	0.11
Indoor worker						
Groundwater ingestion	6.4×10^{-3}	4.1×10^{-5}	9.4×10^{-3}	0.021	0.11	0.11
Soil ingestion	1.5×10^{-7}	8.6×10^{-10}	1.6×10^{-7}	2.6×10^{-7}	1.4×10^{-6}	1.4×10^{-6}
Skin absorption	1.8×10^{-5}	1.2×10^{-7}	2.7×10^{-5}	6.0×10^{-5}	3.2×10^{-4}	3.2×10^{-4}
Fugitive dust inhalation	-	-	-	-	-	-
Sum from All Pathways	6.4×10^{-3}	4.2×10^{-5}	9.4×10^{-3}	0.021	0.11	0.11
Unauthorized intruder						
Soil ingestion	8.7×10^{-10}	5.6×10^{-12}	1.3×10^{-9}	2.9×10^{-9}	1.5×10^{-8}	1.5×10^{-8}
Skin absorption	1.2×10^{-11}	7.5×10^{-14}	1.4×10^{-11}	3.3×10^{-11}	2.0×10^{-10}	2.1×10^{-10}
Fugitive dust inhalation	-	-	-	-	-	-
Sum from All Pathways	8.8×10^{-10}	5.7×10^{-12}	1.3×10^{-9}	2.9×10^{-9}	1.5×10^{-8}	1.6×10^{-8}

Table C.9-17. (continued).

Exposure scenario and pathway	No Action	Performance-Based Closure/ Closure to Landfill Standards	Performance-Based Closure with Class A Grout Disposal	Performance-Based Closure with Class C Grout Disposal	Disposal of Class A grout in low-activity waste disposal facility	Disposal of Class C grout in low-activity waste disposal facility
Uninformed intruder						
Soil ingestion	6.2×10^{-10}	4.0×10^{-12}	1.1×10^{-9}	2.5×10^{-9}	1.1×10^{-8}	1.1×10^{-8}
Skin absorption	8.2×10^{-12}	5.3×10^{-14}	1.5×10^{-11}	3.3×10^{-11}	1.4×10^{-10}	1.5×10^{-10}
Fugitive dust inhalation	-	-	-	-	-	-
Sum from All Pathways	6.3×10^{-10}	4.1×10^{-12}	1.1×10^{-9}	2.5×10^{-9}	1.1×10^{-8}	1.1×10^{-8}
Recreational user						
Groundwater ingestion	6.9×10^{-4}	4.5×10^{-6}	1.0×10^{-3}	2.3×10^{-3}	0.013	0.013
Soil ingestion	8.7×10^{-9}	5.6×10^{-11}	1.3×10^{-8}	2.9×10^{-8}	1.5×10^{-7}	1.5×10^{-7}
Food ingestion	1.1×10^{-3}	7.0×10^{-6}	1.6×10^{-3}	1.8×10^{-3}	0.019	0.019
Skin absorption	1.0×10^{-6}	6.6×10^{-9}	1.5×10^{-6}	3.4×10^{-6}	1.8×10^{-5}	1.8×10^{-5}
Fugitive dust inhalation	-	-	-	-	-	-
Sum from All Pathways	1.8×10^{-3}	1.2×10^{-5}	2.6×10^{-3}	4.1×10^{-3}	0.032	0.032

Table C.9-18. Noncarcinogenic health hazard quotient for nitrate by receptor category, principal intake pathway and facility disposition alternative.

Exposure scenario and pathway	No Action	Performance-Based Closure/ Closure to Landfill Standards	Performance-Based Closure with Class A Grout Disposal	Performance-Based Closure with Class C Grout Disposal	Disposal of Class A grout in low-activity waste disposal facility	Disposal of Class C grout in low-activity waste disposal facility
Maximally exposed resident farmer						
Groundwater ingestion	1.1×10^{-3}	5.2×10^{-6}	2.0×10^{-5}	2.0×10^{-5}	5.2×10^{-6}	5.2×10^{-6}
Soil ingestion	3.6×10^{-8}	1.7×10^{-10}	6.4×10^{-10}	6.4×10^{-10}	1.7×10^{-10}	1.7×10^{-10}
Food ingestion	5.3×10^{-3}	2.5×10^{-5}	0.000094	9.4×10^{-5}	2.5×10^{-5}	2.5×10^{-5}
Skin absorption	1.9×10^{-6}	8.9×10^{-9}	3.4×10^{-8}	3.4×10^{-8}	8.9×10^{-9}	8.9×10^{-9}
Fugitive dust inhalation	-	-	-	-	-	-
Sum from all pathways	6.5×10^{-3}	3.0×10^{-5}	1.1×10^{-4}	1.1×10^{-4}	3.0×10^{-5}	3.0×10^{-5}
Average resident farmer						
Groundwater ingestion	6.2×10^{-4}	2.9×10^{-6}	1.1×10^{-5}	1.1×10^{-5}	2.9×10^{-6}	2.9×10^{-6}
Soil ingestion	1.1×10^{-8}	4.9×10^{-11}	1.9×10^{-10}	1.9×10^{-10}	4.9×10^{-11}	4.9×10^{-11}
Food ingestion	2.2×10^{-3}	1.0×10^{-5}	3.9×10^{-5}	3.9×10^{-5}	1.0×10^{-5}	1.0×10^{-5}
Skin absorption	1.1×10^{-6}	4.9×10^{-9}	1.9×10^{-8}	1.9×10^{-8}	4.9×10^{-9}	4.9×10^{-9}
Fugitive dust inhalation	-	-	-	-	-	-
Sum from All Pathways	2.9×10^{-3}	1.3×10^{-5}	5.0×10^{-5}	5.0×10^{-5}	1.3×10^{-5}	1.3×10^{-5}
INEEL worker						
Groundwater ingestion	4.0×10^{-4}	1.9×10^{-6}	7.0×10^{-6}	7.0×10^{-6}	1.9×10^{-6}	1.9×10^{-6}
Soil ingestion	9.7×10^{-9}	4.5×10^{-11}	1.7×10^{-10}	1.7×10^{-10}	4.5×10^{-11}	4.5×10^{-11}
Skin absorption	1.1×10^{-6}	5.3×10^{-9}	2.0×10^{-8}	2.0×10^{-8}	5.3×10^{-9}	5.3×10^{-9}
Fugitive dust inhalation	-	-	-	-	-	-
Sum from All Pathways	4.0×10^{-4}	1.9×10^{-6}	7.1×10^{-6}	7.1×10^{-6}	1.9×10^{-6}	1.9×10^{-6}
Construction worker						
Groundwater ingestion	4.0×10^{-4}	1.9×10^{-6}	7.0×10^{-6}	7.0×10^{-6}	1.9×10^{-6}	1.9×10^{-6}
Soil ingestion	9.7×10^{-9}	4.5×10^{-11}	1.7×10^{-10}	1.7×10^{-10}	4.5×10^{-11}	4.5×10^{-11}
Skin absorption	1.1×10^{-6}	5.3×10^{-9}	2.0×10^{-8}	2.0×10^{-8}	5.3×10^{-9}	5.3×10^{-9}
Fugitive dust inhalation	-	-	-	-	-	-
Sum from All Pathways	4.0×10^{-4}	1.9×10^{-6}	7.1×10^{-6}	7.1×10^{-6}	1.9×10^{-6}	1.9×10^{-6}
Indoor worker						
Groundwater ingestion	4.0×10^{-4}	1.9×10^{-6}	7.0×10^{-6}	7.0×10^{-6}	1.9×10^{-6}	1.9×10^{-6}
Soil ingestion	4.8×10^{-9}	2.2×10^{-11}	8.5×10^{-11}	8.5×10^{-11}	2.2×10^{-11}	2.2×10^{-11}
Skin absorption	1.1×10^{-6}	5.3×10^{-9}	2.0×10^{-8}	2.0×10^{-8}	5.3×10^{-9}	5.3×10^{-9}
Fugitive dust inhalation	-	-	-	-	-	-
Sum from All Pathways	4.0×10^{-4}	1.9×10^{-6}	7.1×10^{-6}	7.1×10^{-6}	1.9×10^{-6}	1.9×10^{-6}

Table C.9-18. (Continued).

Exposure scenario and pathway	No Action	Performance-Based Closure/ Closure to Landfill Standards	Performance-Based Closure with Class A Grout Disposal	Performance-Based Closure with Class C Grout Disposal	Disposal of Class A grout in low-activity waste disposal facility	Disposal of Class C grout in low-activity waste disposal facility
Unauthorized intruder						
Soil ingestion	5.4×10^{-11}	2.5×10^{-13}	9.5×10^{-13}	9.5×10^{-13}	2.5×10^{-13}	2.5×10^{-13}
Skin absorption	7.2×10^{-13}	3.4×10^{-15}	1.3×10^{-14}	1.3×10^{-14}	3.4×10^{-15}	3.4×10^{-15}
Fugitive dust inhalation	-	-	-	-	-	-
Sum from All Pathways	5.5×10^{-11}	2.6×10^{-13}	9.7×10^{-13}	9.7×10^{-13}	2.6×10^{-13}	2.6×10^{-13}
Uninformed intruder						
Soil ingestion	3.9×10^{-11}	1.8×10^{-13}	6.8×10^{-13}	6.8×10^{-13}	1.8×10^{-13}	1.8×10^{-13}
Skin absorption	3.9×10^{-11}	3.1×10^{-15}	1.1×10^{-14}	1.1×10^{-14}	3.1×10^{-15}	3.1×10^{-15}
Fugitive dust inhalation	-	-	-	-	-	-
Sum from All Pathways	7.7×10^{-11}	1.8×10^{-13}	6.9×10^{-13}	6.9×10^{-13}	1.8×10^{-13}	1.8×10^{-13}
Recreational user						
Groundwater ingestion	4.3×10^{-5}	2.0×10^{-7}	7.6×10^{-7}	7.6×10^{-7}	2.0×10^{-7}	2.0×10^{-7}
Soil ingestion	5.4×10^{-10}	2.5×10^{-12}	9.5×10^{-12}	9.5×10^{-12}	2.5×10^{-12}	2.5×10^{-12}
Food ingestion	4.1×10^{-5}	1.9×10^{-7}	7.3×10^{-7}	7.3×10^{-7}	1.9×10^{-7}	1.9×10^{-7}
Skin absorption	6.1×10^{-8}	2.8×10^{-10}	1.1×10^{-9}	1.1×10^{-9}	2.8×10^{-10}	2.8×10^{-10}
Fugitive dust inhalation	-	-	-	-	-	-
Sum from All Pathways	8.4×10^{-5}	3.9×10^{-7}	1.5×10^{-6}	1.5×10^{-6}	3.9×10^{-7}	3.9×10^{-7}

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Table C.9-1. Initial amount of residual contaminants in facilities following disposition.

	Sr-90 (Ci)	Tc-99 (Ci)	I-129 (Ci)	Cs-137 (Ci)	Pu-238 (Ci)	Pu-239 (Ci)	Pu-240 (Ci)	Am-241 (Ci)	Np-237 (Ci)	Cd (kg)	F (kg)	Hg (kg)	NO_3 (kg)
Tank Farm[a]	9.3×10^{4}	23	0.12	9.3×10^{4}	790	130	24	120	6.7	79	0.33	130	35
Tank Farm (No Action)[b]	2.4×10^{5}	60	0.34	2.4×10^{5}	2.1×10^{3}	340	65	330	18	2.8×10^{3}	8.8×10^{3}	1.1×10^{3}	1.3×10^{6}
Bin sets[c]	4.8×10^{4}	18	NA[f]	4.5×10^{4}	430	11	7.3	43	0.17	230	4.2×10^{3}	18	1.3×10^{3}
Bin sets (No Action)[c]	9.6×10^{6}	3.6×10^{3}	NA[f]	8.9×10^{6}	8.7×10^{4}	2.1×10^{3}	1.5×10^{3}	8.7×10^{3}	34	4.7×10^{4}	8.5×10^{5}	3.7×10^{3}	2.5×10^{5}
New Waste Calcining Facility[d]	740	0.35	NA[f]	850	20	0.13	0.08	0.7	7.0×10^{-3}	0	2.1×10^{5}	4.5×10^{3}	2.3×10^{4}
Process Equipment Waste Evaporator[d]	740	0.35	NA[f]	8.50	20	0.13	0.08	0.7	7.0×10^{-3}	0	2.1×10^{5}	4.5×10^{3}	2.3×10^{4}
Class A grout in low-activity waste disposal facility[e]	0.58	1.9×10^{3}	1.7	7.0×10^{3}	1.3×10^{-5}	2.5×10^{-7}	2.0×10^{-7}	130	5.8×10^{-10}	1.4×10^{6}	1.9×10^{9}	2.5×10^{7}	0
Class C grout in low-activity waste disposal facility[e]	1.1×10^{7}	3.7×10^{3}	8.6	9.6×10^{6}	1.4×10^{-5}	2.6×10^{-7}	2.2×10^{-7}	130	6.8×10^{-10}	1.4×10^{6}	3.6×10^{9}	4.5×10^{7}	0
Class A grout in Tank Farm[g]	9.3×10^{4}	970	0.97	9.6×10^{4}	790	130	24	190	6.7	7.0×10^{5}	9.5×10^{8}	1.3×10^{7}	35
Class C grout in Tank Farm[h]	5.6×10^{6}	1.9×10^{3}	4.4	4.9×10^{6}	790	130	24	190	6.7	7.0×10^{5}	1.8×10^{9}	2.3×10^{7}	35
Class A grout in bin sets[g]	4.6×10^{4}	970	0.85	4.8×10^{4}	430	11	7.3	110	0.17	7.0×10^{5}	9.5×10^{8}	1.3×10^{7}	1.3×10^{3}
Class C grout in bin sets[h]	5.6×10^{6}	1.9×10^{3}	4.3	4.8×10^{6}	430	11	7.3	110	0.17	7.0×10^{5}	1.8×10^{9}	2.3×10^{7}	1.3×10^{3}

a. Source: Beck (1999a).
b. Source: Beck (1999b,c).
c. Source: Staiger (1999).
d. Source: Demmer and Archibald (1995).
e. Source: Russell et al. (1998).
f. NA = means that there is no information to indicate the presence of the contaminant in the listed facility.
g. Value represents one-half of the "Class A grout in low-activity waste disposal facility" entry plus the facility residual value (i.e., "Tank Farm" and "bin set" entries).
h. Value represents one-half of the "Class C grout in low-activity waste disposal facility" entry plus the facility residual value (i.e., "Tank Farm" and "bin set" entries).

Table C.9-5. Radionuclide inventory used in the derivation of external dose rates from dispositioned facilities.

	HLW Tanks (Ci/m^3)				Bin Sets (Ci/m^3)[c]				Low Activity Waste Disposal Facility (Ci/m^3)[d]			
Radionuclide	No Action[a]	Residual[b]	Residual plus Class A Grout[b]	Residual plus Class C Grout[b]	No Action	Residual	Residual plus Class A Grout	Residual plus Class C Grout	Class A Grout	Class C Grout	New Waste Calcining Facility (Ci/m^3)[e]	Process Equipment Waste Evaporator (Ci/m^3)[e]
Am-241	1.7×10^{-5}	6.5×10^{-3}	0.012	0.012	2.6	0.013	0.018	0.019	0.70	0.70	0.095	0.095
Ba-137m	42	6.2	6.4	400	2.0×10^{3}	10	10	410	-	-	110	110
Co-60	-	8.3×10^{-4}	8.3×10^{-4}	8.3×10^{-4}	-	-	-	-	-	-	-	-
Cs-137	44	6.5	6.8	430	2.1×10^{3}	11	11	430	850	850	120	120
Eu-154	-	7.7×10^{-3}	7.7×10^{-3}	7.7×10^{-3}	-	-	-	-	-	-	-	-
I-129	6.6×10^{-5}	6.5×10^{-6}	7.9×10^{-5}	3.9×10^{-4}	-	-	7.3×10^{-5}	7.7×10^{-3}	-	-	-	-
Np-237	3.4×10^{-3}	3.7×10^{-4}	3.7×10^{-4}	3.7×10^{-4}	3.0×10^{-3}	1.5×10^{-5}	1.5×10^{-5}	1.5×10^{-5}	7.0×10^{-3}	7.0×10^{-3}	9.6×10^{-4}	9.6×10^{-4}
Pa-233	-	3.7×10^{-4}	3.7×10^{-4}	3.7×10^{-4}	2.6×10^{-3}	1.3×10^{-5}	1.3×10^{-5}	1.3×10^{-5}	-	-	-	-
Pu-238	0.4	0.044	0.044	0.044	26	0.13	0.13	0.13	20	20	2.8	2.8
Pu-239	0.064	7.1×10^{-3}	7.1×10^{-3}	7.1×10^{-3}	0.49	2.4×10^{-3}	2.4×10^{-3}	2.4×10^{-3}	0.31	0.31	0.042	0.042
Pu-240	0.012	1.4×10^{-3}	1.4×10^{-3}	1.4×10^{-3}	0.41	2.0×10^{-3}	2.0×10^{-3}	2.0×10^{-3}	0.08	0.08	0.011	0.011
Pu-241	-	0.018	0.018	0.018	9.8	0.049	0.049	0.049	-	-	-	-
Ra-225	-	5.9×10^{-11}	5.9×10^{-11}	5.9×10^{-11}	-	-	-	-	-	-	-	-
Ra-226	-	5.9×10^{-9}	5.9×10^{-9}	5.9×10^{-9}	-	-	-	-	-	-	-	-
Sm-151	-	0.065	0.065	0.065	-	-	-	-	-	-	-	-
Sr-90	45	5.8	5.8	470	2.4×10^{3}	12	1.2	480	740	740	100	100
Tc-99	0.012	1.2×10^{-3}	0.079	0.16	0.79	3.9×10^{-3}	0.082	0.17	0.35	0.35	0.048	0.048
Th-229	-	5.9×10^{-11}	5.9×10^{-11}	5.9×10^{-11}	-	-	-	-	-	-	-	-
Th-230	-	3.4×10^{-7}	3.4×10^{-7}	3.4×10^{-7}	-	-	-	-	-	-	-	-
U-233	-	3.1×10^{-8}	3.1×10^{-8}	3.1×10^{-8}	-	-	-	-	-	-	-	-
U-234	-	1.1×10^{-4}	1.1×10^{-4}	1.1×10^{-4}	-	-	-	-	-	-	-	-
Y-90	45	5.8	5.8	470	2.4×10^{3}	12	12	480	740	740	100	100

a. Source: Beck (1999b,c). Patterned after Tank No. WM-188, which has the highest estimated inventory.
b. Source: Beck (1999a). Patterned after Tank No. WM-185, which is estimated to have highest residual inventory (i.e., after cleaning).
c. Source: Staiger (1999). All bin set cases patterned after Bin Set No. 5.
d. Source: Russell, et al. (1998).
e. Source: Demmer and Archibald (1995).

Table C.9-6. Final results of radionuclide screening for the groundwater release pathway.

Radionuclide	Half-life	Maximum estimated release following facilities disposition (Ci)	Scenario under which maximum release occurs	Previously assessed release (Ci)[a]	Ratio[b]	Screening outcome
Am-241	432 years	1.4×10^{-9}	PEW Evaporator	111	1.3×10^{-11}	Not further assessed
Cs-137	30 year	3.9×10^{3}	Class C grout in landfill	3×10^{4}	0.13	Not further assessed
I-129	1.6×10^{7} years	8.7	Class C grout in landfill	1.5	5.8	Perform quantitative risk assessment
Np-237	2.1×10^{6} years	5.6×10^{-6}	PEW Evaporator	1.4	4.0×10^{-6}	Not further assessed
Sr-90	28.6 years	1.8×10^{4}	Class C grout in landfill	1.9×10^{4}	0.95	Not further assessed
Tc-99	2.1×10^{5} years	1.6	Class C grout in landfill	2.7	0.5	Perform quantitative risk assessment
Pu-238	88 years	$<1\times10^{-10}$	PEW Evaporator	1.2×10^{3}[c]	8.3×10^{-14}	Not further assessed
Pu-239	2.4×10^{4} years	3.3×10^{-7}	PEW Evaporator	1.2×10^{3}[c]	2.8×10^{-10}	Not further assessed
Pu-240	6,570 years	6.0×10^{-7}	PEW Evaporator	1.2×10^{3}[c]	5.0×10^{-10}	Not further assessed
U-233	1.6×10^{5} years	2.7×10^{-7}	PEW Evaporator	2.0[d]	1.4×10^{-7}	Not further assessed
U-234	2.5×10^{5} years	1.5×10^{-9}	PEW Evaporator	2.0[d]	7.5×10^{-10}	Not further assessed
Ac-225[e]	10 days	6.6×10^{-8}	PEW Evaporator		NA	Not further assessed
Pa-233[e]	27 days	5.6×10^{-6}	PEW Evaporator		NA	Not further assessed
Ra-225[e]	14.8 days	6.6×10^{-8}	PEW Evaporator		NA	Not further assessed
Ra-226[e]	1,600 years	$<1\times10^{-10}$	PEW Evaporator		NA	Not further assessed
Th-229[e]	7,340 years	6.6×10^{-8}	PEW Evaporator		NA	Not further assessed
Y-90[e]	64 hours	1.7×10^{4}	Class C grout in landfill		NA	Not further assessed

a. Source: Rodriguez et al. (1997).
b. The “ratio” column presents the quotient of the “maximum estimated release following facility disposition” column and the “previously assessed release” column.
c. Value is for total plutonium.
d. Value is for total uranium.
e. These radionuclides are included because they are decay products of other listed species.
NA = Not Applicable.

Table C.9-7. Final results of nonradiological contaminant screening for the groundwater release pathway.

Contaminants	Percent of total screening product: Tank Farm	Percent of total screening product: Bin sets	Maximum estimated release following facilities disposition (g)	Facility from which maximum release occurs[a]	Previously assessed release (g)	Screening outcome
Mercury	94.47	39.49	43	PEW Evaporator	1.0×10^{6}[(b)]	Not further assessed
Cadmium	3.27	37.74	1.7×10^{4}	Class C grout in landfill	(Not assessed)	Perform quantitative risk assessment
Nitrate	1.36	0.19	6.3×10^{8}	Bin Sets-No Action	(Not assessed)	Perform quantitative risk assessment
Fluoride	0.19	21.24	2.2×10^{9}	PEW Evaporator	(Not assessed)	Perform quantitative risk assessment
Subtotal	99.29	98.66				
All other compounds	0.71	1.34				
Total	100	100				

a. In each case, the applicable closure alternative is Performance-based Closure or Closure to Landfill Standards.
b. Source: Rodriguez et al. (1997).

Table C.9-8. Identities of contaminants and distribution coefficients (cm^3/g) used for analysis of impacts from the disposition of facilities.

	I		II		III		IV		V	
	Non-reducing calcine, K_d	Ref.	Non-reducing concrete, K_d	Ref.	Reducing concrete, K_d	Ref.	Reducing contaminated zone, K_d	Ref.	Non-Reducing contaminated zone, K_d	Ref.
Sr-90	24	c	10	a	1	d	1	d	110[e]	a
Tc-99	3	c	700	a	1,000	d	1,000	d	1[e]	a
I-129	0	c	30	a	2	d	2	d	1[e]	a
Cs-137	51	c	20	a	2	d	2	d	1,900[e]	a
Np-237	3	c	5,000	a	5,000	d	5,000	d	55[e]	a
Pu-238, 239	NA	b	5,000	a	NA	b	NA	b	NA	b
Am-241	82	c	5,000	a	5,000	d	5,000	d	8,400[e]	a
Cadmium	15	c	567	f	567	g	567	g	567	f
Fluoride	0	c	0	f	0	g	0	g	0	f
Mercury	322	c	5,280	f	5,280	g	5,280	g	5,280	f
Nitrate	0	c	0	f	0	g	0	g	0	f

a. WSRC (1994), Table 3.3-2, page 3-69.
b. Solubility limit of 4.4×10^{-13} mols/liter used, WSRC (1994), page C-32.
c. MEPAS default for soil <10 percent clay and pH from 5-9.
d. Bradbury and Sarott (1995), Table 4, Region 1, page 42.
e. Value used for clay from WSRC (1994).
f. MEPAS default used for soil >30 percent clay and pH from 5-9.
g. MEPAS default used for soil >30 percent clay and pH >9.

Table C.9-10. Contaminant-specific parameter values used in closure modeling analyses.

	Units	Radiological contaminants: Tc-99	Radiological contaminants: I-129	Notes
Soil dermal absorption factor	unitless fraction	0.1	0.1	EPA default value for organics is used as a conservative estimate
Water contact permeability constant	cm/hr	1.0×10^{-3}	1.0×10^{-3}	No data for contaminants; value used is for water
Soil-root uptake factor	pCi/g plant per pCi/g soil	40	0.4	From Napier et al. (1988) or Yu (1993) (the higher of the two is used)
Soil-to-water distribution coefficient (K_d)	$(g/cm^3)^{-1}$	3	0	From Schafer (1999)
Food transfer coefficients				
Intake-to-beef	pCi/kg per pCi/d	9.9×10^{-4}	0.007	From Napier et al. (1988) or Yu (1993) (the higher of the two is used)
Intake-to-poultry	pCi/kg per pCi/d	0.03	0.018	From Napier et al. (1988)
Intake-to-milk	pCi/kg per pCi/d	1.0×10^{-3}	0.012	From Napier et al. (1988) or Yu (1993) (the higher of the two is used)
Intake-to-eggs	pCi/kg per pCi/d	3.0	2.8	From Napier et al. (1988)
Radiation dose factors				
Inhalation	(mrem/pCi)	8.31×10^{-6}	1.74×10^{-4}	From Federal Guidance Report No. 11 (EPA 1989)
Ingestion	(mrem/pCi)	1.46×10^{-6}	2.76×10^{-4}	From Federal Guidance Report No. 11 (EPA 1989)
Radionuclide carcinogenic slope factors				
Inhalation	(risk/pCi)	2.89×10^{-12}	1.22×10^{-10}	From EPA HEAST database (EPA 1995)
Ingestion	(risk/pCi)	1.40×10^{-12}	1.84×10^{-10}	From EPA HEAST database (EPA 1995)

	Units	Nonradiological contaminants: Fluoride	Nonradiological contaminants: Nitrate	Nonradiological contaminants: Cadmium	Notes
Soil dermal absorption factor	unitless fraction	0.1	0.1	0.1	From EPA Planning Remediation Guidance
Water contact permeability constant	cm/hr	1.0×10^{-3}	1.0×10^{-3}	1.0×10^{-3}	No data for contaminants; value used is for water
Soil-root uptake factor	mg/kg plant per mg/kg soil	0.02	7.5	2.0	From Napier et al. (1988) or Yu (1993) (the higher of the two is used)
Soil-to-water distribution coefficient (K_d)	$(g/cm^3)^{-1}$	0	0	6	From Schafer (1999)
Food transfer coefficients					
Intake-to-beef	mg/kg per mg/d	0.02	0.01	4.0×10^{-4}	From Napier et al. (1988) or Yu (1993) (the higher of the two is used)
Intake-to-poultry	mg/kg per mg/d	9.9×10^{-4}	9.9×10^{-4}	0.84	From Napier et al. (1988)
Intake-to-milk	mg/kg per mg/d	7.0×10^{-3}	0.011	1.0×10^{-3}	From Napier et al. (1988) or Yu (1993) (the higher of the two is used)
Intake-to-eggs	mg/kg per mg/d	9.9×10^{-4}	9.9×10^{-4}	1.0×10^{-3}	From Napier et al. (1988)
Carcinogenic inhalation slope factor	$(mg/kg\text{-}d)^{-1}$	NA	NA	6.3	From EPA IRIS database (EPA 1998)
Carcinogenic oral slope factor	$(mg/kg\text{-}d)^{-1}$	NA	NA	NA	Data not available per EPA IRIS database (EPA 1998)
Noncarcinogenic inhalation reference dose	mg/kg-d	NA	NA	NA	Data not available per EPA IRIS database (EPA 1998)
Noncarcinogenic oral reference dose	mg/kg-d	0.06	1.6	NA	From EPA IRIS database (EPA 1998)

APPENDIX C.10

ENVIRONMENTAL CONSEQUENCES DATA

TABLE OF CONTENTS

Section Page

List of Tables

Tables Page

C.10 Environmental Consequences Data

C.10.1 WASTE PROCESSING ALTERNATIVES AND OPTIONS

This section presents a summary of data that were used to discuss environmental consequences in the quantitative sections of Chapter 5. The data are presented for each alternative and option. For the Minimum INEEL Processing Alternative, data have been presented for impacts at both INEEL and the Hanford Site. Five categories of construction data, named in the first column of Table C.10-1, were discussed in Chapter 5 and summarized by discipline below. Eight categories of operations data, named in the first column of Table C.10-2, were discussed in Chapter 5 and are also summarized by discipline below.

Land Use. For the operations phase, the values presented in Table C.10-2 are estimates of the amount of land outside of established facility areas that would be disturbed if a particular waste processing alternative is implemented. Land use impacts are discussed in Section 5.2.1.

Socioeconomics. The values presented are the estimated peak year employment and total earnings for both construction and operational phases for each of the proposed waste processing activities for the period 2000 to 2035. These employment levels are not the result of substantial new job creation but reflect the retraining and reassignment of existing personnel. Waste processing related employment is discussed in Section 5.2.2. The employment levels reported in Section 5.2.2 do not distinguish between jobs that are retained and those that are newly generated. A detailed analysis of socioeconomic impacts is provided in Appendix C.1.

Air Resources. The values presented for the construction phase are for parameters associated with nonradiological airborne emissions from construction activities (i.e., operation of heavy equipment, etc.). The values presented for the operations phase are for parameters associated with both radiological and nonradiological airborne emissions during normal waste processing activities. Radiological parameters are the radiation doses from airborne radionuclide emissions that would be received by (a) a hypothetical person residing at the offsite location of highest predicted dose (called the offsite maximally exposed individual); (b) an INEEL worker who is assumed to spend all of his work time at the onsite area of highest predicted dose (called the noninvolved worker); and (c) the entire population located within 50 miles of INTEC. These doses are calculated using a combination of historical monitored emissions data, projected emissions estimates, atmospheric dispersion modeling using annual average meteorological data measured near INTEC, and exposure and dose modeling as described in alternatives and option.

Appendix C.2. Nonradiological parameters for the operations phase include: (a) maximum ambient air concentration of a criteria air pollutant, expressed in terms of the highest percentage of an applicable ambient air quality standard and allowable increment under Prevention of Significant Deterioration rules; (b) maximum ambient air concentration of carcinogenic and non-carcinogenic toxic air pollutants, expressed as the maximum percentage of any level allowed by State of Idaho regulations; and (c) maximum onsite concentration of toxic air pollutants, expressed as the maximum percentage of any occupational exposure limit. Nonradiological pollutant concentrations were calculated using a combination of historical monitored emissions data, projected emissions estimates, and atmospheric dispersion modeling using the ISC-3 code and hourly meteorological data measured near INTEC, as described in Appendix C.2.

Health and Safety. Health and safety impacts for the construction and operational phases are presented in terms of radiological, nonradiological, and occupational injury impacts. The estimated radiation dose is presented for the onsite (involved and non involved) and offsite maximally-exposed individuals. The estimated radiation dose and related increase in latent cancer fatalities over the entire period of waste processing activities are presented for the collective involved worker population. The dose to the individual involved worker and collective involved worker group is based on expected radiological conditions from prior INEEL exposure data for similar facility operations. The annual offsite maximally-exposed individual, general population, and worker radiological impact data are discussed in Section 5.2.10 for the waste processing options. The nonradiological data is presented in terms of the projected noncarcinogenic and carcinogenic toxic pollutant concentrations at the site boundary for the proposed waste processing options. The pollutant concentrations and their hazard quotients (ratio of expected concentration to the Idaho regulatory standard) are discussed in Section 5.2.10. The projected occupational injury data associated with waste processing options is presented in terms of total lost workdays and total recordable cases that would occur over the entire operations phase of each option. The projected lost workdays and total recordable case rates are based on INEEL historic injury rates multiplied by the predicted employment levels for each option. Further data on lost workdays and total recordable cases for peak employment years are discussed in Section 5.2.10.

Utilities and Energy. The values presented for the construction and operational phases are for water use (potable and non-potable), electricity use, sanitary wastewater, and fossil fuel use. They represent an estimate of the change in annual consumption (water, electricity, and fossil fuels) and generation (sanitary wastewater) that may result from proposed waste processing activities for each alternative and option. The baseline site water use is the annual water consumption for the site for all operations. The maximum percent of baseline site water represents the annual maximum incremental change in water use that would occur because of the proposed waste processing activities. The baseline site electricity use is the annual power consumption for the site for all operations. The maximum percent of site electricity use represents the annual maximum incremental change in power consumption that would occur because of the proposed waste processing activities. The baseline site sanitary wastewater value represents the annual volume of wastewater generated from total site operations. The maximum percent of baseline site sanitary wastewater represents the annual maximum incremental change in wastewater generation that would occur as a result of the proposed waste processing activities. The maximum percent of site fossil fuel use represents the annual maximum incremental change in fossil fuel use that would occur because of the proposed waste processing activities. Water use, electricity use, sanitary wastewater, and fossil fuel use, and related consequences are discussed in Section 5.2.12.

Waste and Materials. For the construction and operational phases, the generation of mixed low-level, low-level, hazardous, and industrial (nonhazardous and nonradiological) wastes (in cubic meters) along with a total of all wastes generated is provided. The operational periods for the various alternatives and options would begin at different times, ranging from 1999 to 2007, but the period of evaluation ends with the year 2035 in all cases. Correspondingly, the total waste generation values presented here are only for activities through the year 2035. The waste volumes are discussed in Section 5.2.13. It should be noted that the three options under the Separations Alternative in both tables include waste generation from the base case disposal option (i.e., disposal in a new Low-Activity Waste Disposal Facility) for the grouted low-level waste fraction. Section 5.2.13 includes waste generation estimates for other disposal options in addition to the base case.

Traffic and Transportation. For incident free high-level waste transportation under the operations phase, the values in Table C.10–2 represent the total fatalities from shipments of waste for each alternative by truck and rail. Total fatalities are the sum of radiation related latent cancer fatalities for transportation workers and the general population, plus nonradiological fatalities from vehicular emissions. The estimated risks of latent cancer fatalities represent the radiological risk from transportation accidents. The estimated risk of vehicle related traffic fatalities represents the nonradiological risk from traffic accidents. Both quantities are based on the total number of shipments associated with each alternative. These data are an aggregate of the data presented in Section 5.2.9 and Appendix C.5.

Facility Accidents. For accidents under the operational phase, the maximally-exposed individual and collective dose values in the tables are for the accident having the highest consequences to workers or the public. The accidents selected for reporting are not necessarily the same for workers and the general population. In each category (abnormal event, design basis, and beyond design basis), the accident with the highest consequences was selected, which may be different for workers and the general population. Accident analyses reported in this summary are based on waste processing-related activities only and are found in Section 5.2.14 and in Appendix C.4.

C.10.2 FACILITY DISPOSITION ALTERNATIVES

This section presents a summary of data that were used to discuss facility disposition in the quantitative sections of Section 5.3. The data are presented for new facilities in Table C.10-3 and for existing facilities in Table C.10-4. In Table C.10-3, the data are presented for dispositioning the new facilities that are associated with each of the proposed waste processing options. All new facilities would be dispositioned to clean closure standards at the conclusion of all waste processing activities. Since there are no new facilities under the No Action Alternative, there is no column for No Action in Table C.10-3. Five disposition alternatives are under consideration for the existing facilities. In Table C.10-4, data are presented for each of the proposed disposition alternatives. No descriptions of these alternatives are provided in Section 5.3. Five categories of quantitative data were discussed in Section 5.3, are summarized by discipline below, and presented in Tables C.10-3 and C.10-4. Tables C.10-5 and C.10-6 present the result of the long-term facility disposition fate and transport modeling.

Socioeconomics. The values presented are for the estimated peak year employment and income and are the estimated totals for the life of the dispositioning activity. These employment levels are not the result of substantial new job creation but reflect the retraining and reassignment of existing personnel. Waste processing related employment is discussed in Section 5.3.2. A detailed analysis of socioeconomic impacts is provided in Appendix C.1.

Air Resources. The values presented are for parameters associated with total radiological and nonradiological airborne emissions from normal dispositioning activities. Radiological parameters are the radiation doses from airborne radionuclide emissions that would be received by (a) a hypothetical person residing at the offsite location of highest predicted dose (called the offsite maximally exposed individual); (b) an INEEL worker who is assumed to spend all of his work time at the onsite area of highest predicted dose (called the noninvolved worker); and (c) the entire population located within 80 kilometers (50 miles) of INTEC. These doses are calculated using a combination of historical monitored emissions data, projected emissions estimates, atmospheric dispersion modeling using annual average meteorological data measured near INTEC, and exposure and dose modeling as described in

Table C.10-5. Summary of total lifetime radiation dose and excess carcinogenic risk from exposure to radionuclides according to receptor and facility closure scenario.

Receptor	Facility closure scenario					
	No Action	Performance-Based Closure/ Closure to Landfill Standards	Performance-Based Closure with Class A Grout Disposal	Performance-Based Closure with Class C Grout Disposal	Disposal of Class A grout in low-activity waste disposal facility	Disposal of Class C grout in low-activity waste disposal facility
Lifetime radiation dose to potential receptors (millirem)						
Maximally exposed resident farmer	8.7[a]	13	18	50	21	51
Average resident farmer	4.8	2.7	3.7	10	4.2	10
INEEL worker	5.3	8.9×10^{-11}	9.0×10^{-11}	3.8×10^{-9}	8.9×10^{-11}	9.1×10^{-11}
Construction worker	1.4	1.4	2	5.4	2.2	5.4
Indoor worker	1.4	1.4	2	5.4	2.2	5.4
Unauthorized Intruder[b]	0.29	0.023	2.4×10^{-3}	1.5	0.023	0.023
Uninformed Intruder[c]	0.047	3.8×10^{-3}	7.7×10^{-3}	0.25	3.8×10^{-3}	3.8×10^{-3}
Recreational user	0.22	0.31	0.42	1.2	0.48	1.2
Excess cancer risk (per thousand)						
Maximally exposed resident farmer	4.4×10^{-3}	6.7×10^{-3}	9.2×10^{-3}	0.025	0.01	0.025
Average resident farmer	2.4×10^{-3}	1.4×10^{-3}	1.9×10^{-3}	5.1×10^{-3}	2.1×10^{-3}	5.1×10^{-3}
INEEL worker	2.7×10^{-3}	4.5×10^{-14}	4.5×10^{-14}	1.9×10^{-12}	4.5×10^{-14}	4.5×10^{-14}
Construction worker	6.9×10^{-4}	7.2×10^{-4}	9.8×10^{-4}	2.7×10^{-3}	1.1×10^{-3}	2.7×10^{-3}
Indoor worker	6.8×10^{-4}	7.2×10^{-4}	9.8×10^{-4}	2.7×10^{-3}	1.1×10^{-3}	2.7×10^{-3}
Unauthorized Intruder[a]	1.4×10^{-4}	1.1×10^{-5}	1.2×10^{-6}	7.5×10^{-4}	1.1×10^{-5}	1.1×10^{-5}
Uninformed Intruder[b]	2.4×10^{-5}	1.9×10^{-6}	3.9×10^{-6}	1.3×10^{-4}	1.9×10^{-6}	1.9×10^{-6}
Recreational user	1.1×10^{-4}	1.5×10^{-4}	2.1×10^{-4}	5.8×10^{-4}	2.4×10^{-4}	5.8×10^{-4}

a. An air pathway dose of 170 millirem is calculated based on a maximally exposed individual dose due to failure of a single bin set.
b. Time frame for receptor exposure is during period of institutional control (before 2095).
c. Time frame for receptor exposure is distant future.

Appendix C.2. Nonradiological parameters include: (a) maximum ambient air concentration of a criteria air pollutant, expressed in terms of the highest percentage of an applicable ambient air quality standard and allowable increment under Prevention of Significant Deterioration rules; (b) maximum ambient air concentration of carcinogenic and non-carcinogenic toxic air pollutants, expressed as the maximum percentage of health-based reference levels designated (for new facilities) by State of Idaho regulations; and (c) maximum onsite concentration of toxic air pollutants, expressed as the maximum percentage of any occupational exposure limit. Nonradiological pollutant concentrations were calculated using a combination of historical monitored emissions data, projected emissions estimates, and atmospheric dispersion modeling using the ISC-3 code and hourly meteorological data measured near INTEC, as described in Appendix C.2.

Table C.10-6. Summary of estimated noncarcinogenic health hazard quotients from exposure to nonradiological contaminants according to receptor and facility closure scenario.

	Facility closure scenario					
Receptor	No Action	Performance-Based Closure/ Closure to Landfill Standards	Performance -Based Closure with Class A Grout Disposal	Performance -Based Closure with Class C Grout Disposal	Disposal of Class A grout in low-activity waste disposal facility	Disposal of Class C grout in low-activity waste disposal facility
Health hazard quotient due to cadmium intake						
Maximally exposed resident farmer	4.3×10^{-7}	6.5×10^{-8}	4.6×10^{-7}	4.8×10^{-7}	1.5×10^{-5}	1.6×10^{-5}
Average resident farmer	6.7×10^{-8}	1.0×10^{-8}	7.1×10^{-8}	7.5×10^{-8}	2.3×10^{-6}	2.5×10^{-6}
INEEL Construction worker	7.0×10^{-8}	1.1×10^{-8}	7.5×10^{-8}	7.8×10^{-8}	2.4×10^{-6}	2.6×10^{-6}
Indoor worker	7.0×10^{-8}	1.1×10^{-8}	7.5×10^{-8}	7.8×10^{-8}	2.4×10^{-6}	2.6×10^{-6}
Recreational user	3.7×10^{-9}	1.2×10^{-9}	8.7×10^{-9}	9.1×10^{-9}	2.8×10^{-7}	3.1×10^{-7}
Health hazard quotient due to fluoride intake						
Maximally exposed resident farmer	0.08	5.2×10^{-4}	0.12	0.27	1.4	1.4
Average resident farmer	0.04	2.6×10^{-4}	0.058	0.13	0.69	0.71
INEEL Construction worker	6.4×10^{-3}	4.2×10^{-5}	9.4×10^{-3}	0.021	0.11	0.11
Indoor worker	6.4×10^{-3}	4.2×10^{-5}	9.4×10^{-3}	0.021	0.11	0.11
Recreational user	1.8×10^{-3}	1.2×10^{-5}	2.6×10^{-3}	4.1×10^{-3}	0.032	0.032
Health hazard quotient due to nitrate intake						
Maximally exposed resident farmer	6.5×10^{-3}	3.0×10^{-5}	1.1×10^{-4}	1.1×10^{-4}	3.0×10^{-5}	3.0×10^{-5}
Average resident farmer	2.9×10^{-3}	1.3×10^{-5}	5.0×10^{-5}	5.0×10^{-5}	1.3×10^{-5}	1.3×10^{-5}
INEEL Construction worker	4.0×10^{-4}	1.9×10^{-6}	7.1×10^{-6}	7.1×10^{-6}	1.9×10^{-6}	1.9×10^{-6}
Indoor worker	4.0×10^{-4}	1.9×10^{-6}	7.1×10^{-6}	7.1×10^{-6}	1.9×10^{-6}	1.9×10^{-6}
Recreational user	8.4×10^{-5}	3.9×10^{-7}	1.5×10^{-6}	1.5×10^{-6}	3.9×10^{-7}	3.9×10^{-7}

Health and Safety. Health and safety impacts are presented in terms of total radiological and occupational injury impacts for the entire period of the dispositioning activities. The estimated increase in latent cancer fatalities is presented for the collective involved worker population. The dose to the collective involved worker group is based on expected radiological conditions from prior INEEL exposure data for similar facility operations. The projected occupational injury data associated with waste processing options is presented in terms of total lost workdays and total recordable cases that would occur over the entire operations phase of each option. The projected lost workdays and total recordable case rates are based on INEEL historic injury rates multiplied by the predicted employment levels for dispositioning activities following each waste processing option and for each disposition alternative for the existing facilities. Further data on lost workdays and total recordable cases are discussed in Section 5.3.8.

Utilities and Energy. The values presented are for water use (potable and non-potable), electricity use, sanitary wastewater, and fossil fuel use. They represent the utility and energy requirements for dispositioning (clean closing) new facilities built to support the various waste processing alternatives and dispositioning existing facilities, depending on the facility disposition alternative selected. Water use, electricity use, sanitary wastewater, and fossil fuel use and related consequences are discussed in Section 5.2.12.

Waste and Materials. The data presented represent the total generation of mixed low-level, low-level, hazardous, and industrial nonhazardous and nonradiological wastes (in cubic meters) from the dispositioning activities over the entire dispositioning period. The waste volumes are discussed in Section 5.3.11.

Table C.10-1. Summary of construction impacts by waste processing alternatives and options.[a]

				Separations Alternative			Non-Separations Alternative			Minimum INEEL Processing Alternative	
	Units	No Action Alternative	Continued Current Operations Alternative	Full Separations Option	Planning Basis Option	Transuranic Separations Option	Hot Isostatic Pressed Waste Option	Direct Cement Waste Option	Early Vitrification Option	At INEEL	At Hanford
Socioeconomics											
Direct employment	Number of jobs	20	90	850	870	680	360	400	330	200	290
Indirect employment	Number of jobs	20	90	880	900	700	370	420	340	210	300
Total employment	Number of jobs	40	180	1.7×10^{3}	1.8×10^{3}	1.4×10^{3}	730	820	670	410	590
Total earnings	1996 dollars	1.0×10^{6}	4.4×10^{6}	4.2×10^{7}	4.3×10^{7}	3.4×10^{7}	1.8×10^{7}	2.0×10^{7}	1.6×10^{7}	1.0×10^{7}	1.4×10^{7}
Air Resources											
Criteria pollutant emissions	Total tons	18	61	790	750	810	630	740	580	470	350
	Tons per year	3.5	18	250	250	240	180	200	160	120	59
Toxic air pollutant emissions	Total pounds	20	68	880	840	910	710	830	650	530	390
	Pounds per year	3.9	20	280	280	270	800	220	180	130	66
Fugitive dust emissions	Total tons	110	210	2.8×10^{3}	680	2.6×10^{3}	670	910	550	2.6×10^{3}	1.3×10^{3}
	Tons per year	22	46	490	200	430	190	240	150	420	220
Health and Safety											
Total campaign collective worker dose	Person-rem	72	72	120	120	120	110	110	110	120	NA[b]
Total worker latent cancer fatalities	Latent cancer fatalities	0.03	0.03	0.05	0.05	0.05	0.05	0.05	0.05	0.05	NA
Total recordable cases	Cases	4	14	200	240	170	86	81	88	100	230
Total lost workdays	Days	34	120	1.7×10^{3}	2.0×10^{3}	1.4×10^{3}	720	680	740	840	NR[c]
Utilities and Energy											
Potable water use	Million gallons per year	0.12	0.77	6.6	6.8	4.7	3.0	3.2	2.5	2.9	1.8
Baseline potable water use, INTEC operations	Million gallons per year	55	55	55	55	55	55	55	55	55	NA
Percent of baseline INTEC potable water use	Percentage	0.22	1.4	12	12	8.5	5.4	5.8	4.5	5.3	NA
Nonpotable water use	Million gallons per year	0.04	0.11	0.38	0.41	0.27	0.28	0.46	0.30	0.29	0.04
Baseline nonpotable water use, INTEC operations	Million gallons per year	400	400	400	400	400	400	400	400	400	NA

Table C.10-1. (Continued).

	Units	No Action Alternative	Continued Current Operations Alternative	Separations Alternative: Full Separations Option	Separations Alternative: Planning Basis Option	Separations Alternative: Transuranic Separations Option	Non-Separations Alternative: Hot Isostatic Pressed Waste Option	Non-Separations Alternative: Direct Cement Waste Option	Non-Separations Alternative: Early Vitrification Option	Minimum INEEL Processing Alternative: At INEEL	Minimum INEEL Processing Alternative: At Hanford
Percent of baseline INTEC nonpotable water use	Percentage	0.01	0.03	0.09	0.1	0.07	0.07	0.12	0.07	0.07	NA
Electricity use	Megawatt-hours per year	180	3.4×10^{3}	3.3×10^{3}	6.5×10^{3}	2.9×10^{3}	4.0×10^{3}	4.0×10^{3}	900	1.1×10^{3}	2.9×10^{3}
Baseline INTEC electricity use	Megawatt-hours per year	8.8×10^{4}	8.8×10^{4}	8.8×10^{4}	8.8×10^{4}	8.8×10^{4}	8.8×10^{4}	8.8×10^{4}	8.8×10^{4}	8.8×10^{4}	NA
Percent of INTEC electricity use	Percentage	0.2	3.9	3.9	7.4	3.3	4.5	4.5	1.0	1.3	NA
Sanitary wastewater	Million gallons per year	0.12	0.77	6.6	6.8	4.7	3.0	3.2	2.5	2.9	1.8
Baseline INTEC sanitary wastewater	Million gallons per year	55	55	55	55	55	55	55	55	55	NA
Percent of baseline INTEC sanitary wastewater	Percentage	0.22	1.4	12	12	8.5	5.5	5.8	4.5	5.3	NA
Fossil fuel use	Million gallons per year	6.6×10^{-3}	0.04	0.43	0.41	0.45	0.35	0.39	0.30	0.23	0.09
Baseline INTEC fossil fuel use	Million gallons per year	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	NA
Percent of baseline INTEC fossil fuel use	Percentage	0.7	41	440	470	460	360	400	310	230	NA
Waste and Materials[d]											
Mixed low-level waste generation[e]	Cubic meters	220	240	1.1×10^{3}[f]	1.1×10^{3}	1.1×10^{3}[f]	1.1×10^{3}	1.1×10^{3}	1.1×10^{3}	1.1×10^{3}	0
Low-level waste generation[e]	Cubic meters	0	20	330[f]	210	210[f]	260	340	310	110	0
Hazardous waste generation[e]	Cubic meters	0	30	790[f]	880	280[f]	790	560	640	340	20
Industrial waste generation[e]	Cubic meters	1.4×10^{3}	6.8×10^{3}	5.5×10^{4}[f]	6.0×10^{4}	3.9×10^{4}[f]	2.6×10^{4}	3.0×10^{4}	2.3×10^{4}	2.6×10^{4}	1.9×10^{4}

a. The categories of land use, traffic and transportation, and facility accidents do not have construction impacts.
b. NA = Not applicable or not assessed.
c. NR = Not reported.
d. Construction does not generate HLW, transuranic waste, or low-activity waste.
e. Values presented represent totals for the duration of the project.
f. This value represents the highest quantity among the disposal methods considered.

Table C.10-2. Summary of operations impacts by waste processing alternatives and options.

				Separations Alternative			Non-Separations Alternative			Minimum INEEL Processing Alternative	
	Units	No Action Alternative	Continued Current Operations Alternative	Full Separations Option	Planning Basis Option	Transuranic Separations Option	Hot Isostatic Pressed Waste Option	Direct Cement Waste Option	Early Vitrification Option	At INEEL	At Hanford
Land Use											
Open land converted to industrial use for new facilities	Acres	0	0	22[a]	0[a]	22[a]	0	0	0	22[a]	52
Socioeconomics[b]											
Direct employment	Number of jobs	70	280	440	480	320	460	530	330	330	740
Indirect employment	Number of jobs	170	500	790	860	570	820	930	590	590	1.3×10^{3}
Total employment	Number of jobs	240	780	1.2×10^{3}	1.3×10^{3}	890	1.3×10^{3}	1.5×10^{3}	920	920	2.1×10^{3}
Total earnings	1996 dollars	5.0×10^{6}	1.6×10^{7}	2.6×10^{7}	2.8×10^{7}	1.8×10^{7}	2.7×10^{7}	3.1×10^{7}	1.9×10^{7}	1.9×10^{7}	4.3×10^{7}
Air Resources											
Dose to offsite maximally-exposed individual	Millirem per year	6.0×10^{-4}	1.7×10^{-3}	1.2×10^{-4}	1.8×10^{-3}	6.0×10^{-5}	1.8×10^{-3}	1.7×10^{-3}	8.9×10^{-4}	9.5×10^{-4}	2.8×10^{-5}
Dose to noninvolved worker	Millirem per year	7.0×10^{-6}	1.8×10^{-5}	4.4×10^{-5}	9.0×10^{-5}	3.4×10^{-5}	3.6×10^{-5}	3.0×10^{-5}	4.8×10^{-5}	1.0×10^{-4}	1.3×10^{-5}
Collective dose to population within 50 miles of INTEC	Person-rem per year	0.03	0.09	5.6×10^{-3}	0.1	3.1×10^{-3}	0.1	0.1	0.05	0.05	1.3×10^{-3}
Maximum ambient concentration of criteria air pollutant (highest percent of ambient air quality standard)	Percentage	16	16	17	17	16	16	16	16	16	NA
Prevention of Significant Deterioration increment consumption (highest percent of allowable increment in Class I area)	Percentage	39	43	47	53	44	44	44	40	39	NA
Prevention of Significant Deterioration increment consumption (highest percent of allowable increment in Class II area)	Percentage	28	28	29	29	29	28	28	28	28	NA

Table C.10-2. Summary of operations impacts by waste processing alternatives and options (continued).

				Separations Alternative			Non-Separations Alternative			Minimum INEEL Processing Alternative	
	Units	No Action Alternative	Continued Current Operations Alternative	Full Separations Option	Planning Basis Option	Transuranic Separations Option	Hot Isostatic Pressed Waste Option	Direct Cement Waste Option	Early Vitrification Option	At INEEL	At Hanford
Maximum offsite concentration of carcinogenic toxic air pollutant (highest percent of State of Idaho acceptable air concentration for carcinogens)	Percentage	1.8	2.9	12	14	5.8	5.1	4.3	2.4	1.2	NA
Maximum ambient (offsite or public road location) concentration of non-carcinogenic toxic air pollutant (highest percent of State of Idaho acceptable air concentration)	Percentage	0.04	0.06	0.26	0.31	0.13	0.11	0.1	0.05	0.03	NA
Maximum onsite concentration of toxic air pollutant [highest percent of occupational exposure limit (8-hour time weighted average)]	Percentage	0.03	0.13	0.3	0.37	0.21	0.14	0.14	0.04	0.06	NA
Health and Safety											
Total campaign collective worker dose	Person-rem	490	760	1.1×10^{3}	1.5×10^{3}	980	1.3×10^{3}	1.6×10^{3}	870	1.1×10^{3}	350
Total worker latent cancer fatalities	Latent cancer fatalities	0.19	0.30	0.44	0.61	0.39	0.51	0.64	0.35	0.42	0.14
Integrated non-involved worker dose	Millirem	2.5×10^{-4}	2.0×10^{-4}	9.2×10^{-4}	8.6×10^{-4}	7.1×10^{-4}	5.8×10^{-4}	3.6×10^{-4}	1.3×10^{-3}	1.4×10^{-3}	2.3×10^{-5}
Integrated offsite maximally-exposed-individual dose	Millirem	0.02	0.02	2.5×10^{-3}	6.3×10^{-3}	1.3×10^{-3}	0.02	0.02	0.03	0.02	5.0×10^{-5}
Total recordable cases	Cases	44	120	350	430	270	290	330	260	240	27
Total lost workdays	Days	310	860	2.5×10^{3}	3.1×10^{3}	1.9×10^{3}	2.0×10^{3}	2.3×10^{3}	1.8×10^{3}	1.7×10^{3}	NR
Utilities and Energy											
Potable water use	Million gallons per year	1.4	2.7	4.0	5.8	2.8	3.8	4.8	2.9	2.8	4.8
Baseline potable water use, INTEC operations	Million gallons per year	55	55	55	55	55	55	55	55	55	NA

Table C.10-2. Summary of operations impacts by waste processing alternatives and options (continued).

				Separations Alternative			Non-Separations Alternative			Minimum INEEL Processing Alternative	
	Units	No Action Alternative	Continued Current Operations Alternative	Full Separations Option	Planning Basis Option	Transuranic Separations Option	Hot Isostatic Pressed Waste Option	Direct Cement Waste Option	Early Vitrification Option	At INEEL	At Hanford
Percent of baseline INTEC potable water use	Percentage	2.5	4.9	7.2	11	5.1	6.9	8.7	5.3	5.1	NA
Nonpotable water use	Million gallons per year	14	62	5.0	69	53	89	62	6.3	6.3	500
Baseline nonpotable water use, INTEC operations	Million gallons per year	400	400	400	400	400	400	400	400	400	NA
Percent of baseline INTEC nonpotable water use	Percentage	3.5	16	1.3	17	13	22	16	1.6	1.6	NA
Electricity use	Megawatt-hours per year	1.2×10^4	1.8×10^4	4.0×10^4	5.0×10^4	2.9×10^4	3.3×10^4	2.8×10^4	3.9×10^4	2.5×10^4	6.6×10^5
Baseline INTEC electricity use	Megawatt-hours per year	8.8×10^4	8.8×10^4	8.8×10^4	8.8×10^4	8.8×10^4	8.8×10^4	8.8×10^4	8.8×10^4	8.8×10^4	NA
Percent of INTEC electricity use	Percentage	13	20	45	57	33	38	32	44	28	NA
Sanitary wastewater	Million gallons per year	1.4	2.7	4.0	5.8	2.8	3.8	4.8	2.9	2.8	4.8
Baseline INTEC sanitary wastewater	Million gallons per year	55	55	55	55	55	55	55	55	55	NA
Percent of baseline INTEC sanitary wastewater	Percentage	2.5	4.9	7.2	11	5.1	6.9	8.7	5.2	5.1	NA
Fossil fuel use	Million gallons per year	0.64	1.9	4.5	6.3	2.2	2.8	2.5	1.1	0.49	1.3
Baseline INTEC fossil fuel use	Million gallons per year	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	NA
Percent of baseline INTEC fossil fuel use	Percentage	640	1.9×10^3	4.5×10^3	6.3×10^3	2.2×10^3	2.8×10^3	2.5×10^3	1.1×10^3	490	NA
Waste and Materials[c]											
Mixed low-level waste generation	Cubic meters	1.3×10^3	3.2×10^3	5.8×10^3	7.9×10^3	5.2×10^3[d]	6.4×10^3	8.6×10^3	6.0×10^3	5.7×10^3	0
Low-level waste generation	Cubic meters	190	9.5×10^3	1.2×10^3	1.0×10^4	960	1.0×10^4	1.0×10^4	750	700	1.5×10^3
Hazardous waste generation	Cubic meters	0	0	1.6×10^3	1.2×10^3	960	4	4	4	40	23
Industrial waste generation	Cubic meters	1.4×10^4	1.9×10^4	5.3×10^4	5.2×10^4	4.3×10^4	4.3×10^4	5.0×10^4	4.2×10^4	3.5×10^4	6.7×10^3

Table C.10-2. Summary of operations impacts by waste processing alternatives and options (continued).

	Units	No Action Alternative	Continued Current Operations Alternative	Separations Alternative: Full Separations Option	Separations Alternative: Planning Basis Option	Separations Alternative: Transuranic Separations Option	Non-Separations Alternative: Hot Isostatic Pressed Waste Option	Non-Separations Alternative: Direct Cement Waste Option	Non-Separations Alternative: Early Vitrification Option	Minimum INEEL Processing Alternative: At INEEL	Minimum INEEL Processing Alternative: At Hanford
Traffic and Transportation											
Estimated total latent cancer fatalities from cargo related incident-free HLW transportation	Latent cancer fatalities										
Truck		NA	0.01	0.08	0.09	0.23	0.47	1.5	0.98	0.55	NA
Rail		NA	9.1×10^{-5}	5.0×10^{-4}	6.3×10^{-4}	7.6×10^{-3}	9.4×10^{-4}	2.8×10^{-3}	2.1×10^{-3}	1.7×10^{-3}	NA
Estimated total number of latent cancer fatalities from cargo related transportation accidents	Latent cancer fatalities										
Truck		NA	5.0×10^{-5}	8.9×10^{-5}	1.5×10^{-4}	0.093	5.1×10^{-6}	0.023	1.5×10^{-6}	0.018	NA
Rail		NA	2.1×10^{-6}	1.8×10^{-5}	2.2×10^{-5}	0.037	2.2×10^{-6}	1.3×10^{-3}	7.8×10^{-8}	2.8×10^{-3}	NA
Estimated total number of vehicle related traffic fatalities from transportation accidents	Fatalities										
Truck		NA	8.9×10^{-3}	0.087	0.12	0.98	0.21	0.64	0.44	0.33	NA
Rail		NA	2.1×10^{-3}	0.026	0.030	0.13	0.038	0.11	0.080	0.062	NA
Facility Accidents											
Estimated maximum latent cancer fatalities within 50 miles population from bounding accident	Latent cancer fatalities										
Abnormal event		0.65	0.65	2.8×10^{-5}	2.8×10^{-5}	0.04	2.8×10^{-5}	2.8×10^{-5}	2.8×10^{-5}	1.3×10^{-3}	NA
Design basis		33	33	1.8	2.9	4.0	2.9	2.9	7.0×10^{-3}	0.06	NA
Beyond design basis		1.8	1.8	600	600	4.0	1.8	5.6	3.3	26	NA
Estimated maximum population dose from bounding accident	Person-rem										
Abnormal event		1.3×10^{3}	1.3×10^{3}	0.06	0.06	71	0.06	0.06	0.06	2.6	NA
Design basis		6.6×10^{4}	6.6×10^{4}	3.5×10^{3}	5.9×10^{3}	7.9×10^{3}	5.9×10^{3}	5.9×10^{3}	14	120	NA
Beyond design basis		3.5×10^{3}	3.5×10^{3}	6.0×10^{5}	6.0×10^{5}	7.9×10^{3}	3.5×10^{3}	1.1×10^{4}	6.6×10^{3}	5.3×10^{4}	NA
Estimated dose to maximally-exposed individual from bounding accident	Millirem										

Table C.10-2. Summary of operations impacts by waste processing alternatives and options (continued).

				Separations Alternative			Non-Separations Alternative			Minimum INEEL Processing Alternative	
	Units	No Action Alternative	Continued Current Operations Alternative	Full Separations Option	Planning Basis Option	Transuranic Separations Option	Hot Isostatic Pressed Waste Option	Direct Cement Waste Option	Early Vitrification Option	At INEEL	At Hanford
Abnormal event		170	170	5.3×10^{-3}	5.3×10^{-3}	5.8	5.3×10^{-3}	5.3×10^{-3}	5.3×10^{-3}	0.25	NA
Design basis		9.7×10^{3}	9.7×10^{3}	460	350	1.3×10^{3}	350	350	1.6	3.0	NA
Beyond design basis		420	420	6.8×10^{4}	6.8×10^{4}	1.3×10^{3}	460	1.0×10^{3}	730	4.9×10^{3}	NA
Estimated maximum dose to noninvolved worker from bounding accident	Millirem										
Abnormal event		1.2×10^{4}	1.2×10^{4}	0.36	0.36	390	0.36	0.36	0.36	17	NA
Design basis		6.6×10^{5}	6.6×10^{5}	3.2×10^{4}	2.4×10^{4}	8.6×10^{4}	2.4×10^{4}	2.4×10^{4}	110	210	NA
Beyond design basis		2.9×10^{4}	2.9×10^{4}	4.6×10^{6}	4.6×10^{6}	8.6×10^{4}	3.2×10^{4}	7.1×10^{4}	5.0×10^{4}	3.4×10^{5}	NA

a. Low-Activity Waste Disposal Facility.
b. Values presented are for peak year.
c. Values presented are totals for the duration of the project.
d. This value represents the highest quantity among the disposal methods considered.

Table C.10-3. New facility disposition data.

	Units	Continued Current Operations Alternative	Separations Alternative: Full Separations Option	Separations Alternative: Planning Basis Option	Separations Alternative: Transuranic Separations Option	Non-Separations Alternative: Hot Isostatic Pressed Waste Option	Non-Separations Alternative: Direct Cement Waste Option	Non-Separations Alternative: Early Vitrification Option	Minimum INEEL Processing Alternative
Socioeconomics									
Direct employment	Number of jobs	110	910	830	830	750	850	690	630
Indirect employment	Number of jobs	110	1.1×10^{3}	860	870	780	880	700	660
Total employment	Number of jobs	220	2.1×10^{3}	1.7×10^{3}	1.7×10^{3}	1.5×10^{3}	1.7×10^{3}	1.4×10^{3}	1.3×10^{3}
Total earnings	1996 dollars	6.2×10^{6}	5.3×10^{7}	4.8×10^{7}	4.8×10^{7}	4.3×10^{7}	4.9×10^{7}	3.9×10^{7}	3.6×10^{7}
Air Resources									
Dose to maximum offsite individual	Millirem per year	1.1×10^{-10}	3.3×10^{-10}	3.9×10^{-10}	4.7×10^{-10}	1.8×10^{-10}	1.3×10^{-10}	1.4×10^{-10}	5.6×10^{-10}
Dose to non-involved worker	Millirem per year	2.0×10^{-11}	6.0×10^{-11}	7.0×10^{-11}	1.4×10^{-10}	3.7×10^{-11}	2.1×10^{-11}	2.8×10^{-11}	1.6×10^{-10}
Collective dose to population within 50 miles of INTEC	Person-rem per year	3.4×10^{-9}	1.0×10^{-8}	1.2×10^{-8}	1.1×10^{-8}	4.7×10^{-9}	3.8×10^{-9}	3.9×10^{-9}	1.3×10^{-8}
Maximum ambient concentration of criteria air pollutant (highest percent of ambient air quality standard)	Percentage	18	22	24	21	22	22	21	22
Maximum offsite concentration of carcinogenic toxic air pollutant (highest percent of State of Idaho acceptable air concentration for carcinogens)	Percentage	0.65	2.1	2.6	1.8	1.9	2.1	1.7	2.0
Maximum ambient (offsite or public road location) concentration of non-carcinogenic toxic air pollutant (highest percent of State of Idaho acceptable air concentration)	Percentage	0.13	0.43	0.53	0.36	0.38	0.43	0.35	0.4
Maximum onsite concentration of toxic air pollutant [highest percent of occupational exposure limit (8-hour time weighted average)]	Percentage	6.5	21	26	18	19	21	17	20
Health And Safety									
Estimated latent cancer fatalities in involved worker population	Latent cancer fatalities	0.05	0.10	0.10	0.08	0.09	0.10	0.06	0.05
Total recordable cases	Cases	25	80	80	55	80	78	67	47
Total lost workdays	Days	200	660	690	460	680	650	560	390
Utilities and Energy[a]									
Potable water use	Million gallons per year	1.2	5.2	5.6	4.2	4.9	5.5	3.8	3.5
Nonpotable water use	Million gallons per year	0.80	1.8	3.1	1.7	2.6	1.8	1.2	1.4
Electricity use	Megawatt-hours per year	490	1.3×10^{3}	1.8×10^{3}	1.1×10^{3}	1.4×10^{3}	1.4×10^{3}	1.1×10^{3}	1.1×10^{3}

Table C.10-3. (Continued).

			Separations Alternative			Non-Separations Alternative			
	Units	Continued Current Operations Alternative	Full Separations Option	Planning Basis Option	Transuranic Separations Option	Hot Isostatic Pressed Waste Option	Direct Cement Waste Option	Early Vitrification Option	Minimum INEEL Processing Alternative
Sanitary wastewater	Million gallons per year	1.2	5.2	5.6	4.2	4.9	5.5	3.8	3.5
Fossil fuel use	Million gallons per year	0.21	0.84	1.0	0.69	0.79	0.82	0.65	0.42
Waste and Materials									
Mixed low-level waste	Cubic meters	11	550[a]	480[d]	350[b]	340	350	480	140
Low-level waste	Cubic meters	5,600	6.8×10^{4}[b]	7.3×10^{4}[c]	4.4×10^{4}[b]	5.0×10^{4}	4.9×10^{4}	4.1×10^{4}	1.5×10^{4}
Hazardous waste	Cubic meters	260	28[a]	290	30[b]	340	410	160	56
Industrial waste	Cubic meters	4,800	6.7×10^{4}[b]	7.2×10^{4}[c]	4.1×10^{4}[a]	6.8×10^{4}	9.5×10^{4}	8.0×10^{4}	2.8×10^{4}

a. Peak annual values.
b. Onsite grout disposal facility.
c. Offsite disposal of Class A grout.

Table C.10-4. Existing facility disposition data.

		Alternatives									
		Clean closure		Performance based closure		Closure to landfill standards		Performance based closure with Class A grout disposal		Performance based closure with Class C grout disposal	
	Units	Tank Farm	Bin Sets	Tank Farm	Bin Sets	Tank Farm	Bin Sets	Tank Farm	Bin Sets	Tank Farm	Bin Sets
Socioeconomics											
Direct employment	Number of jobs	300	60	20	50	10	30	10	10	50	50
Indirect employment	Number of jobs	300	60	20	60	10	30	10	10	50	50
Total employment	Number of jobs	600	120	40	110	20	60	20	20	100	100
Total earnings	1996 dollars	1.6×10^{7}	3.4×10^{6}	1.2×10^{6}	3.2×10^{6}	7.0×10^{5}	1.6×10^{6}	7.0×10^{5}	6.0×10^{5}	2.8×10^{6}	2.8×10^{6}
Air resources - Tank Farm											
Dose to offsite maximally-exposed individual[a]	Millirem per year	1.2×10^{-9}		1.5×10^{-10}		1.1×10^{-9}		1.5×10^{-10}		1.5×10^{-10}	
Dose to noninvolved worker	Millirem per year	1.2×10^{-9}		1.5×10^{-10}		1.1×10^{-9}		1.5×10^{-10}		1.5×10^{-10}	
Collective dose to population within 50 miles of INTEC	Person-rem per year	3.1×10^{-8}		3.8×10^{-9}		2.8×10^{-8}		3.9×10^{-9}		3.9×10^{-9}	
Maximum ambient concentration of criteria air pollutant (highest percent of ambient air quality standard)	Percentage	17		16		16		16		16	
Maximum offsite concentration of carcinogenic toxic air pollutant (highest percent of State of Idaho acceptable air concentration for carcinogens)	Percentage	0.19		0.04		0.03		0.02		0.02	
Maximum ambient (offsite or public road location) concentration of non-carcinogenic toxic air pollutant (highest percent of State of Idaho acceptable air concentration)	Percentage	0.04		8.0×10^{-3}		5.0×10^{-3}		5.0×10^{-3}		5.0×10^{-3}	
Maximum onsite concentration of toxic air pollutant [highest percent of occupational exposure limit (8-hour time weighted average)]	Percentage	1.9		0.37		0.26		0.23		0.23	

Table C.10-4. Existing facility disposition data (continued).

	Units	Clean closure	Performance based closure	Closure to landfill standards	Performance based closure with Class A grout disposal	Performance based closure with Class C grout disposal
		Air resources – Bin sets				
Dose to offsite maximally-exposed individual	Millirem per year	1.0×10^{-10}	1.3×10^{-10}	9.2×10^{-10}	1.3×10^{-10}	1.3×10^{-10}
Dose to noninvolved worker	Millirem per year	2.3×10^{-11}	3.0×10^{-11}	2.2×10^{-10}	3.0×10^{-11}	3.0×10^{-11}
Collective dose to population within 50 miles of INTEC	Person-rem per year	5.5×10^{-9}	7.2×10^{-9}	5.1×10^{-8}	7.2×10^{-9}	7.2×10^{-9}
Maximum ambient concentration of criteria air pollutant (highest percent of ambient air quality standard)	Percentage	16	16	16	16	16
Maximum offsite concentration of carcinogenic toxic air pollutant (highest percent of State of Idaho acceptable air concentration for carcinogens)	Percentage	9.0×10^{-3}	8.0×10^{-3}	8.0×10^{-3}	0.01	0.01
Maximum ambient (offsite or public road location) concentration of non-carcinogenic toxic air pollutant (highest percent of State of Idaho acceptable air concentration)	Percentage	2.0×10^{-3}	2.0×10^{-3}	2.0×10^{-3}	2.0×10^{-3}	2.0×10^{-3}
Maximum onsite concentration of toxic air pollutant [highest percent of occupational exposure limit (8-hour time weighted average)]	Percentage	0.09	0.08	0.08	0.12	0.12

Table C.10-4. Existing facility disposition data (continued).

		Alternatives									
		Clean closure		Performance based closure		Closure to landfill standards		Performance based closure with Class A grout disposal		Performance based closure with Class C grout disposal	
	Units	Tank Farm	Bin Sets	Tank Farm	Bin Sets	Tank Farm	Bin Sets	Tank Farm	Bin Sets	Tank Farm	Bin Sets
Health and Safety											
Estimated latent cancer fatalities in involved worker population	Latent cancer fatalities	3.0	0.38	0.10	0.34	0.09	0.16	0.12	0.38	0.19	0.46
Total recordable cases	Cases	290	60	10	37	6	22	9	3	9	3
Total lost workdays	Days	2,400	500	76	310	59	180	97	360	97	380
Utilities and Energy											
Potable water use	Million gallons per year	2.0	0.32	0.11	0.31	0.06	0.15	0.13	0.52	0.14	0.6
Nonpotable (process) water use	Million gallons per year	0.05	3.9×10^{-3}	0.06	0.01	0.09	0.01	0.05	0.03	0.05	0.03
Electricity use	Megawatt-hours per year	7.3×10^{3}	3.2×10^{3}	4.4×10^{3}	6.0×10^{3}	1.2×10^{3}	990	4.6×10^{3}	1.5×10^{3}	4.6×10^{3}	1.5×10^{3}
Sanitary wastewater	Million gallons per year	2.0	0.32	0.13	0.32	0.10	0.16	0.14	0.52	0.15	0.56
Fossil fuel use	Million gallons per year	0.08	3.9×10^{-3}	0.02	6.6×10^{-3}	0.01	5.2×10^{-3}	0.01	5.2×10^{-3}	0.01	5.0×10^{-3}
Waste and Materials											
Mixed low-level waste	Cubic meters	1.1×10^{4}	180	120	85	480	33	120	540	120	540
Low-level waste	Cubic meters	1.1×10^{3}	4.6×10^{3}	0	150	0	150	0	0	0	0
Hazardous waste	Cubic meters	0	130	79	100	0	100	27	28	27	28
Industrial waste	Cubic meters	1.6×10^{5}	2.4×10^{4}	1.9×10^{3}	3.6×10^{3}	1.7×10^{3}	3.6×10^{3}	1.5×10^{3}	1.5×10^{4}	1.5×10^{3}	1.5×10^{4}

APPENDIX D

GLOSSARY

APPENDIX D. GLOSSARY

Terms in this glossary are defined based on the context in which they are to be used in this EIS.

100-year flood

A flood that occurs, on average, every 100 years (equates to a 1 percent probability of occurring in any given year).

500-year flood

A flood that occurs, on average, every 500 years (equates to a 0.2 percent probability of occurring in any given year).

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 89 (actinium-89) through 103 (lawrencium-103).

Advanced Mixed Waste Treatment Project (AMWTP)

Planned facility to be located at the INEEL to treat mixed waste intended for packaging and shipment to the Waste Isolation Pilot Plant for disposal.

airborne release fraction

The fraction of spilled or leaked radioactive material that becomes airborne at the point of origin.

airborne release rate

The airborne release fraction divided by the leak time duration.

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 that 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 consisting of two protons and two neutrons that is spontaneously emitted during radioactive decay from the nucleus of certain radionuclides. It is the least penetrating of the three common types of radiation (alpha, beta, and gamma).

alternative

A major strategy or choice to address the EIS "Purpose and Need" statement, as opposed to the engineering options available to achieve the goal of an alternative.

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).

as low as reasonably achievable (ALARA)

A process by which a graded approach is applied to maintaining radiation dose levels to workers and the public and releases of radioactive materials to the environment at a rate that is as far below applicable limits as reasonably achievable.

atomic number

The number of positively charged protons in the nucleus of an atom and the number of electrons on an electrically neutral atom.

aquifer

A body of permeable rock, rock fragments, or soil through which groundwater moves and is capable of yielding significant quantities of water to wells and/or springs.

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

Dark to medium-dark colored rocks that are volcanic in origin.

baseline

For purposes of this EIS, the conditions expected to exist in 1999, the projected date for the Record of Decision, against which the environmental consequences of the various alternatives are evaluated.

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 1/1,837 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 accident

A beyond-design-basis accident is more severe than a design-basis accident. It generally involves multiple failures of engineered safety systems and would be expected to occur less than once in a million years.

bin set(s)

A series of reinforced concrete vaults, each containing three to seven stainless steel storage bins. The bins store calcined HLW (see *Calcined Solids Storage Facilities*).

biodiversity

Pertains to the variety of life (e.g., plants, animals, and other organisms) that inhabits a particular area or region.

borosilicate

A form of glass made from silica sand, boric oxide, and soda ash.

bottoms (tank)

Material remaining in waste tanks after most of the contents have been pumped out for solidification or transfer to other storage tanks. This term can also refer to specific tanks used to collect bottom waste from several other tanks.

bounding

An attribute of an analysis that means it is unlikely that the actual outcome of a scenario will have greater magnitude than the analyzed outcome. The bounding condition is established by selecting analysis assumptions and input parameters that will maximize the analytical result. See also *representative*.

bounding accident

A postulated accident that defines the range of anticipated accidents and is used to evaluate the consequences of accidents at facilities. The most conservative parameters (e.g., source terms and meteorology) are applied to a conservative accident resulting in a bounding accident analysis.

by-product material

(a) Any radioactive material (except special nuclear material) that comes from, or is made radioactive by, exposure to the radiation incident to the process of producing or utilizing special nuclear material, or (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. However, the exemption applies only to the actual radionuclides dispersed or suspended in the waste substance. Any nonradioactive hazardous waste component of the waste is subject to regulation under the Resource Conservation and Recovery Act.

calcination

The act or process by which a substance is heated to a high temperature that is below the melting or fusing point. Calcination results in moisture removal, organic destruction, and high temperature chemical reactions. The final waste form is a dense powder.

calcine

To heat a substance to a high temperature, but below its melting point, driving off moisture and volatile constituents. When used as a noun, this term is also used to refer to the material produced by this process.

Calcined Solids Storage Facilities (CSSF)

A series of reinforced concrete vaults commonly referred to as bin sets. The vaults contain three to seven stainless steel storage bins for the storage of calcined HLW generated in the New Waste Calcining Facility. Calcined solids from New Waste Calcining Facility are transferred pneumatically to the Calcined Solids Storage Facilities through buried underground transfer lines. This EIS refers to the Calcined Solids Storage Facilities as “bin sets.”

canister

A container for high-level waste such as calcined, cemented, or vitrified wastes.

capable fault

In part, a capable fault is one that may have had movement at or near the ground surface at least once within the past 35,000 years, or has had recurring movement within the past 500,000 years. Further definition can be found in 10 CFR 100, Appendix A.

carcinogen

A radionuclide or chemical that has been proven or suspected to be either a promoter or initiator of cancer in humans or animals.

cask

A specially designed container used for shipping, storage, and disposal of radioactive material that affords protection from accidents and provides shielding for radioactive material. The design includes special shielding, handling, and sealing features to provide positive containment and minimize personnel exposure.

cementitious waste

Calcine that is slurried with SBW, recalcined, and then mixed with cement.

ceramic

Materials made from non-metallic minerals such as clays through firing at high temperatures.

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.

characterization

The determination of waste composition and properties, whether by review of process history, nondestructive examination or assay, or sampling and analysis, generally done for the purpose of determining appropriate storage, treatment, handling, transport, and disposal requirements.

chronic exposure

The absorption, ingestion, or inhalation of a hazardous material by an individual over a long period of time (for example, over a lifetime).

Class A waste

As defined by the Nuclear Regulatory Commission, Class A wastes are radioactive wastes that are usually segregated from other wastes at disposal sites to ensure the stability of the disposal site. Class A waste can be disposed of along with other wastes if the requirements for stability are met. Class A waste usually has lower concentrations of radionuclides than Class C waste.

Class C waste

Radioactive waste that is suitable for near surface disposal but due to its higher radionuclide concentrations must meet more rigorous requirements for waste form stability. Class C waste requires additional protective measures at the disposal facility to protect against inadvertent intrusion.

Code of Federal Regulations (CFR)

A document containing the regulations of Federal departments and agencies.

collective dose

Sum of the effective dose equivalents for individuals composing a defined population. The units for this dose are person-rem.

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

Total dose equivalent accumulated in an organ or tissue in the 50 years following a single intake of radioactive materials into the body.

committed effective dose equivalent

The sum of committed radiological dose equivalents to various tissues in the body, each multiplied by the appropriate weighting factor and expressed in units of rem.

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.

condensate

Liquid that results from condensing a gas by cooling below its saturation temperature.

contact-handled

Radioactive materials, usually packaged in some form, that emit radiation levels low enough to permit close and unshielded manipulation by workers.

contaminant

Any chemical or radioactive substance that contaminates (pollutes) air, soil, or water. This term also refers to any hazardous substance that does not occur naturally or that occurs at levels greater than those naturally occurring in the surrounding environment (background).

contamination

The presence of unwanted chemical or radioactive material on the surfaces of structures, areas, objects, or externally or internally to personnel.

credible accident

An accident that has a probability of occurrence greater than or equal to one in a million per year or a frequency of occurrence greater than or equal to one in a million years.

critical

A condition in which uranium, plutonium, or other fissionable materials are capable of sustaining a nuclear fission chain reaction.

criticality

State of being critical. Refers to a self-sustaining nuclear chain reaction in which there is an exact balance between the production of neutrons and the losses of neutrons in the absence of extraneous neutron sources.

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 a radioactive material with the passage of time, due to the spontaneous emission of either alpha or beta particles from the atomic nuclei, often accompanied by gamma radiation (see *half-life*).

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.

delisting

A regulatory process to exclude a waste produced at a particular facility from the lists in Subpart D of 40 CFR Part 261. To be eligible for an exclusion, a listed waste must not: meet the criteria for which it was listed, exhibit any hazardous waste characteristics, and exhibit any other factors (including additional constituents) that could cause the waste to be a hazardous waste.

design basis accident (DBA)

For nuclear facilities, a postulated abnormal event that is used to establish the performance requirements of structures, systems, and components that are necessary to maintain them in a safe shutdown condition indefinitely or to prevent or mitigate the consequences so that the general public and operating staff are not exposed to radiation in excess of appropriate guideline values.

design basis earthquake

The maximum intensity earthquake that might occur along the fault nearest to a safety-related facility. Safety-related facilities are built to withstand a design basis earthquake.

disposal

Emplacement of high-level radioactive waste, spent nuclear fuel, or other highly radioactive material in a repository with no foreseeable intent of recovery, whether or not such emplacement permits the recovery of such waste.

disposal package

The primary container that holds, and is in contact with, solidified high-level radioactive waste, spent nuclear fuel, or other radioactive materials, and any overpacks that are emplaced at a repository.

disposition

As used in this EIS, disposition is the set of activities performed on INTEC facilities that no longer have a mission so that they can be placed in a condition consistent with INEEL's future land use plans. These activities could include closure, deactivation, decontamination, and decommissioning.

DOE Orders

Internal requirements of 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. A public road crossing a DOE site is considered to be within the DOE site boundary if DOE or the site contractor has the ability to control traffic on the road if necessary (during an emergency, for example).

dosage

The concentration-time profile for exposure to toxicological hazards which is often expressed in terms of amount of exposure per unit of time.

dose (or radiation dose)

A general 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 equivalent

Product of the absorbed dose, the quality factor, and any other modifying factors. The dose equivalent is a quantity for comparing the biological effectiveness of different kinds of radiation on a common scale. The unit of dose equivalent is the rem. A millirem is one one-thousandth of a rem.

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 are 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 concept this as the effective dose.

effluent

A liquid or gaseous waste stream released from a facility.

effluent monitoring

Sampling or measuring specific liquid or gaseous effluent streams for the presence of pollutants.

engineered barriers

Manmade components of a system designed to prevent the release of radionuclides into the environment. These barriers include the radioactive waste form, radioactive waste canisters, and other materials placed over and around such canisters.

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 analyzing environmental media (e.g., soils) in and around a facility for the purpose of (a) confirming compliance with performance objectives, and (b) detecting 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 in the past as a result of production activities, accidental releases, or disposal activities.

Environmental Restoration Program

A DOE subprogram concerned with all aspects of assessment and cleanup of both contaminated facilities that are 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.

evaporator

A facility that mechanically reduces the water contents in tank waste to concentrate the waste and reduce storage space needs.

exposure pathways

The course a chemical or physical agent takes from the source to the exposed organism. An exposure pathway describes a unique mechanism by which an individual or population is exposed to chemicals or physical agents at or originating from a release site. Each exposure pathway includes a source or release from a source, an exposure point, and an exposure route. If the exposure point differs from the source, a transport/exposure medium such as air or water is also included.

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.

facility worker

Any worker whose day-to-day activities are controlled by 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.

Feasibility Study

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 possible alternatives for remediation and describe a remedial action that satisfies applicable or relevant appropriate requirements (ARARs) for mitigating confirmed environmental contamination. The Feasibility Study 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 Feasibility Study is based on information provided in the remedial investigation (RI). Successful completion of an Feasibility Study 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 binding 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 INEEL. 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.

fines

Fraction of calcined material that consists of small, powder-like particles (less than ½ millimeter in size) that are readily dispersed in air.

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 primary fissile materials are uranium-233, uranium-235, and plutonium-239.

fission

The splitting of a heavy 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, such as uranium-238, that can be fissioned by fast neutrons.

frit

Finely ground glass

fractionator

A device, also known as a distillation column, that separates a feed stream into two or more fractions by contacting the vapor and liquid phases of the incoming mixture. The lighter (lower boiling) components of the feed stream are concentrated in the vapor phase (known as overheads), and the heavier (higher boiling) components are concentrated in the liquid phase (known as bottoms).

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 of an atom. 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.

geologic repository

A deep (on the order of 600 meter [1,928 feet] or more) underground mined array of tunnels used for disposal of radioactive waste.

greater confinement facility

A disposal strategy that consists of placing the waste at the bottom of deep, large diameter, boreholes and covering it with soil, clay, gravel, sand, or concrete. This strategy was first developed in the early 1980s as a method for disposing of low-level wastes that were not suitable for near-surface disposal by shallow land burial (i.e., within 30 meters below the earth surface). The minimum greater confinement disposal depth is equal to or greater than 30 meters. This method could potentially be used for high-level waste disposal pending assessments to confirm acceptable performance.

greater-than-Class-C waste

Low-level radioactive waste that exceeds U.S. Nuclear Regulatory Commission concentration limits for Class C low-level waste, as specified in 10 CFR Part 61. DOE is responsible for disposing of Greater-Than-Class-C wastes from U.S. Department of Energy non-defense programs.

gross alpha

The total alpha radiation from all sources (e.g., radioactive materials) reported in one measurement.

gross beta

The total beta radiation from all sources (e.g., radioactive materials) reported in one measurement.

groundwater

Water occurring beneath the earth's surface in the intervals between soil grains, in fractures, and in porous formations.

grout

A fluid mixture of cement-like materials and liquid waste that sets up as a solid mass and is used for waste fixation, immobilization, and stabilization purposes.

habitat

The sum of environmental conditions in an area naturally or normally occupied (or used) by a plant or animal.

half-life

The time in which half the atoms of a particular radioactive substance disintegrate to another nuclear form. Measured half-lives vary from a fraction of a second to billions of years.

hazard index

A measure of the noncarcinogenic health effects of human exposure to chemicals. Health effects are assumed to be additive for exposure to multiple chemicals. A hazard index of greater than 1.0 is indicative of potential adverse health effects. Health effects could be minor temporary effects or fatal, depending on the chemical and amount of exposure.

hazardous chemical

A term defined under the Occupational Safety and Health Act and the Emergency Planning and Community Right-to-Know Act as any chemical that is a physical hazard or a health hazard.

hazardous material

A substance or material, including a hazardous substance, which has been determined by the U.S. Secretary of Transportation to be capable of posing an unreasonable risk to health, safety, and property when transported in commerce.

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 (CERCLA).

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 material, special nuclear material, and by-product material, as defined by the Atomic Energy Act, are specifically excluded from the definition of solid waste.

heavy metals

Metallic elements with high atomic weights (for example, mercury, chromium, cadmium, arsenic, and lead) that can harm organisms at low concentrations and that tend to accumulate in the food chain.

HEPA

High-efficiency particulate air

high- activity waste (HAW)

Considered to be the mixed radioactive waste generated by separating as much of the radioactivity as is practicable from the HLW stream. The resultant stream is expected to be greater than 10 CFR 61 Class C concentrations and, therefore, is required to be disposed of in a geological repository in a manner that meets the performance objectives of the Nuclear Waste Policy Act.

high-efficiency particulate air (HEPA) filter

A filter with an efficiency of at least 99.97 percent used to separate particles from air exhaust streams prior to releasing that air into the atmosphere.

high-level waste

High-level waste is the highly radioactive waste material resulting from the processing of spent nuclear fuel, including liquid waste produced directly in processing and any solid material derived from such liquid waste that contains fission products in sufficient concentrations, and other highly radioactive material that is determined, consistent with existing law, to require isolation.

hot isostatic press (HIP)

A process that stabilizes and reduces the volume of high-level waste where calcined waste is retrieved, mixed with suitable additives, canned, and then heated and pressed in the container to form a ceramic-like material. The resulting waste form is expected to be equivalent to vitrified waste and potentially acceptable as a waste form for disposal in a geologic repository.

hydraulic conductivity

Capacity of a porous media to transport water.

hydrogeology

The study of groundwater and how it relates to geologic processes. Synonymous with "geohydrology."

hydrology

The study of water, including groundwater, surface water, and rainfall.

Idaho Settlement Agreement

A court-ordered agreement among the State of Idaho, DOE, and the Navy. Under the Settlement Agreement, DOE must meet certain conditions relating to the management of high-level waste at the INEEL.

immobilization

A process (e.g., solidification or vitrification) used to stabilize waste. Immobilizing the waste inhibits the release of waste to the environment.

inadvertent intrusion

The inadvertent disturbance of a disposal facility or its immediate environment by a burrowing animal or human intruder that could result in loss of containment of the waste or exposure of personnel. Inadvertent intrusion is a significant consideration in the design requirements or waste acceptance criteria of a waste disposal facility and development of its waste acceptance criteria.

incidental waste or waste incidental to reprocessing

Wastes resulting from processing spent nuclear fuel that is determined to be incidental to processing and thus not high-level waste. This waste must be managed under DOE's regulatory authority in accordance with the requirements for transuranic waste or low-level waste, as appropriate. When determining whether spent nuclear fuel reprocessing plant wastes shall be managed as another waste type or as high-level waste, either the citation or evaluation process described below shall be used:

1. Citation. Waste incidental to reprocessing by citation includes spent nuclear fuel reprocessing plant wastes that meet the description included in the Notice of Proposed Rulemaking (34 FR 8712) for proposed Appendix D, 10 CFR Part 50, Paragraphs 6 and 7. These radioactive wastes are the result of reprocessing plant operations, such as, but not limited to: contaminated job wastes including laboratory items such as clothing, tools, and equipment.

2. Evaluation. Determinations that any waste is incidental to reprocessing by the evaluation process shall be developed under good record-keeping practices, with an adequate quality assurance process, and shall be documented to support the determinations.

incineration

The efficient burning of 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 filters are used to prevent radionuclides and heavy metals from going out of the stack and into the atmosphere.

in situ

A Latin term meaning "in place."

institutional control

The period of time when a site is under active governmental control. For the purposes of this analysis, the time period of 2000 through 2095 is assumed.

interim action

An action that may be undertaken while work on a required program Environmental Impact Statement (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 National Environmental Policy Act 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.

interim storage

Temporary storage of waste until an ultimate disposal plan is approved and implemented.

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.

involved worker

See *facility worker*.

irreversible and irretrievable resource commitments

Resources that would be irreversibly and irretrievably committed as a result of construction and operation of high-level waste management facilities would include those that are consumed or expended (such as electricity and fossil fuels), those that cannot be recycled (such as concrete and aggregate), and those that cannot be fully restored (such as parcels of land that cannot be returned to a pristine state).

isotope

An isotope of a chemical element has the same atomic number (i.e., number of protons) but a different atomic mass (i.e., number of neutrons plus proton) than other isotopes of the same element. Thus, carbon-12, carbon-13, and carbon-14 are isotopes of the element carbon. Isotopes may be radioactive.

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.

landfill

A solid waste facility or part of a facility for the disposal of solid wastes in or on the land. This includes a sanitary landfill, balefill, landspreading disposal facility, or a hazardous waste, problem waste, limited purpose, inert, or demolition waste landfill.

latent cancer fatality (LCF)

A fatality resulting from cancer occurring some time after an exposure to a known or suspected carcinogenic substance or chemical.

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 self-evident.

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-activity waste (LAW)

The mixed radioactive waste that remains after separating as much of the radioactive high-activity waste (HAW) as is practicable from the HLW stream. The resultant stream is expected to meet the 10 CFR 61 Class C or lower limits and therefore, can be disposed of in a near surface facility in a manner that meets the performance objectives of 10 CFR 61. Thus it meets the evaluation process for waste incidental to reprocessing (INEEL definition).

low-level waste (LLW)

Waste that contains radioactivity and is not classified as high-level waste, transuranic waste, or spent nuclear fuel, or by-product tailings containing uranium or thorium from processed ore (as defined in Section II e(2) of the Atomic Energy Act).

low-level mixed waste (LLMW)

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.*).

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 of maximum exposure on the DOE site boundary nearest to the facility in question. Sometimes called maximally exposed offsite individual.

maximum contaminant level (MCL)

Under the Safe Drinking Water Act, the maximum permissible concentrations of specific constituents in drinking water 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.

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. With respect to high-level waste, DOE has historically assumed a canister of defense program high-level waste contains 0.5 MTHM.

millirem

One thousandth of a rem (see *rem*).

mitigation

Actions taken to avoid, minimize, rectify, or compensate potential adverse environmental impacts.

mixed waste

Waste that contains both hazardous wastes 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.

monitored retrievable storage

A concept for interim storage of waste or spent fuel. The waste would be continuously monitored and would be stored in such a way that it could be retrieved at a later date.

monolithic tanks

Those INTEC tanks whose secondary containment vaults were constructed of cast-in-place reinforced concrete. This design includes the two octagonal vaults for tanks WM-180 and WM-181 and a single square vault housing the tanks WM-187, WM-188, WM-189, and WM-190, with partitions separating the tanks. These tank vault designs are expected to meet seismic design criteria.

nanocurie

One billionth of a curie (see *curie*).

National Priorities List (NPL)

A formal listing of the nation's most hazardous waste sites, as established under 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, to a depth of 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.

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.

noncertifiable waste

Waste that does not meet the waste acceptance criteria for the intended treatment, storage, or disposal facility or transportation requirements; or waste that may be too difficult to characterize adequately to prove that it meets the applicable criteria.

noninvolved workers

Workers that are located 640 meters from INTEC but are not involved in the activities described in Chapter 3 of this EIS.

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.

nuclear criticality

A self-sustaining nuclear chain reaction.

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-gas

Gas evolved or generated during a treatment process. Incineration or vitrification is an example of thermal treatment processes that may produce off-gas.

off-gas treatment

Generic name for equipment designed to clean up gases being vented from processes. May consist of absorbers, sand beds, gas flares, and high-efficiency particulate air (HEPA) filters.

off-link doses

Doses to members of the public within 800 meters of a road or railway.

offsite population

The collective population living within a 50-mile radius of a nuclear facility.

on-link doses

Doses to members of the public sharing a road or railway.

operable unit

A discrete portion of a hazardous waste site (referred to as a "Waste Area Group" at INEEL) 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.

overpack

A thick steel secondary canister designed to dissipate heat and to shield and contain radioactive waste. In general, any container into which another container is placed.

particulate

Pertains to minute, separate particles. An example of a dry particulate is dust.

perched water

A discontinuous saturated water body above the water table with unsaturated conditions existing both above and below. Perched water at the INEEL occurs in a variety of situations. The upper most perched water at INTEC historically has been found at the top of the basalt (bottom of alluvial sediments). This type occurs near the Big Lost River. Other perched water bodies occur below the alluvium/basalt interface and above the Snake River Plain Aquifer. The perched water bodies are formed as a result of infiltrating water encountering a significant reduction in the permeability of the subsurface materials. This reduced permeability is generally a result of sedimentary materials (sedimentary interbeds) deposited between basalt flows but has been observed at the top of basalt flows without the presence of sedimentary materials.

perched water table

An underground water body that occupies a basin in impermeable material (such as clay) and is located in a position higher than the water table.

perennial stream

A watercourse that flows year-round.

permanent disposal

For high-level waste, the term means emplacement in a repository for high-level radioactive waste, spent nuclear fuel, or other highly radioactive material with no foreseeable intent of recovery, whether or not such emplacement permits the recovery of such waste.

permeability

The degree of ease with which water can pass through a rock or soil.

person-rem

A unit used to measure the radiation exposure to an entire group and to compare the effects of different amounts of radiation on groups of people. It is obtained by multiplying the average dose equivalent (measured in rem) to a given organ or tissue by the number of persons in the population of interest.

pH

A measure of the relative acidity or alkalinity of a solution. A neutral solution has a pH of 7, acids have a pH of less than 7, and bases have a pH of greater than 7.

picocurie

One trillionth of a curie (see *curie*).

pillar and panel tanks

Those INTEC tanks whose secondary containment vaults were constructed of prefabricated reinforced concrete sections. This design includes the five vaults housing tanks WM-182, WM-183, WM-184, WM-185, and WM-186. This vault design is not expected to meet seismic design criteria. Consequently, these tanks will be removed from service prior to the monolithic tanks.

playa

A shallow basin in a desert plain in which water gathers and then evaporates.

plume

The distribution of contaminants a distance away from a point source in a medium like groundwater or air. It is a defined area of contamination.

point estimate risk

The product of the probability (likelihood) of an accident occurring and the consequences of the accident (latent cancer fatalities).

population

For risk assessment purposes, population consists of the total potential members of the public or workforce who could be exposed to a possible radiation or chemical dose from an exposure to radionuclides or carcinogenic chemicals.

population dose

Sum of radiation doses for individuals composing a defined population (see *collective dose, effective dose equivalent*).

Portland cement

A hydraulic cement made by finely pulverizing the clinker produced by calcining a mixture of clay and limestone or similar materials.

prefilter

A filter that provides first-stage air filtration to remove larger particulates and prolong the efficient use of a high-efficiency particulate air (HEPA) filter.

privatization

Use of the commercial sector for services usually performed by the government or its contractors.

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 condensate

Liquid that is boiled off from an aqueous solution, then condensed back into a liquid.

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)

Processing of reactor irradiated nuclear material (primarily spent nuclear fuel) to recover fissile and fertile material, in order to recycle such materials. Historically, processing has involved aqueous chemical separations of elements (typically uranium or plutonium) from undesired elements in the fuel.

public

Anyone outside the DOE site boundary. With respect to accidents analyzed in this EIS, anyone outside the DOE site boundary at the time of an accident.

public comment

A written or verbal remark or statement of fact or opinion made in response to a position proposed by a government agency.

rad

A unit of radiation 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 here, 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 hazard 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.

radionuclide

A distinct nuclear species; the nuclear entity analogous to an element in chemistry that has distinct nuclear properties (e.g., cesium-137, uranium-238, technetium-99).

raffinate

That portion of a treated liquid mixture remaining after chemically removing selected components; in high-level waste, first cycle raffinate is the highly radioactive liquid remaining after dissolved spent nuclear fuel is processed through a single solvent extraction operation to remove recoverable uranium or plutonium.

RCRA

See *Resource Conservation and Recovery Act*.

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).

recharge

The process of restoring or replenishing water to an aquifer through percolation downward through the soil. Recharge can be natural (e.g., precipitation) or artificial (intentional discharge of water to the ground).

Record of Decision (ROD)

A public document that records the final decision(s) concerning a proposed agency 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 process, both of which take into consideration public comments and community concerns.

regulated substances

A general term used to refer to materials other than radionuclides that are regulated by Federal, state, (or possibly local) requirements.

rem

A unit of radiation dose that reflects the ability of different types of radiation to damage human tissues and the susceptibility of different tissues to the damage. Rem is a measure of effective dose equivalent.

remedial investigation

The Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) process of determining the nature and extent of hazardous substance contamination and, as appropriate, conducting treatability investigations. The remedial investigation provides the site-specific information for the feasibility study that follows.

remediation

Process of cleaning up, treating, or otherwise improving conditions at a site where a hazardous substance release has occurred.

remote-handled

This term refers to radioactive waste that must be handled at a distance to protect workers from unnecessary exposure.

remote handling

The handling of wastes from a distance to protect human operators from unnecessary exposure.

repository

For high-level waste, any system licensed by the U.S. Nuclear Regulatory Commission that is intended to be used for, or may be used for, the deep geologic disposal of high-level radioactive waste and spent nuclear fuel, whether or not the system is designed to permit the recovery, for a limited period during initial operation, of any materials placed in the system. It includes both surface and subsurface areas at which high-level radioactive waste and spent nuclear fuel handling activities are conducted as defined in the Nuclear Waste Policy Act [42 U.S.C. 10101]. For transuranic waste, the repository is defined as the Waste Isolation Pilot Plant Facility.

representative

An attribute of an analysis that means the analytical result can represent the results of hypothetical analyses of other similar scenarios. The hypothetical, unanalyzed scenarios are expected to have outcomes similar enough to let the representative analysis stand for the unanalyzed scenarios. The representative analysis does not necessarily produce an analysis that bounds the analyses for all similar scenarios. See also *bounding*.

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. 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 transport, 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.

respirable fraction

That fraction of airborne droplets or particulate matter (aerosol) with individual particle aerodynamic equivalent diameter of 10 micrometers or less and can be inhaled into the human respiratory system. Non-condensable gases and vapors have a respirable fraction equal to 1.00.

retrieval

The process of recovering wastes that have been stored or disposed of onsite so they may be appropriately characterized, treated, and disposed of.

risk

Quantitative expression that considers both the probability that an event causes harm and the consequences of that event.

road ready

Waste material that has been treated and placed in containers, ready for shipment to a geologic or suitable repository. The containers must be placed into transportation casks prior to shipment.

safety analysis report

A report that summarizes the hazards associated with the operation of a particular facility and defines minimum safety requirements.

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.

scaling factor

A multiplier that allows the inference of one radionuclide concentration from another that is more easily measured.

scope

The range of actions, alternatives, and impacts to be considered in a document prepared pursuant to the National Environmental Policy Act.

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.

shielding

Bulkheads, walls, or other constructions used to absorb or deflect/scatter radiation to protect personnel or equipment.

sodium-bearing waste (SBW)

SBW is liquid waste that is generated from decontamination operations of INTEC facilities involved in the processing of spent nuclear fuel and the treatment of HLW. SBW contains large quantities of sodium and potassium nitrates. Radionuclide concentrations for SBW are generally 10 to 1,000 times less than liquid HLW. Typically, SBW is processed through an evaporator to reduce the volume and stored in the HLW tanks. It has been historically managed within the HLW program because of the existing plant configuration and some physical chemical properties that are similar to HLW. SBW contains hazardous and radioactive materials and is classified as mixed transuranic waste. This is in agreement with the INEEL Site Treatment Plan and aligns SBW with the current DOE waste definitions of DOE Manual 435.1-1. Hence, this EIS refers to SBW as mixed transuranic waste.

sole-source aquifer

A designation granted by the U.S. Environmental Protection Agency when groundwater from a specific aquifer supplies at least 50 percent of the drinking water for the area overlying the aquifer. Sole-source aquifers have no alternative source or combination of sources that 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.

solidification

Changing a substance from liquid to solid by cooling it below its melting temperature or by adding solid-forming materials such as Portland cement. This term also can refer to removing waste from wastewater.

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)].

solvent

Substance (usually liquid) capable of dissolving one or more other substances.

source material

(a) Uranium, thorium, or any other material that is determined by the U.S. 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 U.S. Nuclear Regulatory Commission may by regulation determine from time-to-time [Atomic Energy Act 11(z)]. Source material is exempt from regulation under to Resource Conservation and Recovery Act.

source term (Q)

The quantity of radioactive material released by an accident or operation that causes exposure after transmission or deposition. Specifically, it is that fraction of respirable material at risk that is released to the atmosphere from a specific location. The source term defines the initial condition for subsequent dispersion and consequence evaluations. Q = material at risk × damage ratio × airborne release fraction × respirable fraction × leak path factor. The units of Q are quantity at risk averaged over the specified time duration.

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).

spent nuclear fuel

Fuel that has been withdrawn from a nuclear reactor following irradiation, the constituent elements of which have not been separated.

stabilization

Treatment of waste to protect the environment from contamination. This includes rendering a waste immobile or safe for handling and disposal.

stakeholder

Any person or organization interested in or affected by DOE activities. Stakeholders may include representatives from Federal agencies, State agencies, Congress, Native American Tribes, unions, educational groups, business and industry, environmental groups, and members of the general public.

storage

Retention of high-level radioactive waste, spent nuclear fuel, transuranic, or hazardous wastes with the intent to recover such waste or fuel for subsequent use, processing, or disposal.

tank heel

The amount of liquid or bottoms remaining in the tank after the normal industry practices to empty the tank have been completed to the extent that is technically and economically feasible.

Tank Farm

An installation of multiple adjacent tanks at INTEC interconnected for storage of liquid radioactive waste.

thermal treatment

The treatment of hazardous waste in a device that 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).

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 density of the porous media.

transuranic waste

Waste containing more than 100 nanocuries per gram of waste of alpha-emitting transuranic isotopes, with half-lives greater than 20 years, 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.

transuranic radionuclide

Any radionuclide having an atomic number greater than 92.

treatment

Any activity that alters the chemical or physical nature of a hazardous waste to reduce its toxicity, volume, mobility or to render it amenable for transport, storage, or disposal.

treatment facility

Land area, structures, and/or equipment used for the treatment of waste or spent nuclear fuel.

TRUPACT

Transuranic Package Transporter. (See *TRUPACT II Container*.)

TRUPACT II Container

The package designed to transport contact-handled transuranic waste to the Waste Isolation Pilot Plant site. It is a cylinder with a flat bottom and a domed top that is transported in the upright position. The major components of the TRUPACT-II are an inner, sealed, stainless steel containment vessel within an outer, sealed, stainless steel containment vessel. Each containment vessel is nonvented and capable of withstanding 50 pounds per square inch of pressure. The inner containment vessel cavity is 6 feet in diameter and 6.75 feet tall, with a capability of transporting fourteen 55 gallon drums, two standard waste boxes, or one 10-drum overpack.

United States Geological Survey (USGS)

A Federal agency that collects and analyzes information on geology and geological resources, including groundwater 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.

vitrification

A method of immobilizing waste (e.g., radioactive, hazardous, and mixed). This involves combining other materials and waste and melting the mixture into glass. The purpose of this process is to immobilize the waste so it can be isolated from the environment.

volatile organic compound

Compounds, such as xylene and toluene, that readily evaporate and vaporize at normal temperatures and pressures.

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.

waste acceptance criteria

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 Area Group (WAG)

Ten groupings of hazardous waste release sites under the INEEL 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. A combination of waste characterization, documentation, quality assurance, and periodic audits of the certification program accomplish certification.

waste characterization

See *characterization*.

Waste Isolation Pilot Plant (WIPP)

A DOE facility near Carlsbad, New Mexico, authorized to dispose of defense-generated transuranic waste in a deep geologic repository in a salt layer 2,150 feet underground.

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 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 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.

wind rose

A diagram showing how often winds of various speeds blow from different directions. This is usually based on annual averages.

*Yucca Mountain Sit*e

A candidate site in Nye County, Nevada which is being considered as a geologic repository for disposal of spent nuclear fuel and high-level waste. For purposes of analysis, this EIS assumes Yucca Mountain will ultimately receive INEEL's high-level waste. This assumption may not be substantiated after further analysis and planning by DOE.

APPENDIX E

DISTRIBUTION LIST

APPENDIX E. DISTRIBUTION LIST

DEPARTMENT OF ENERGY is providing copies of the Draft EIS to Federal, state, and local elected and appointed officials and agencies of government; Native American groups; national, state, local environmental and public interest groups; and other organizations and individuals listed below. Copies will be provided to other interested parties upon request.

DRAFT EIS

Yvonne F. Abernethy
Tetra Tech NUS

The Honorable Daniel Akaka
U.S. Senate

Pam Allister
Snake River Alliance

Steve Allred
Idaho Division of Environmental Quality

Andrea Alpine
U.S. Department of the Interior
United States Geological Survey

Navroze D. Amaria
Raytheon Engineers & Constructors

The Honorable General Anderson
Paiute Indian Tribes of Utah

Hal N. Anderson
Idaho Department of Water Resources

Lillis Connery Anderson

Carl Armbrister
U.S. Department of Transportation

The Honorable Richard Arnold
Pahrump Paiute Tribe

Paul Atelsek
National Highway Traffic Safety Administration

Kaitlin Backland
Citizen Alert

Anne Badgley
U.S. Department of the Interior
Fish and Wildlife Service

Jim Baker
Cedar Mountain Supply

James C. Baker, Ph.D.
Idaho Department of Agriculture

Jila Banaee

Rob Baracker
U.S. Department of the Interior
Bureau of Indian Affairs

The Honorable Joe Barton
U.S. House of Representatives

Robert Baumgartner
Bureau of Disaster Services

Gregory Baxter
U.S. Department of Labor
Occupational Safety and Health Administration

Phyllis Beard
Amalgamated Sugar Co.

Keith Beartusk
U.S. Department of the Interior
Bureau of Indian Affairs

Jennifer Belcher
Washington Natural Resources Department

Rosina Bierbaum
Executive Office of the President
Office of Science and Technology Policy

Jeinene Big Day
Shoshone-Bannock Tribe

The Honorable Jeff Bingaman
U.S. Senate

Sheree Black
Oak Ridge Recreation
Site Specific Advisory Board

Michele D. Blackburn
Tetra Tech NUS

Brent Blackwelder
Friends of the Earth

Jack A. Blackwell
U.S. Department of Agriculture
Natural Resources and Environment

The Honorable Tom Bliley
U.S. House of Representatives

Robert Bobo
Shoshone-Bannock Tribes – Department of Energy Tribal Project

David Bodde
Environmental Management Advisory Board

Jeff Bohr
U.S. Department of Agriculture
Natural Resource Conservation Service

J. P. Bollinger
U.S. Department of Agriculture
Natural Resource Conservation Service

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U.S. Department of Energy

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U.S. Department of Agriculture
Natural Resources and Environment

Janet Bouknight
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Fred Carlson
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Marcia Carlson
U.S. Department of Energy
Office of Hearings Reference Room

Beverly Carlyle

Carolyn Huntoon
U.S. Department of Energy

Cynthia Carpenter
Nuclear Regulatory Commission
Office of Nuclear Reactor Regulation

Ted Carpenter
Coalition 21

Lois Chalmers
IEER

Dwight Chamberlain
Nuclear Regulatory Commission
Office of Nuclear Reactor Regulation

George Chandler
Northern New Mexico Citizen's Advisory Board

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National Congress of American Indians

The Honorable Helen Chenoweth
U.S. House of Representatives

Elouise Chicharello
U.S. Department of the Interior
Bureau of Indian Affairs

Graham Chisholm
The Nature Conservancy

Dianne Ciarlette
American Nuclear Society
Office of the Executive Director

Chuck Clarke
U.S. Environmental Protection Agency
Region 10

Documents Clerk
Idaho Falls Public Library

John J. Cline
Idaho Bureau of Disaster Services

Thomas Cochran
National Resources Defense Council, Inc.

William Cohen
Office of the Executive Director
Environment and Natural Resources Division

Carol Cole
Jason Associates

Neil Coleman
U.S. Nuclear Regulatory Commission

John Commander
Idaho Falls Chamber of Commerce
INEEL Committee

Dennis Connor
U.S. Department of Energy
Rocky Flats Public Reading Room

Steven J. Connor
Tetra Tech NUS

John T. Conway
Defense Nuclear Facilities Safety Board

Beverly A. Cook
U.S. Department of Energy
Idaho Operations Office

John Cook
U.S. Department of the Interior
National Park Service

Wallace Cory
Idaho Department of Health & Welfare

The Honorable Larry Craig
U.S. Senate

Robert Craig
U.S. Department of the Interior
Yucca Mountain Project Branch

William Craig
Tetra Tech NUS

The Honorable Michael Crapo
U.S. Senate

Robert J. Creed, Jr.

Alice Crockett

Jeanne-Marie Crockett
New Mexico Environmental Department

Grace Crunican
Oregon Department of Transportation

Kent T. Cubbage
Tetra Tech NUS

Bruce Culp
PS2 Associates

Rodney B. Cummins
U.S. Department of Energy

Max Dakins
University of Idaho

Raphael Daniels
Defense Nuclear Facilities Safety Board

David De Courcy
Federal Emergency Management Agency

Brad Debow

Bryce Denning
BBWI

Kimberly Depaul
U.S. Department of Defense
Department of the Navy

William Dickerson
U.S. Environmental Protection Agency
Office of Federal Activities

Greta Joy Dicus
Nuclear Regulatory Commission

The Honorable John Dingell
U.S. House of Representatives

Ted Doerr

Ann Dold
Idaho Department of Health and Welfare
INEEL Oversight Program

The Honorable Pete Domenici
U.S. Senate

Gervaise Dona-Ashe

Mike Donahoo
U.S. Department of the Interior
Fish and Wildlife Service

Jerry Downs
Idaho Department of Health and Welfare
INEEL Oversight Program

Karl J. Dreher
Idaho Department of Water Resources

Ann Dubois
U.S. Department of Energy
Los Alamos Area Office
Northern New Mexico Citizens Advisory Board

F. J. Dunhour

Paul Dunigan
U.S. Department of Energy
Richland Operations Office

Dirk Dunning
Oregon Office of Energy

Andree Duvarney
U.S. Department of Agriculture
Natural Resources Conservation Service

Melany Earnhardt
North State Legal Services, Inc.
Environmental Poverty Law Project

Bill Eastlake
State of Idaho INEEL Oversight Program

Steven Eide

Jud Ellis

Tom Enyeart
SAIC

Henry Falk
U.S. Department of Health and Human Services
Agency for Toxic Substances and Disease Registry

Rick Fawcett

Libby Fayad
National Parks and Conservation Association

Mark Fetzer

Randy Fields
U.S. Department of the Interior
United States Geological Survey

James J. Fiore
U.S. Department of Energy

Tom Fitzsimmons
State of Washington Ecology Department

Thomas Fouch
U.S. Department of the Interior

Steven Frank
U.S. Department of Energy

Curt Fransen
Idaho Health & Welfare Division

Barbara French
Northwest Technical Resources

Douglas French

Jennifer French

George Froom
Heyburn City Council

Jaime Fuhrman
INEEL Oversight Program

Philip Fulmer
Tetra Tech NUS

Ben Gannon

Bruce Gardner
Paducah Site-Specific Advisory Board

Mary Gaylord
U.S. Department of the Interior
Bureau of Land Management

Tom Geary
Idaho Farm Bureau Federation

John Geddie

Ray Geimer
SAIC

The Honorable Jim Geringer
State of Wyoming

Norman Gerstein
NTG Inc.

Tom Gesell
Idaho State University

Marshall Gingery
U.S. Department of the Interior
National Park Service

Tom Glaccum

Jean-Luc Glorleux
Tetra Tech NUS

Robert Godfrey
Embassy of Australia

Dirk Gombert

Jeff Gordon
U.S. Department of Energy
Nevada Operations Office

Jim Gorman
Citizens Advisory Board for
Nevada Test Site Programs

Kevin Gover
U.S. Department of the Interior
Bureau of Indian Affairs

The Honorable Bob Graham
U.S. Senate

Roger Gray
Australian Nuclear Science & Technology

Walter T. Greaves

Richard Green
U.S. Department of Health and Human Services
Office of the Secretary

Wendy Green Lowe
Jason Associates Corp.

Lance Greenwade

Nancy Greer
Golden Field Office Reading Room

Steve Grimm
U.S. Department of Transportation
Federal Railroad Administration

Charles Groat
U.S. Department of the Interior
United States Geological Survey

Robert Guenzler
State of Idaho
Nuclear Engineering and Technology

The Honorable Kenny Guinn
State of Nevada

Julie Hagenson
U.S. Environmental Protection Agency
Region 10

Bernhard Hall
The Nature Conservancy
Montana Field Office

Flint Hall
State of Idaho
INEEL Oversight Program

The Honorable Ralph Hall
U.S. House of Representatives

Julie Hamilton
Wyoming Federal Land Policy Office

Darrell Hamlett
Ameripride Services

Don Hancock
Southwest Research & Information Center

Susan Hanson
Shoshone-Bannock Tribes

Dan Harris
U.S. Department of Transportation
Federal Highway Administration

Jeffrey Harris
Idaho Department of Health & Welfare

Phillip Hashimoto
EQE International

Kathryn Hauer
Tetra Tech NUS

Dawn Haygood
Savannah River Site Citizens Advisory Board

Alan Herbst

David Herrin
U.S. Department of Energy
Idaho Operations Office

Lindy High

Robert Hill
American Association of Blacks In Energy

Stan Hobson

Jessica Hodge
Citizen Alert

Jean Holdren

Lee Hollinshead

Kenneth Holt
U.S. Department of Health and Human Services
Centers for Disease Control & Prevention

Jim Hopla

Dean Howell

Dennis Hoyem
U.S. Department of the Interior
Bureau of Land Management

Jesse Hughes
U.S. Department of Transportation
Office of Hazardous Materials Enforcement

Robert A. Hughes
Bechtel Nevada

Jeff Hunt
U.S. Environmental Protection Agency
Region 10

The Honorable Duncan Hunter
U.S. House of Representatives

Dennis Hurtt
U.S. Department of Energy

Ralph Hutchison
Oak Ridge Environmental Peace Alliance

Mickey Ibarra
White House
Office of Intergovernmental Affairs

Jim Jackson

Richard J. Jackson
U.S. Department of Health and Human Services
Center for Disease Control and Prevention

Robert Jackson

Dave Jacobs
Central Intelligence Agency
Environmental Safety Group

Bob Jaundalderis
KTRV - Fox 12 News

Charles N. Jeffress
U.S. Department of Labor
Occupational Safety and Health Administration

William D. Jensen
U.S. Department of Energy
Idaho Operations Office

The Honorable Gary Johnson
State of New Mexico

H. Ray Johnson
Nevada Test Site Advisory Board

Harold Johnson
U.S. Department of Energy
Carlsbad Area Office

Adam Jostsons
Australian Nuclear Science & Technology

J. Jeffrey Kahle
Container Products Corp.

Peter Karcz
U.S. Department of Energy

Nancy Kaufman
U.S. Department of the Interior
Fish and Wildlife Service

Karen N. Keck

Kate Kelly
Idaho Division of Environmental Quality

The Honorable Dirk Kempthorne
State of Idaho

Thomas Kiess
National Research Council

Ronald Kilz

R. J. Kimmel
U.S. Department of Energy
Idaho Operations Office

John King

The Honorable John Kitzhaber
State of Oregon

Keith A. Klein
U.S. Department of Energy

Seb Klein
U.S. Department of Energy
Idaho Operations Office

Don Klima
Advisory Council on Historic Preservation

Malcolm Knapp
Nuclear Regulatory Commission
Office of Nuclear Material Safety and Safeguards

Dieter A. Knecht

Jeffrey Koplan
U.S. Department of Health and Human Services
Center for Disease Control and Prevention

Dan Kotansky
U.S. Department of the Interior
Bureau of Land Management

Kenneth R. Krivanek

Ryan Kuehmichel
U.S. Department of Labor
Occupational Safety and Health Administration

Stephanie Kukay
Idaho State Library

Kenneth Kumor
NASA
Environmental Management Division

The Honorable Mary Landrieu
U.S. Senate

Jennifer Langston
Post Register

Robert Lanza
IFC Kaiser

Lyle Laverty
U.S. Department of Agriculture
Natural Resources and Environment

Carolyn Lawson
U.S. Department of Energy
FOIA Reading Room

John Layman

The Honorable Michael Leavitt
State of Utah

Earl Leming
Tennessee Department of Environment & Conservation

R. Charles Lemmon
KMYT/Channel 11

Manuel Leon
State Of Idaho, INEEL Oversight Program

The Honorable Carl Levin
U.S. Senate

Paul Lewis
U.S. Department of Energy, Savannah River Operations Office Reading Room

George Lobsenz
Energy Daily

The Honorable Gary Locke
State of Washington

Christopher Logan
Weapons Complex Monitor

John Logan

Mary Lisa Lombardi

Guy Loomis
BBWI

Becky Lopez
Pantex Plant Citizens Advisory Board

Bob Loux
State of Nevada, Agency for Nuclear Projects

Sue Ludeman
Bonneville Power Administration Reading Room

Werner Lutze
Center for Radioactive Waste Management

Jeffrey A. Lybarger
U.S. Department of Health and Human Services
Agency for Toxic Substances and Disease Registry

D. W. Macdonald
U.S. Department of Energy
Idaho Operations Office

John Mackinney
U.S. Environmental Protection Agency

Peter Maggiore
New Mexico Environment Department

Swen Magnuson

Steve Maheras

Gary Mahn
Idaho Department of Commerce

Arjun Makhijani
Institute for Energy and Environmental Research

Theresa Marquez
U.S. Department of Energy
Albuquerque Operations Office Reading Room

Langdon Marsh
Oregon Department of Environmental Quality

Tom Marshall
Rocky Flats Citizen's Advisory Board

Paul Martin
U.S. Department of Energy
Idaho Operations Office

Debbie Maxwell
U.S. Department of the Interior
Western Ecological Research Center

Jeff Mccann

Paul Mccawley
U.S. Department of Agriculture

Gail McClure
U.S. Department of Energy
Richland Operations Office

Robert Mcguire
U.S. Department of Transportation
Research and Special Programs Administration

Lynn Mckee
U.S. Environmental Protection Agency
Region 10

Michael Mckenzie-Car
SAIC

Donald Mcmurrian

Mary Mcneil
AAA Auto Club

Jim Melillo
U.S. Department of Energy
Office of Environmental Management

Alan Merritt

Ellis Merschoff
Nuclear Regulatory Commission

T. J. Meyer

Sherri Miles

Roy F. Miller

Terry Miller
KIDK/Channel 3

Gregory F. Miner
Residuals Management Inc.

Camille Mittleholtz
U.S. Department of Transportation
Headquarters

Carol Moehrle
Idaho Department of Health and Welfare
North Central District Health Department

Damon Moglen
Greenpeace International

Collin Moller

Michael Monk

William E. Monroe
Tennessee Department of Environment & Conservation

Minyon Moore
White House
Office of Political Affairs

Ralph O. Morgenweck
U.S. Department of the Interior
Fish and Wildlife Service

Jim Morris
Craters of the Moon

Sid Morrison
Washington Transportation Department

Peter Morros
Nevada Department of Conservation & Natural Resources

Patrick Muffler
U.S. Department of the Interior
Geologic Division

Carlan Mullen
The Honorable Frank Murkowski

U.S. Senate
Dan Muslin

U.S. Department of Defense
Department of the Navy

Patricia Natoni
U.S. Department of Energy
Idaho Operations Office

Oregon NEPA Point of Contact
Office of the Governor

The Honorable Don Nickles
U.S. Senate

Hitesh Nigam
U.S. Department of Energy
Office of NEPA Policy and Assistance

Ken Niles
Oregon Department of Environment

Bob Nitschke

P. K. Niyogi
U.S. Department of Energy

Office of Facility Safety Analyses

Niels Nokkentved
Twin Falls Times News

Wayne Nordwall
U.S. Department of Interior
Bureau of Indian Affairs

Jane Norton
State of Colorado
Public Health & Environment Department

Dennis O'Connor
Office of Radiation & Indoor Air

Rachel O'Dell
Jackson Hole News

The Honorable David Obey
U.S. House of Representatives

Joseph Ossi
U.S. Department of Transportation
Federal Transit Administration

Tamar Osterman
National Trust for Historic Preservation
Department of Law and Public Policy

Lieutenant Governor Butch Otter
State of Idaho

The Honorable Bill Owens
State of Colorado

Ron Paarman

The Honorable Ron Packard
U.S. House of Representatives

Susan Panzitta
The Environmental Company, Inc.

Jerry Pardilla
National Tribal Environmental Council

Mervin Parker, Jr.
U.S. Department of Heath and Human Services
Food and Drug Administration

Rick Parkin
U.S. Environmental Protection Agency
Region 10

Linda Parkinson
Twin Falls Public Library

Tisha Patton
Fernald Citizens Advisory Board

Brent Paul
Federal Emergency Management Agency

Luke Paulus
State of Idaho INEEL Oversight Program

Bob Peralta

J. H. Phillips
Duke Engineering & Services, Inc.

Wayne Pierre
U.S. Environmental Protection Agency
Region 10

Gary Pitchford
U.S. Department of Energy
Chicago Operations Office Reading Room

Cathy Poland
Nuclear Regulatory Commission
Office of Nuclear Materials Safety

Gerald Pollet
Heart of America Northwest

Doug Posson
U.S. Department of the Interior
United States Geological Survey

President
Idaho Protective Specialists Inc.

The Honorable Marc Racicot
State of Montana

Pete Rahn
New Mexico Highway & Transportation
Department

Constance Ramirez
General Services Administration
Office of Business Performance

Karen Randolph
U.S. Department of Energy
Richland Operations Office

James Rasmussen
National Oceanic and Atmospheric
Administration Oceanic and Atmospheric
Research

Huey Reed
Idaho Department of Health and Welfare
Central District Health Department

Merilyn Reeves
Hanford Advisory Board

The Honorable Harry Reid
U.S. Senate

Scott Reno
Idaho Department of Health and Welfare
Division of Environmental Quality

John Reynolds
U.S. Department of the Interior
National Park Service

Vic Rezendes
U.S. General Accounting Office

Norman Rhoads

Charles M.Rice
Rice, Inc.

Bart Richards

Dixie Richardson
Office of Governor Dirk Kempthorne

Dr. Peter Rickards
Vote on INEEL

Suzanne Ricks
Eastern Idaho Technical College Library

Mary Riedner
Idaho Bureau of Hazardous Materials

Barbara Ritchie
Washington Department of Ecology

Carl Robertson
U.S. Department of Energy
Idaho Operations Office

Mark Robinson
Federal Agency Regulatory Commission

Ronald Robinson
National Transportation Safety Board
Office of Highway Safety

Carmen Rodriguez

Tomasina V. Rogers
Occupational Safety and Health Review
Commission

Gene Rollins
Dade Moeller & Associates

Steve Romano

The Honorable Carlos Romero-Barcelo
U.S. House of Representatives

Linda Rosenstock
U.S. Department of Health and Human Services
Centers for Disease Control and Prevention

Annette Ross
U.S. Department of Energy
Oakland Operations Office Reading Room

Amy Rothrock
U.S. Department of Energy
Oak Ridge Operations Reading Room

Joseph Rousseau
U.S. Department of the Interior
United Sates Geological Survey

Lawrence Rudolph
National Science Foundation

Dave Rydalch
Idaho Water Resource Board

Jennifer Salisbury
New Mexico Energy, Minerals & Natural
Resources Department

Duane Sammons
Idaho Department of Law Enforcement

Dan Sanow
U.S. Department of Energy
Idaho Operations Office

Doug Sarno
Fernald Citizens Advisory Board

John Savage
Oregon Energy Office

Vijay Sazawal
Cogema Inc.

Alan Schilk
State of Idaho, INEEL Oversight Program

Ramona Schreiber
U.S. Department of Commerce

Dale Schutte
Nevada Test Site Advisory Board

Melanie Scott
U.S. Department of Energy
Yucca Mountain Site Characterization Office

Brian Seggerty

Darryl Siemer
BBWI

The Honorable Michael Simpson
U.S. House of Representatives

The Honorable Norman Sisisky
U.S. House of Representatives

The Honorable Ike Skelton
U.S. House of Representatives

Ken Skipper
U.S. Department of Energy
Yucca Mountain Site Characterization Office

Gail Small
Native Action

Anthony Smialek
U.S. Department of Transportation
Office of Hazardous Materials Enforcement

Bryan Smith
Idaho Transportation Department

The Honorable Robert Smith
U.S. Senate

Antonin Smrcka
Century University

Rhey Solomon
U.S. Department of Agriculture
Forest Service

The Honorable Jim Sorensen
City of Kimberly, Idaho

The Honorable Floyd Spence
U.S. House of Representatives

Robert G. Stanton
U.S. Department of the Interior
National Park Service

J. M. Steele
U.S. Department of Energy

Jeff Steele
U.S. Department of the Interior
Bureau of Land Management

Lawrence Stein
White House
Office of Legislative Affairs

Lynne Stembridge
Hanford Education Action League

Thomas Stephens
Nevada Department of Transportation

Donna Sterba
Hanford Site Advisory Board

The Honorable Ted Stevens
U.S. Senate

Margaret Stewart
Environmental Resource Center

Frank Strasheim
U.S. Department of Labor
Occupational Safety and Health Administration

Clive Strong
State of Idaho, Natural Resources Division

Amy Sumariwalla

Kristine Svinicki
Office of Senator Larry Craig

Willie Taylor
U.S. Department of the Interior
Office of Environmental Policy & Compliance

Richard Terrill
U.S. Department of Labor, Region X

W. Thompson
Nuclear Systems Associates, Inc.

Grace Thorpe
National Environmental Coalition of American Indians

The Honorable Strom Thurmond
U.S. Senate

Dale Towell
Idaho Department of Fish & Game

Juan Tracey

Terri Traub
U.S. Department of Energy
Richland Operations Office Reading Room

Kathleen Trever
State of Idaho, INEEL Oversight Program

Ines Triay
U.S. Department of Energy
Waste Isolation Pilot Plant

Elissa Turner
U.S. Department of Energy
Civilian Radioactive Waste Management

Roger Twitchell
U.S. Department of Energy
Idaho Operations Office

Craig Tyler

Louis W. Uccelini
National Oceanic and Atmospheric Administration
National Weather Service

Susie Vader

Todd Van Horne
Idaho State Library

Amy Vanhoover

Harold E. Varmus
U.S. Department of Health and Human Services
National Institute of Health

Art Vaughn
Ameripride

Bruce Verharren
Argonne National Laboratory

Don Vernon
BBWI

Martin Virgilio
Nuclear Regulatory Commission
Office of Nuclear Material Safety and Safeguards

The Honorable Peter Visclosky
U.S. House of Representatives

Paul G. Voilleque
MJP Risk Assessment, Inc

Bill Waldman
The Nature Conservancy
New Mexico Field Office

Doug Walker
State of Idaho, INEEL Oversight Program

Andy Wallo
U.S. Department of Energy
Office of Environmental Policy and Assistance

The Honorable John Warner
U.S. Senate

Dane Watkins
Watkins Enterprises

Kafi Watlington
Natural Resources Defense Council

Dave Watson
National Transportation Safety Board
Office of Railroad Safety

John B. Weeks
U.S. Department of the Interior
Water Resources Division

Richard Welland
Federal Emergency Management Agency

Martha Whetstone
Federal Emergency Management Agency

K. B. Whitaker
U.S. Department of Energy
Idaho Operations Office

T. L. Wichmann
U.S. Department of Energy
Idaho Operations Office

Mary V. Wilcox
U.S. Department of Energy
Idaho Operations Office

Jack Williams

Robert Williams
U.S. Department of Agriculture
Natural Resources and Environment

Gail Willmore
U.S. Department of Energy
Idaho Falls Public Reading Room

Robin Wilson
Waste Isolation Pilot Plant Technical Library

Charles Winder
Idaho Department of Transportation

Ralph Wolter
Ace Printing

Stephen Woods
Idaho State University Library

Michael Worley
U.S. Department of Energy
Office of Environmental Management

Carolyn Wright
State of Utah NEPA Point of Contact

Joseph Wysocki
U.S. Department of Agriculture
Cooperative State Research Education and Extension

The Honorable C. W. Bill Young
U.S. House of Representatives

Nuclear Regulatory Commission
Office of Nuclear Regulation

Center for Environmental Management

Information Officer
Defense Nuclear Safety Board

Idaho State Department of Labor

Idaho Department of Health and Welfare
South Central Health Department

Snake River Alliance

U.S. Department of the Interior
Office of Environmental Policy & Compliance

Irwin City Council

Mckay Library, Ricks College
State Document Collection

University of Idaho Library

Hazardous Waste Library

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U.S. Department of Energy
Washington State University Reading Room
WSU Tri-Cities Branch CampU.S.

Idaho Department of Health & Welfare
INEEL Oversight Program Library

Nevada Test Site Reading Room

Idaho Department of Commerce
Division of Science & Technology

Boise Public Library
Reading Room

Kiwanis Club of Burley

U.S. Department of the Navy
Environmental Planning & NEPA Compliance Program

U. S. Department of Transportation
Environmental Division

U.S. Department of Health & Human Services
National Center for Environmental Health

KPVE TV

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Individuals

Wayne Adair
Wood River Journal

Arleen Adams

Anthony Addison
Arapahoe Business Council

The Honorable Terry Aguilar
San Ildefonso Pueblo

Ed Alexander
Rocky Mountain Express Newspaper

The Honorable Wayne Allard

Brian Allen

Pam Allister
Snake River Alliance

Steve Allred
Idaho Division of Environmental Quality

Andrea Alpine
U.S. Department of the Interior
United States Geological Survey

Navroze Amaria
Raytheon Engineers & Constructors

The Honorable Allen Ambler
Lovelock Tribal Council

The Honorable Curtis Anderson
Las Vegas Tribal Council

Gary Anderson

The Honorable General Anderson
Paiute Indian Tribes of Utah

The Honorable Greg Anderson
City of Pocatello

Hal Anderson
Idaho Department of Water Resources

Lillis Connery Anderson

M. R. Anderson
U.S. Department of Energy
Idaho Operations Office

Paul Anderson
KZBQ

Ross Anderson
Seattle Times

Carl Armbrister
Federal Highway Administration

The Honorable Bennie Armstrong
Suquamish Tribal Council

Doug Armstrong
KTVB Channel 7

Charlotte Arnold
Shelley High School

The Honorable Richard Arnold
Pahrump Paiute Tribe

The Honorable Bruce Babbitt
U.S. Department of the Interior

The Honorable Inez Baca
Pueblo of Sandia

J. Paul Bacca

Anne Badgley
U.S. Department of the Interior
Fish and Wildlife Service

The Honorable Velma Bahe
Kootenai Tribal Council

Marc Bailey
KRIC Radio

The Honorable Alex Bailon
Pueblo of Santo Domingo

The Honorable Brian Baird
Washington Legislature

Jim Baker
Cedar Mountain Supply

James Baker, Ph.D.
Idaho Department of Agriculture

Jim Balginy
KUPI

Jila Banaee

Rob Baracker
U.S. Department of the Interior
Bureau of Indian Affairs

Rocky Barker
Idaho Statesman

The Honorable Jack Barraclough
Idaho Legislature

James Barrett
B&W Services, Inc.

The Honorable Lenore Barrett
Idaho Legislature

The Honorable Joe Barton
U.S. House of Representatives

The Honorable Max Baucus
U.S. Senate

Robert Baumgartner
Bureau of Disaster Services

Gregory Baxter
U.S. Department of Labor
Occupational Safety and Health Administration

Seth Beal
Butte County Commissioner

Phyllis Beard
Amalgamated Sugar Company

The Honorable Kelsey Begaye
Navajo Nation

Jennifer Belcher
Washington Natural Resources Department

Kate Neilly Bell
University News
Boise State University

The Honorable Robert Bennett
U.S. House of Representatives

Alan Benson
U.S. Department of Energy
Yucca Mountain Site Characterization Office

The Honorable Shelley Berkley
Nevada Legislature

The Honorable Roy Bernal
All Indian Pueblo Council

K. Betts
American Chemical Society

Jeinene Big Day
Shoshone-Bannnock Tribe

The Honorable Spike Bighorn
Fort Peck Tribal Executive Board

Valerie Bighorse
Fort Hall Air Quality Program

The Honorable Jeff Bingaman
U.S. Senate

Fritz Bjornsen
Snake River Alliance

Don Black
Blackfoot Morning News

Sheree Black
Oak Ridge Reservation
Site Specific Advisory Board Coordinator

Brent Blackwelder
Friends of the Earth

Jack Blackwell
U.S. Department of Agriculture

Mary Blair

The Honorable Tom Bliley
U.S. House of Representatives

The Honorable Earl Blumenauer
Oregon Legislature

Robert Bobo
Shoshone-Bannock Tribes - U.S. Department of Energy Tribal Project

Donna Boe
U.S. House of Representatives

Jeff Bohr
U.S. Department of Agriculture
Natural Resources Conservation Service

Larry Boing
Argonne National Laboratory East

J. P. Bollinger

Sharon Boltz

M. J. Bonkoski
U.S. Department of Energy
Idaho Operations Office

Carol Borgstrom
U.S. Department of Energy

Dale Bosworth
U.S. Department of Agriculture

The Honorable Malcolm Bowekaty
Pueblo of Zuni

B. R. Bowman
U.S. Department of Energy
Idaho Operations Office

Georgia Bowman

Louis Boyle
L. A. Hartert & Company

The Honorable Kevin Brady, Sr.
Yomba Tribal Council

Beatrice Brailsford
Snake River Alliance

The Honorable Tawnda Bromley
City of Rathdrum

Ken Brooks
U.S. Environmental Protection Agency
Region X

Chuck Broscious
Environmental Defense Institute

Wayne Brower
Bingham County Commissioner

Carol M. Browner
U.S. Environmental Protection Agency

Alan Brownstein
U.S. Department of Energy
Office of Civilian Radioactive Waste Management

The Honorable Frank Bruneel
Idaho Legislature

The Honorable Richard Bryan
U.S. Senate

Helen Buehler
League of Women Voters of Teton County

Brad Bugger
U.S. Department of Energy
Idaho Operations Office

Bill Buley
Bonner County Daily

Kenneth Bulmahn

Susan Burch
U.S. Department of the Interior
Fish and Wildlife Service

Blaine Burkman

The Honorable Conrad Burns
U.S. Senate

Raymond Burstedt
Idaho Small Business Development Center

The Honorable Don Burtenshaw
Idaho Legislature

Ronald Bush
Hawley, Troxell, Ennis & Hawley

The Honorable Robert Byrd
U.S. Senate

Jackie Cabasso
Western States Legal Foundation

Lorie Cahn

T. B. Calloway
Westinghouse Savannah River Company

Charles Cammack
Arco Advertiser

Lin Campbell
Idaho Department of Water Resources

Curtis Cannell
Magic Valley Regional Medical Center

The Honorable Chris Cannon
U.S. House of Representatives

John Capek

The Honorable Pearl Capoeman-Baller
Quinault Indian Nation Business Committee

Dave Carlson

Fred Carlson
Carlson & Associates, Inc.

Marcia Carlson
U.S. Department of Energy
Office of Hearings Reference Room

Beverly Carlyle

Carolyn Huntoon
U.S. Department of Energy
Office of Environmental Management

Ted Carpenter
Coalition 21

Tom Carpenter
Government Accountability Project

The Honorable Thomas Carper
National Governors Association

David Carson
U.S. Department of Justice

Darwin Casper
Jefferson County Commissioner

Lois Chalmers

Dwight Chamberlain
Nuclear Regulatory Commission

Christine Chandler
Responsible Environmental Action League

John Chappell

Raymond Charley
Navajo Nation UMPTRA Program

Joann Chase
National Congress of American Indians

The Honorable Roger Chase
U.S. House of Representatives

The Honorable Helen Chenoweth
U.S. House of Representatives

Roger Christensen

Jim Christopher
KSEI

John Church
Economic Consulting and Forecasting

Dianne Ciarlette
American Nuclear Society

The Honorable M. Brian Cladoosby
Swinomish Tribal Council

Chuck Clarke
U.S. Environmental Protection Agency
Region X

Ron Clawson
Idaho Falls Chamber of Commerce

Jennifer Clay

Tom Clements
Greenpeace

Documents Clerk
Idaho Falls Public Library

John Cline
Idaho Bureau of Disaster Services

Thomas Cochran
Natural Resources Defense Council

Jay Coghlan
Concerned Citizens for Nuclear Safety

The Honorable William S. Cohen
Secretary of Defense

Carol Cole
Jason Associates

Neil Coleman
U.S. Nuclear Regulatory Commission

The Honorable H. Coles
City of Boise

Rita Colwell
National Science Foundation

John Commander
Idaho Falls Chamber of Commerce

The Honorable Carl Conche
Taos Pueblo

Dennis Connor
U.S. Department of Energy
Rocky Flats Public Reading Room

David Conrad
Council of Energy Resource Tribes

John T. Conway
Defense Nuclear Facilities Safety Board

John Cook
U.S. Department of the Interior
National Park Service

The Honorable Merrill Cook
U.S. House of Representatives

Maggie Coon
The Nature Conservancy

The Honorable Bert Corcoran
Chippewa Cree Business Committee

Wallace Cory
Idaho Department of Health & Welfare
Division of Environmental Quality

Brian Costner
Institute for Energy and Environmental Research

Tonya Covington
Sandia National Laboratory
Site Specific Advisory Board

The Honorable Larry Craig
U.S. Senate

Robert Craig
Idaho Department of Health & Welfare
Water Resources Division

David Crandall

Mike Crane

The Honorable Michael Crapo
U.S. Senate

Alice Crockett
Skyline High School Library

Jeanne-Marie Crockett
New Mexico Environmental Department

Diane Croson

The Honorable Dolores Crow
Idaho Legislature

Grace Crunican
Oregon Department of Transportation

The Honorable Barbara Cubin
U.S. House of Representatives

Dan Cudaback
Eastern Idaho Economic Development Council

Bruce Culp

David Culp
Plutonium Challenge

Wallace Cummings

Rodney B. Cummins
U.S. Department of Energy

Max Dakins
University of Idaho

The Honorable William Daley
Secretary, Department of Commerce

Raphael Daniels
Defense Nuclear Facilities Safety Board

The Honorable Denton Darrington
Idaho Legislature

The Honorable Walter Dasheno
Santa Clara Pueblo

Dan Davenport

The Honorable Bart Davis
Idaho Legislature

The Honorable Gwen Davis
Northwestern Band of Shoshoni Nation

David DeCourcy
Federal Emergency Management Agency

Brad Debow

The Honorable Peter DeFazio
U.S. House of Representatives

The Honorable Diana Degette
U.S. House of Representatives

Bryce Denning
BBWI

Brian Denny
D. H. "Doc" Detonancour

Sherry Devlin
The Missoulian

The Honorable Norman Dicks
U.S. House of Representatives

Greta Joy Dicus
Nuclear Regulatory Commission

The Honorable John Dingell
U.S. House of Representatives

Georgia Dixon

Wendy Dixon
U.S. Department of Energy, Yucca Mountain
Site Characterization Office

Ted Doerr

Ann Dold
State of Idaho, INEEL Oversight Program

Steven Dolley
Nuclear Control Institute

Michael Dombeck
U.S. Department of Agriculture
Forest Service

The Honorable Pete Domenici
U.S. Senate

Gervaise Dona-Ashe

Mike Donahoo
U.S. Department of the Interior
Fish and Wildlife Service

Jerry Downs
State of Idaho, INEEL Oversight Program

Karl Dreher

Ann Dubois
U.S. Department of Energy
Los Alamos Area Office
Northern New Mexico Citizens Advisory Board

F. Dunhour

Paul Dunigan
U.S. Department of Energy
Richland Operations Office

The Honorable Jennifer Dunn
U.S. House of Representatives

Dirk Dunning
Oregon Office of Energy

John Duray

The Honorable Harry Early
Pueblo of Laguna

Mark Eddy
The Denver Post

Joyce Edlesfen
Rexburg Standard Journal

Joyce Edlesfen
Fremont County Herald Chronicle

Ted Edwards
Clark County Commissioner

Teri Ehresman

Steven Eide

Maureen Eldredge
Alliance for Nuclear Accountability

Jean Elle
League of Woman Voters

Heather Elliott
Nevada State Clearinghouse
Department of Administration

Jud Ellis

Paul Emerson
Lewiston Morning Tribune

Douglas Empey

Tom Enyeart
SAIC

The Honorable Michael Enzi
U.S. Senate

Sue Evans

John Evans, Sr.
D. L. Evans Bank

Todd Everts
Montana Legislative Environmental Quality Council

Henry Falk
U.S. Department of Health and Human Services
Agency for Toxic Substances and Disease Registry

Ed Fast

Joanie Fauci

Rick Fawcett

Mike Feller
Coeur D'Alene Press

Michael Fellows

Montgomery Watson

Bob Fick
Associated Press

Randy Fields
U.S. Department of the Interior
U.S. Geological Survey

Phillip Fineman

J. Finlinson

James J. Fiore
U.S. Department of Energy

Alex Fischer

Tom Fitzsimmons
State of Washington, Ecology Department

Jerry Foisel

Pat Ford

Howard Forsythe

David Fortier

Thomas Fouch
U.S. Department of the Interior

Stacey Francis

Steven Frank
U.S. Department of Energy

Curt Fransen

The Honorable Evan Frasure
Idaho Legislature

Barbara French
Northwest Technical Resources

Douglas French

Jennifer French

George Freund
Coalition 21

George Froom
Heyburn City Council

The Honorable Clement Frost
Southern Ute Tribe

Jaime Fuhrman
State of Idaho
INEEL Oversight Program

The Honorable Raymond Gachupin
Pueblo of Jemez

The Honorable Lee Gagner
Idaho Legislature

Chuck Galloway
Shoshone-Bannock Tribe

Ben Gannon

Bruce Gardner
Paducah Site Specific Advisory Board

Mary Gaylord
U.S. Department of the Interior
Bureau of Land Management

Tom Geary
Idaho Farm Bureau Federation

The Honorable Robert L. Geddes
Idaho Legislature

John Geddie

Ray Geimer
SAIC

The Honorable Art George
Nooksack Indian Tribal Council

The Honorable Jim Geringer
State of Wyoming

J. A. Gernant
U.S. Department of Energy
Idaho Operations Office

Norman Gerstein

The Honorable Jim Gibbons
U.S. House of Representatives

Toni Gillette
KIVI/Channel 6

Marshall Gingery
National Park Service
Spring Gulch Preserve

Tom Glaccum

The Honorable David Glickman
Secretary, U.S. Department of Agriculture

Denise Glore
U.S. Department of Energy, Idaho Operations Office

Robert Godfrey
Embassy of Australia

Joseph Goffman
Environmental Defense Fund

Sidney Goldstein
Occupational Safety and Health Review Commission

Dirk Gombert

Jeff Gordon
U.S. Department of Energy
Nevada Operations Office Reading Room

The Honorable Slade Gordon
U.S. Senate

Susan Gordon
Alliance for Nuclear Accountability

Dan Gorham
Wood River Journal

Jim Gorman
Citizens Advisory Board for Nevada Test Site Programs

Kevin Gover
U.S. Department of the Interior

The Honorable Bob Graham
U.S. Senate

Roger Gray
Australian Nuclear Science & Technology

Walter Greaves

L. A. Green
U.S. Department of Energy
Idaho Operations Office

Wendy Green Lowe
Jason Associates

Lance Greenwade

Janet Greenwald
Citizens for Alternatives to Radioactive Dumping

Nancy Greer
U.S. Department of Energy
Golden Field Office Reading Room

Kay Greiting
Bingham County Commissioner

Steve Grimm
Federal Railroad Administration

Charles Groat
U.S. Department of the Interior
United States Geological Survey

Bill Gruber
The Wyoming Tribune-Eagle

The Honorable Kenny Guinn
State of Nevada

Missy Guisto

Ron Guymon

Ernie Haar
Jason Associates

The Honorable J Steven Hadley
Idaho Legislature

Julie Hagenson
U.S. Environmental Protection Agency
Region X

James Hall
National Transportation Safety Board

Laurel Hall

The Honorable Ralph Hall
U.S. House of Representatives

Julie Hamilton
Wyoming Federal Land Policy Office

Darrell Hamlett
Ameripride Services

Shaun Hammersmar
KTRV/Channel 12

The Honorable Todd Hammond
U.S. House of Representatives

Don Hancock
Southwest Research & Information Center

The Honorable James Hansen
U.S. House of Representatives

The Honorable Reed Hansen
Idaho Legislature

Susan Hanson
Shoshone-Bannock Tribes

Barbara Harper
Yakama Indian Nation

Jeffrey Harris
Idaho Department of Health & Welfare

The Honorable Norman Harry
Pyramid Lake Paiute Tribal Council

Phillip Hashimoto
EQE International

The Honorable Doc Hastings
U.S. House of Representatives

The Honorable Orrin Hatch
U.S. Senate

The Honorable Delbert Havatone
Hualapai Tribal Council

The Honorable Stan Hawkins
Idaho Legislature

Dawn Haygood
Savannah River Site Advisory Board

The Honorable Joel Hefley
U.S. House of Representatives

The Honorable Margaret Henbest
Idaho Legislature

Dave Hensel

Alan Herbst

The Honorable Issac Herrera
Pueblo of Cochiti

The Honorable Milton Herrera
Pueblo of Tesuque

Blanche Herrick

Lindy High
Idaho Office of Public Instruction

The Honorable Rick Hill
U.S. House of Representatives

Stan Hobson
INEEL Citizens Advisory Board

Russell Hoeflich
The Nature Conservancy, Oregon Field Office

Vickie Holbrook
Idaho Press Tribune

Andy Holderreed
Castleford Men's Club

Jean Holdren

Lee Hollinshead

Tricia Holly
Exchange Monitor Publications

Kenneth Holt
U.S. Centers for Disease Control & Prevention

The Honorable Darlene Hooley
U.S. House of Representatives

Rick Hoover
Moscow-Pullman Daily News

Jim Hopla

The Honorable Ernest House
Ute Mountain Ute Tribe

John Hovinga

Dean Howell

Dennis Hoyem
U.S. Department of the Interior
Bureau of Land Management

Mike Hudson
KWIK/KPKY

M. F. Huebner
Bonneville County Sportsman Association

Jesse Hughes
U.S. Department of Transportation

Robert A. Hughes
Bechtel Nevada

The Honorable Duncan Hunter
U.S. House of Representatives

Dennis Hurtt
U.S. Department of Energy
Carlsbad Area Office

Leonard Hutterman

The Honorable Cecil Ingram
Idaho Legislature

The Honorable Jay Inslee
U.S. House of Representatives

Diane Jackson
The Wilderness Society

Jim Jackson

Richard Jackson
U.S. Department of Health and Human Service
Center for Disease Control and Prevention

Robert Jackson

Tim Jackson
Idaho State Journal

John James

The Honorable Wendy Jaquet
Idaho Legislature

W. G. Jasen
WMH

Bob Jaundalderis

Charles Jeffress
U.S. Department of Labor
Occupational Safety and Health Administration

T. W. Jenkins
U.S. Department of Energy
Idaho Operations Office

A. T. Jines
U.S. Department of Energy
Idaho Operations Office

Lowell Jobe

The Honorable Gary Johnson
State of New Mexico

Harold Johnson
U.S. Department of Energy
Carlsbad Area Office

Marc Johnson
The Gallatin Group

Vicki Johnson
U.S. Department of Energy
Idaho Operations Office

Adam Jostsons
Australian Nuclear Science & Technology

Kent Just

J. Jeffrey Kahle
Container Products Corp

Peter Karcz
U.S. Department of Energy
Office of Environmental Management

George Katseanes
Bingham County Commissioner

Nancy Kaufman
U.S. Department of the Interior
Fish and Wildlife Service

Karen Keck

Kate Kelly
Idaho Division of Environmental Quality

The Honorable Dirk Kempthorne
State of Idaho

The Honorable Jim Kempton

The Honorable Wayne Kendell

Richard Kenney
Coalition 21

Ronald Kilz

R. J. Kimmel
U.S. Department of Energy
Idaho Operations Office

John King

Ron King
U.S. Department of Energy
Idaho Operations Office

David Kipping

The Honorable John Kitzhaber
State of Oregon

Tony Kluk
U.S. Department of Energy
Office of Environmental Management

Malcolm Knapp
Nuclear Regulatory Commission

Dieter Knecht

Jeffrey Koplan
U.S. Department of Health and Human Services
Center for Disease Control and Prevention

Dan Kotansky
U.S. Department of the Interior
Bureau of Land Management

P. A. Kroupa
U.S. Department of Energy
Idaho Operations Office

Fred Krupp
Environmental Defense Fund

Ryan Kuehmichel
U.S. Department of Labor
Occupational Safety and Health Administration

Stephanie Kukay
Idaho State Library

Kenneth Kumor
NASA
Environmental Management Division

The Honorable Kent Kunz
Idaho Legislature

Stephen Laflin
International Isotopes

The Honorable Dennis Lake
Idaho Legislature

The Honorable Mary Landrieu
U.S. Senate

Jennifer Langston
Post Register

Lyle Laverty
U.S. Department of Agriculture
Natural Resources and Environment

Carolyn Lawson
U.S. Department of Energy
FOIA Reading Room

John Layman

W. H. Leake
U.S. Department of Energy
Idaho Operations Office

The Honorable Michael Leavitt
State of Utah

Kim Lee
KFTZ/KOSZ

M. A. Lee

The Honorable Robert Lee
Idaho Legislature

The Honorable Jesse Leeds
Las Vegas Indian Center

Earl Leming
Tennessee Department of Environment & Conservation

J.K. Lemley
Lemley & Associates

R. Charles Lemmon
KMVT

Lew Lenker
White Mortuary

Jay Lenkersdorf
South Idaho Press

D. Leroy

The Honorable Carl Levin
U.S. Senate

Paul Lewis
U.S. Department of Energy
Savannah River Operations Office Reading Room

Hazardous Library
Research & Information Center

The Honorable Golden Linford
Idaho Legislature

George Lobsenz
Energy Daily

The Honorable Gary Locke
State of Washington

The Honorable Thomas Loertscher
Idaho Legislature

Christopher Logan
Weapons Complex Monitor

John Logan

Rob Logan

Mary Lisa Lombardi

Josh Long
Jackson Hole Guide

Guy Loomis
BBWI

Becky Lopez
Pantex Plant Citizens Advisory Board

Vaughn Lotspeich

Bob Loux
State of Nevada Agency for Nuclear Projects

The Honorable Alvino Lucero
Pueblo of Isleta

Sue Ludeman
U.S. Department of Energy
Bonneville Power Administration Reading Room

Dick Lumenello
KIDO Radio

Werner Lutze
Center for Radioactive Waste Management

Jeffrey Lybarger
U.S. Department of Health and Human Services
Agency for Toxic Substances and Disease Registry

Jerry Lyle
U.S. Department of Energy
Idaho Operations Office

James Lyons
Department of Agriculture
Under Secretary for Natural Resources and Environment

D. W. Macdonald
U.S. Department of Energy
Idaho Operations Office

John Mackinney
U.S. Environmental Protection Agency

Peter Maggiore
New Mexico Environmental Department

Swen Magnuson

Steve Maheras

Gary Mahn
Idaho Department of Commerce

Dean Mahoney
INEEL Cizitens Advisory Boards

Linda Mapes
Seattle Times

The Honorable Jaques Marcott
City of Arco

The Honorable Bert Marley
Idaho Legislature

Theresa Marquez
U.S. Department of Energy
Albuquerque Operations Office Reading Room

Langdon Marsh
Oregon Department of Environmental Quality

Tom Marshall
Rocky Flats Citizen's Advisory Board

T Marti
IT Corporation

Sally Martin Lewis
Mactec, Inc.

Dennis Maughan
Twin Falls County Commissioner

Robyn Maxfield
Farm Times

Debbie Maxwell
U.S. Department of the Interior
Western Ecological Research Center

Jeff McCann

Thomas McClain
U.S. Department of Energy PNNL

Gail McClure
U.S. Department of Energy
Richland Operations Office

Rob McClure
Seattle Post-Intelligencer

The Honorable Joe McConnell
Fort Bellknap Community Council

The Honorable Marvin McDade
South Fork Band Council

The Honorable Jim McDermott
U.S. House of Representatives

Scott McDonald
Association of Idaho Cities

Robert McEnaney
Snake River Alliance

The Honorable Scott McInnis
U.S. House of Representatives

Lynn McKee
U.S. Environmental Protection Agency
Region X

Michael McKenzie-Car
SAIC

Donald McMurrian

Baird McNaught

Mary McNeil
AAA Auto Club

John McQuigg

D. W. Mecham

Doug Meiklejohn
New Mexico Environmental Law Center

Alan Merritt
BBWI

Ellis Merschoff
U.S. Nuclear Regulatory Commission

The Honorable Edward Metcalf
Coquille Indian Tribe

The Honorable Jack Metcalf
U.S. House of Representatives

T. J. Meyer

The Honorable Linda Milam
City of Idaho Falls

E. W. Miles
U.S. Department of Energy
Idaho Operations Office

Sherri Miles

Roy F. Miller

Terry Miller
KIDK-TV

Gregory Miner
Residuals Management Inc

The Honorable Antone Minthorn
Confederated Tribes of the Umatilla Indian Reservation

The Honorable Sara Misquez
Mescalero Apache Tribe

The Honorable Jeff Mitchell
Klamath General Council

Camille Mittleholtz
U.S. Department of Transportation
Environmental Division

Carol Moehrle
North Central District Health Department

Collin Moller

Michael Monk

William Monroe
Tennessee Department of Environment & Conservation

Greg Moore
Idaho Mountain Express

Richard Moore
Southwest Network

The Honorable Anthony Moquino
Pueblo of San Juan

Darwin Morgan
U.S. Department of Energy
Nevada Operations Office

Ralph Morgenweck
U.S. Department of the Interior
Fish and Wildlife Services

Jim Morris
Craters of the Moon National Monument

Sid Morrison
Washington Transportation Department

Peter Morros
Nevada Department of Conservation & Natural Resources

The Honorable Max Mortensen
Idaho Legislature

Patrick Muffler
U.S. Department of the Interior

Carlan Mullen

The Honorable Vince Munoz, Jr.
Ysleta Del Sur Pueblo

George Murgel
Boise State University

The Honorable Frank Murkowski
U.S. Senate

The Honorable Patty Murray
U.S. Senate

Todd Nelson
KSRA

W. Greg Nelson
Idaho Farm Bureau

Glen Nenema
Kalispel Business Committee

Colorado NEPA Point of Contact
Office of the Governor

Oregon NEPA Point of Contact
Office of the Governor

The Honorable George Nethercutt
U.S. House of Representatives

The Honorable Bruce Newcomb
Idaho Legislature

C. R. Nichols

Nick Nichols

Don Nickles

Rick Nielsen
Citizen Alert

Warren Niemi

Hitesh Nigam
U.S. Department of Energy
Office of NEPA Policy and Assistance

The Honorable Ben Nighthorse Campbell
U.S. Senate

Ken Niles
Oregon Department of Energy

T Ninnemann
KSGT/KMTN

Bob Nitschke

P.K. Niyogi
U.S. Department of Energy
Office of Facility Safety Analyses

The Honorable Laird Noh
Idaho Legislature

Nils Nokkentved
Twin Falls Times News

Don Northrup
Butte County Commissioner

Jane Norton
Colorado Public Health & Environment
Department

Dennis O'Connor

Rachel O'Dell
Jackson Hole News

The Honorable David Obey
U.S. House of Representatives

William Old Chief
Blackfeet Tribal Business Council

Anthony Ortiz
Pueblo of San Felipe

Lieutenant Governor Butch Otter
State of Idaho

William Otting

James Owendoff
U.S. Department of Energy

The Honorable Bill Owens

State of Colorado

Ron Paarman

The Honorable Michael Pablo
Confederated Salish & Kootenai Tribal Council

The Honorable Ron Packard
U.S. House of Representatives

David Paige

The Honorable James Paiva
Shoshone Paiute Business Council

The Honorable Joseph Pakootas

Colville Business Council

Jim Paluzzi
KBSU

Susan Panzitta
The Environmental Company, Inc.

Rick Parkin
U.S. Environmental Protection Agency
Region X

Linda Parkinson
Twin Falls Public Library

Deb Patla

The Honorable Olney Patt Jr.
Confederated Tribes of Warm Springs

Tisha Patton
Fernald Citizens Advisory Board

The Honorable Bob Peck
Wyoming Legislature

Chris Peck
Spokesman Review, Sandpoint Office

The Honorable Christian Penn Jr.
Quileute Tribal Council

The Honorable Samuel Penney
Nez Perce Tribal Executive Committee

The Honorable Nevada Penoli
Wells Indian Colony Band Council

Bob Peralta

The Honorable David Perez
Nambe Pueblo

T.L. Perkins
U.S. Department of Energy
Idaho Operations Office

Penny Phelps
BBWI

J. H. Phillips
Duke Engineering & Services, Inc.

Fredrick G. Pieper
U.S. Department of Energy
Idaho Operations Office

Wayne Pierre
U.S. Environmental Protection Agency
Region X

The Honorable Dolores Pigsley
Siletz Tribal Council

Gary Pitchford
U.S. Department of Energy
Chicago Operations Office Reading Room

Dave Plourde
General Manager
KADQ

Cathy Poland
Nuclear Regulatory Commission

Joyce G. Pole

Gerald Pollet
Heart of America Northwest

Doug Posson
U.S. Department of the Interior
United States Geological Survey

Robert Prasil
KRLC/KMOK

Idaho Protective Specialists, Inc.

Joseph Pruitt

The Honorable Marc Racicot
State of Montana

KSRA-AM/KSRA- Radio

The Honorable Eagle Rael
Picuris Pueblo

Pete Rahn
New Mexico Highway & Transportation
Department

Karen Randolph
U.S. Department of Energy
Richland Operations Office

Phil Reberger
State of Idaho

Huey Reed
Central District Health Department

Len Reed
The Oregonian

Scott Reese
City of Blackfoot

The Honorable Harry Reid
U.S. Senate

Scott Reno
State of Idaho
Division of Environmental Quality

John Reynolds
U.S. Department of the Interior
National Park Service

Norman Rhoads

Charles Rice
Rice, Inc.

Bart Richards

Dixie Richardson
Office of Governor Dirk Kempthorne

The Honorable Melvin Richardson
Idaho Legislature

Dr. Peter Rickards
Vote On INEEL

Suzanne Ricks
Eastern Idaho Technical College Library

Ann Riedesel
BNFL, Inc.

Mary Riedner
Idaho Bureau of Hazardous Materials

Jim Rindfleisch

Mike Ripley
KOZE

The Honorable James Risch
Idaho Legislature

Barbara Ritchie
Washington Department of Ecology

Jeff Robbins
U.S. Department of Energy
Albuquerque Operations Office

Pat Roberts
KBCI

Carl Robertson
U.S. Department of Energy
Idaho Operations Office Public Reading Room

Ronald Robinson
National Transportation Safety Board

Brent Robson
Teton County Commissioner

Carmen Rodriguez

Tomasina Rogers
Occupational Safety and Health Review
Commission

Gene Rollins
Dade Moeller & Associates

Steve Romano

Keith Rose
U.S. Environmental Protection Agency

Linda Rosenstock
U.S. Department of Health and Human Services
Centers for Disease Control and Prevention

Bob Rosenthal
KBOI

Annette Ross
U.S. Department of Energy
Oakland Operations Office Reading Room

Amy Rothrock
U.S. Department of Energy
Oak Ridge Operations Reading Room

Joseph Rousseau
U.S. Department of the Interior
United States Geological Survey

Woody Russell
U.S. Department of Energy
Idaho Operations Office

Dave Rydalch
Idaho Water Resource Board

Jennifer Salisbury
New Mexico Energy, Minerals & Natural Resources Department

Duane Sammons

The Honorable Bruce Sanchez
Pueblo of Santa Ana

Doug Sarno
Fernald Citizens Advisory Board

Walter Sato
U.S. Department of Energy
Idaho Operations Office

John Savage
Oregon Energy Office

Vijay Sazawal
Cogema Inc.

The Honorable Bob Schaffer
U.S. House of Representatives

Dale Schutte
Nevada Test Site Advisory Board

F. G. Schwartz
U.S. Department of Energy
Idaho Operations Office

The Honorable Keith Scott
City of Rigby

Melanie Scott
Yucca Mountain Site Characterization Office

Brian Seggerty

Donna E. Shalala
Secretary of Health and Human Services

Gregory Shenton
Clark County Commissioner

Frank Sherman

The Honorable Amadao Shije
Pueblo of Zia

The Honorable Priscilla Shipley
Stillaguamish Board of Directors

D. B. Shirley
U.S. Department of Energy
Idaho Operations Office

Jeanine Shreeve
University of Idaho Research Office

Bill Shurtleff
Bonneville County Commissioner

Fred Sica
Idaho Falls Chamber of Commerce

Darryl Siemer
BBWI

Larry Simmons
Jefferson County Commissioner

The Honorable Michael Simpson
U.S. House of Representatives

The Honorable Norman Sisisky
U.S. House of Representative

The Honorable Joe Skeen
U.S. House of Representative

The Honorable Ike Skelton
U.S. House of Representatives

Michael Skougard
U.S. Department of Energy
Nevada Operations Office

Rodney Slater
Secretary of Transportation

Sheryll Slim
Shoshone-Bannock Tribe

Anthony Smialek
U.S. Department of Transportation
Office of Hazardous Materials Enforcement

The Honorable Adam Smith
U.S. House of Representatives

Bryan Smith
Idaho Transportation Department

The Honorable Gordon Smith
U.S. Senate

The Honorable Linda Smith
U.S. House of Representatives

The Honorable Robert Smith
U.S. Senate

Antonin Smrcka
Century University

The Honorable Helen Snapp
Fort McDermitt Tribal Council

Lynn Snider

Steven Snider
Kuna Junior High School

Jim Solecki

The Honorable Jim Sorensen
City of Kimberly

The Honorable Floyd Spence
U.S. House of Representatives

K. M. Spencer

R. M. Stallman
U.S. Department of Energy
Idaho Operations Office

Daniel Standiford
Westinghouse
Waste Isolation Pilot Plant

Robert Stanton
U.S. Department of the Interior
National Park Service

R. A. Starck
U.S. Department of Energy
Idaho Operations Office

J. M. Steele
U.S. Department of Energy
Office of Nuclear Energy

Jeff Steele
U.S. Department of the Interior
Bureau of Land Management

Stu Steibel
KLEW

Lynne Stembridge
Hanford Education Action League

The Honorable W. Clint Stennett
Idaho Legislature

The Honorable Ernest Stensgar
Coeur D'Alene Tribal Council

Thomas Stephens
Nevada Department of Transportation

Donna Sterba
Hanford Advisory Board

The Honorable Ted Stevens
U.S. Senate

Margaret Stewart
Environmental Resource Center

Sue Stiger
BBWI

The Honorable Christine Stones
Ely Shoshone Tribe

Frank Strasheim
U.S. Department of Labor
Occupational Safety and Health Administration

Joe Stringer
Duke Engineering & Services, Inc.

Clive Strong

Amy Sumariwalla

Lori Suppah
Sho-Ban News

Arthur Sutherland
Rogers & Associates

Kristine Svinicki

Vicki Swain
General Manager
KSRV

Tom Tancredo
Representative

John Tanner
Coalition 21

Mike Taugher
The Albuquerque Journal

Jannette Taylor
Coeur D'Alene Tribe

Miriam Taylor
U.S. Department of Energy
Idaho Operations Office

Richard Terrill
U.S. Department of Labor
Occupational Safety and Health Administration

Shawn Terry
Inside Energy

The Honorable Craig Thomas
U.S. Senate

The Honorable Tim Thompson
Duckwater Shoshone Tribe

W. Thompson
Nuclear Systems Associates, Inc.

The Honorable Strom Thurmond
U.S. Senate

Bob Tiller
Physicians for Social Responsibility

The Honorable John Tippets
Idaho Legislature

The Honorable Eugene Tom
Moapa Paiute Indian Tribe

The Honorable Lloyd Tortalita
Pueblo of Acoma

Dale Towell
Idaho Department of Fish & Game

Juan Tracey

David Trapp
Teton County Commissioner

Terri Traub
U.S. Department of Energy
Richland Operations Office Reading Room

Kathleen Trever
State of Idaho
INEEL Oversight Program

Robert Trout
Merrick & Company

Mark Trump
Teton County Commissioner

Elissa Turner
U.S. Department of Energy
Office of Civilian Radioactive Waste
Management

The Honorable Jerry Twiggs
Idaho Legislature

Roger Twitchell
U.S. Department of Energy
Idaho Operations Office

Craig Tyler

Louis Uccelini
National Oceanic and Atmospheric Administration
National Weather Service

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U.S. House of Representatives

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Jim Valentine
BBWI

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U.S. Department of Health and Human Services
National Institute of Health

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Ameripride

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Paul Voilleque
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Center for Environment & Development in Arab Region

R. P. Wakins

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Bill Waldman
The Nature Conservancy, New Mexico

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Northern Cheyenne Tribal Council

Andy Wallo
U.S. Department of Energy
Office of Environmental Policy and Assistance

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U.S. Senate

John Washakie
Shoshone Business Council

Dane Watkins
Watkins Enterprises

Lee Watkins

Dave Watson
U.S. National Transportation Safety Board
Office of Railroad Safety

Larry Watson

John Weeks
U.S. Department of the Interior
Central Regional Research Branch

Richard Welland
Federal Emergency Management Agency
Region 8

Chris Wentz
Radioactive Waste Task Force

Sandy Wessel
B&W Services

The Honorable Cameron Wheeler
Idaho Legislature

The Honorable Ralph Wheeler
Idaho Legislature

Martha Whetstone
Federal Emergency Management Agency
Region 9

K. B. Whitaker
U.S. Department of Energy
Idaho Operations Office

Sean Whiting
KIFI

The Honorable Herbert Whitish
Shoalwater Bay Tribal Council

The Honorable Lin
Idaho Legislature

T. L. Wichmann
U.S. Department of Energy
Idaho Operations Office

Mary V. Willcox
U.S. Department of Energy
Idaho Operations Office

A. C. Williams
U.S. Department of Energy
Idaho Operations Office

The Honorable Cassidy Williams
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U.S. Department of Agriculture
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Michael Worley
U.S. Department of Energy
Office of Environmental Management

Carolyn Wright
State of Utah NEPA Point of Contact

Charlotte Wright
Defense Cleanup

The Honorable David Wu
U.S. House of Representatives

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Makah Tribal Council

Jamestown S'klallam Tribal Council

Irwin City Council

Squaxin Island Tribal Council

Minidoka County Commissioner

Tulalip Board of Directors

The Messenger-Index

Battle Mountain Band Council

Lewis Clark State College Library Reading Room

Mackay Library, Ricks College
State Document Collection

Boise Public Library
Reading Room

Puylallup Tribal Council

Lower Elwha Community Council

Nuclear Remediation

Washoe Tribal Council

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Hailey City Council

Samish Indian Nation

Muckleshoot Tribal Council

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Nisqually Indian Community Council

Goshute Business Council

Dresslerville Community Council

Confederated Tribes of the Grande Ronde Tribal

Confederated Tribes of Coos, Lower Umpqua &
Suislaw Indians

Cambridge Community Library

Yerrington Paiute Tribal Council

Pueblo of Acoma

Cow Creek Band of Umpqua Indians

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Clearwater Library

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Reno-Sparks Tribal Council

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Physics Today

Washington State University
Tri-Cities Branch Campus
Department of Energy Reading Room

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INEEL Oversight Program Library

U.S. Department of Energy
Nevada Test Site Reading Room

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Division of Science & Technology

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Idaho State Department of Labor

U.S. Department of Energy
Idaho Operations Office
Idaho HLW & FD EIS Project Office
850 Energy Drive, MS 1108
Idaho Falls, ID 83401-1563

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