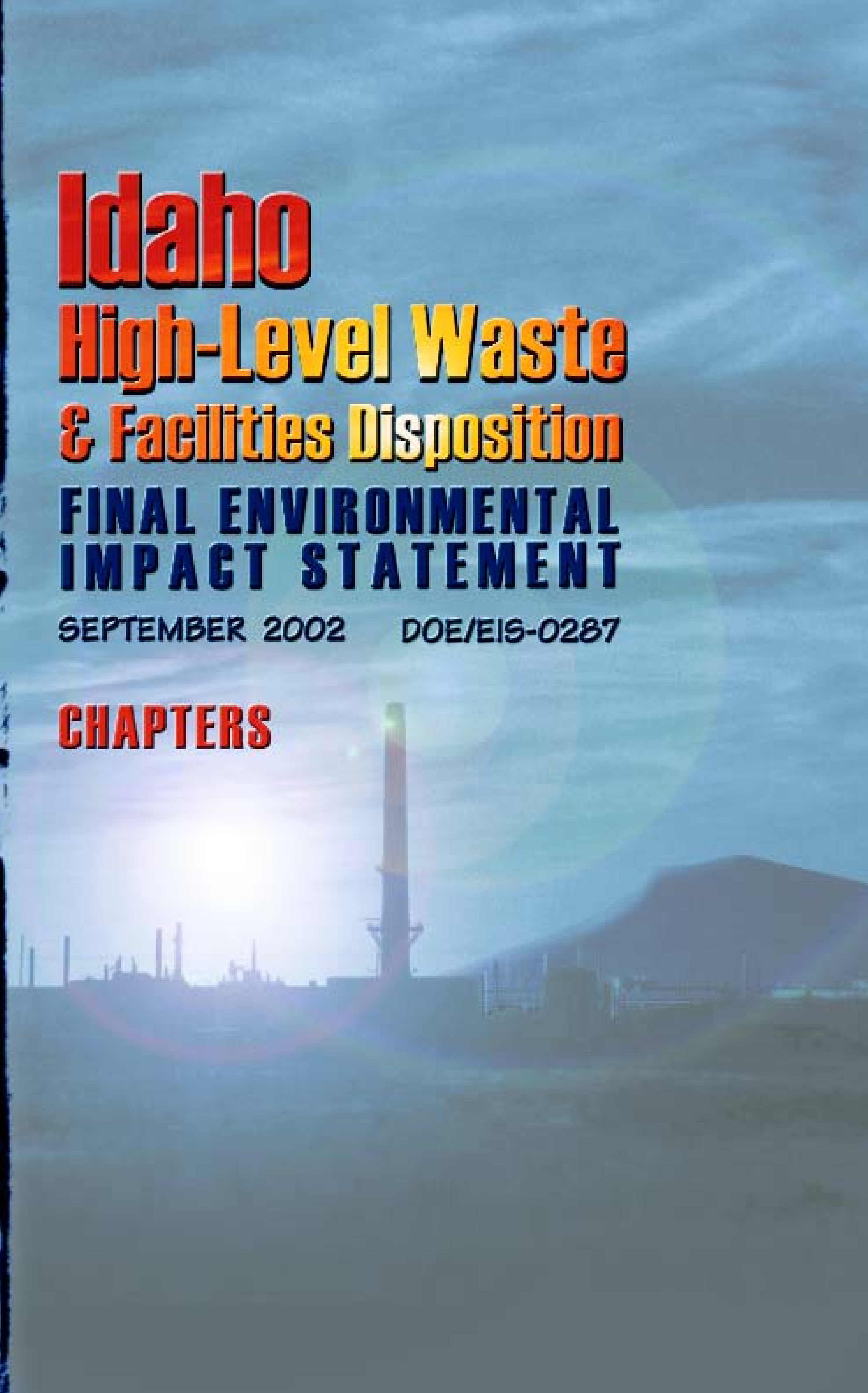

Idaho High-Level Waste & Facilities Disposition

FINAL ENVIRONMENTAL IMPACT STATEMENT

SEPTEMBER 2002 DOE/EIS-0287

CHAPTERS

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 Final Environmental Impact Statement (DOE/EIS-0287) (Final EIS)

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This Final EIS is composed of a Summary, Chapters 1 through 13, and appendices. Copies of the EIS or appendices may be requested from Richard Kimmel at the address, phone number, or email address shown above. The EIS and appendices are available in "hard copy," on a compact disk, or both if desired.

The EIS also will be available on the Internet at http://tis.eh.doe.gov/nepa/documentspub.html, http://www.id.doe.gov, or http://www.oversight.state.id.us.

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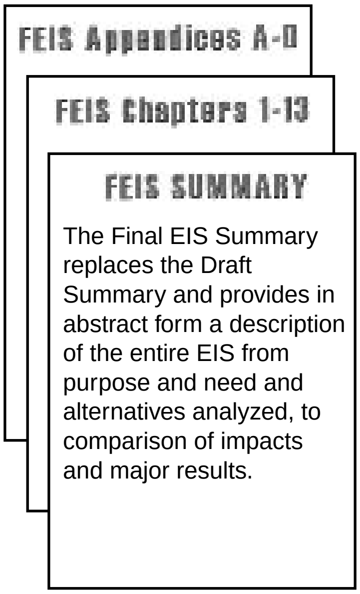
Abstract: This EIS analyzes the potential environmental consequences of alternatives for managing high-level waste (HLW) calcine, mixed transuranic waste/sodium bearing waste (SBW) and newly generated liquid waste at the Idaho National Engineering and Environmental Laboratory (INEEL) in liquid and solid forms. This EIS also analyzes alternatives for the final disposition of HLW management facilities at the INEEL after their missions are completed. After considering comments on the Draft EIS (DOE/EIS-0287D), as well as information on available treatment technologies, DOE and the State of Idaho have identified separate preferred alternatives for waste treatment. DOE's preferred alternative for waste treatment is performance based with the focus on placing the wastes in forms suitable for disposal. Technologies available to meet the performance objectives may be chosen from the action alternatives analyzed in this EIS. The State of Idaho's Preferred Alternative for treating mixed transuranic waste/SBW and calcine is vitrification, with or without calcine separations. Under both the DOE and State of Idaho preferred alternatives, newly generated liquid waste would be segregated after 2005, stored or treated directly and disposed of as low-level, mixed low-level, or transuranic waste depending on its characteristics. The objective of each preferred alternative is to enable compliance with the legal requirement to have INEEL HLW road ready by a target date of 2035. Both DOE and the State of Idaho have identified the same preferred alternative for facilities disposition, which is to use performance-based closure methods for existing facilities and to design new facilities consistent with clean closure methods.

READERS GUIDE

The Idaho High Level Waste and Facilities Disposition Environmental Impact Statement (EIS) is composed of a Summary, Chapters 1 through 13, and appendices. The EIS structure is illustrated in Figure 1. The EIS Summary stands alone and contains all the information necessary to understand the issues dealt with in detail in the EIS.

The public comment period on the Draft EIS was from January 21, 2000 to March 20, 2000 and was extended to April 19, 2000 in response to public request. Public hearings were held in Idaho Falls, Pocatello, Twin Falls, Boise and Fort Hall, Idaho; Jackson, Wyoming; Portland, Oregon and Pasco, Washington. Changes between the Draft and Final EIS, including those made in response to public comment, are printed in ***bold italics*** where occurring with text repeated from the Draft EIS, or are identified by the header ***"New Information"*** at the top of each page composed of all new text as shown in Figure 2.

Changes and information added to the Final EIS resulting from public comment on the Draft EIS or from further U.S. Department of Energy (DOE) and State of Idaho review include:



The Final EIS Summary replaces the Draft Summary and provides in abstract form a description of the entire EIS from purpose and need and alternatives analyzed, to comparison of impacts and major results.

FIGURE 1

- DOE reorganized portions of the Final EIS. Purpose and Need for Agency Action is now presented as Chapter 1 and Background as Chapter 2. The glossary and distribution list (Appendix D and E, respectively, of the Draft EIS) are presented as Chapters 7 and 12. A new Chapter 8 lists the contents of the appendixes. References were moved to Chapter 9. The list of preparers and organizational conflict of interest statements were merged as Chapter 10. The index for the Final EIS is in Chapter 13.

- Section 2.3.5 "Other Information and Technologies Reviewed" was added to address technologies and variations on alternatives proposed to DOE both during and apart from public comment.

- An additional alternative and an option have been added. They are the Direct Vitrification Alternative, which is the State of Idaho's preferred waste processing alternative, and the Steam Reforming Option. The Steam Reforming Option includes steam reforming for the treatment of liquid wastes and shipping the high-level waste calcine directly to a geologic repository without further treatment.

- Chapter 3 has been reorganized to present the State of Idaho and the DOE Preferred Alternatives.

- Section 3.3, "Alternatives Eliminated from Detailed Analysis" has been updated to review why some alternatives and technologies were not considered further by DOE.

- Discussion of Waste Incidental to Reprocessing Determination under DOE Order 435.1 has been expanded. The expanded discussion of the procedure is located in the text box on page 2-9.

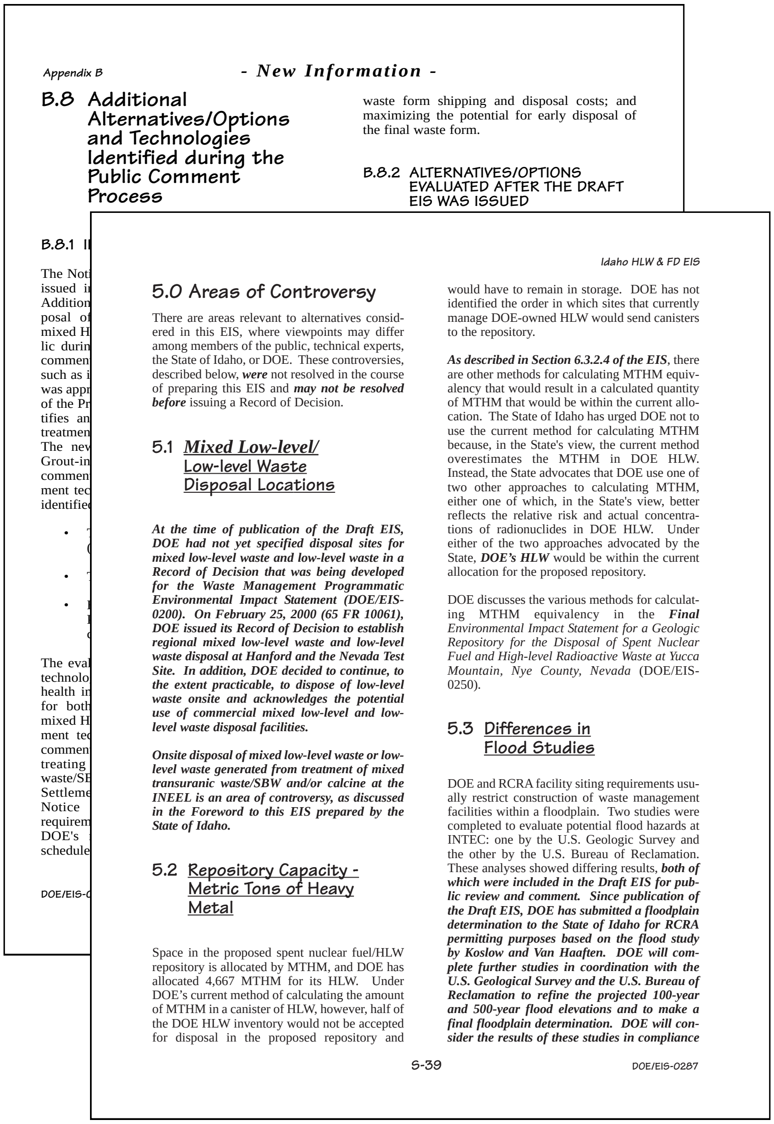
- Tables 3-1 and 3-3 and Tables 3-2 and 3-5 were combined. Table 3-5 was added to summarize the impacts associated with the facility disposition alternatives evaluated in the Draft EIS as well as the State of Idaho and DOE Preferred Alternative for facility disposition.

- Chapter 4 "Affected Environment" has been updated.

- "CALPUFF" modeling was conducted to analyze air quality impacts from Idaho National Engineering and Environmental Laboratory (INEEL) emissions on Yellowstone and Grand Teton National Parks and Craters of the Moon National Monument. The results of this modeling are presented in Section 5.2.6 and Appendix C.2.

- A higher volume of waste would be produced from vitrification of calcine at the Hanford Site than presented in the Draft EIS analysis of the Minimum INEEL Processing Alternative (see Appendix C.8). The higher volume resulted in increases in transportation impacts, which are presented in Section 5.2.9 and Appendix C.5.

- Waste inventory information was refined including updated source term data in Appendix C.7. Corresponding changes were made in long-term facility disposition modeling (Appendix C.9) and facility accident analysis (Appendix C.4). The results of this analysis are shown in Section 5.2.14 and Tables 5.3-8, 5.3-16 and 5.3-17.



Appendix B - New Information -

B.8 Additional Alternatives/Options and Technologies Identified during the Public Comment Process

waste form shipping and disposal costs; and maximizing the potential for early disposal of the final waste form.

B.8.2 ALTERNATIVES/OPTIONS EVALUATED AFTER THE DRAFT EIS WAS ISSUED

Idaho HLW & FD EIS

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, ***were*** not resolved in the course of preparing this EIS and ***may not be resolved before*** issuing a Record of Decision.

5.1 *Mixed Low-level/* Low-level Waste Disposal Locations

At the time of publication of the Draft EIS, DOE had not yet specified disposal sites for mixed low-level waste and low-level waste in a Record of Decision that was being developed for the Waste Management Programmatic Environmental Impact Statement (DOE/EIS-0200). On February 25, 2000 (65 FR 10061), DOE issued its Record of Decision to establish regional mixed low-level waste and low-level waste disposal at Hanford and the Nevada Test Site. In addition, DOE decided to continue, to the extent practicable, to dispose of low-level waste onsite and acknowledges the potential use of commercial mixed low-level and low-level waste disposal facilities.

Onsite disposal of mixed low-level waste or low-level waste generated from treatment of mixed transuranic waste/SBW and/or calcine at the INEEL is an area of controversy, as discussed in the Foreword to this EIS prepared by the State of Idaho.

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.

As described in Section 6.3.2.4 of the EIS, 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's HLW*** would be within the current allocation for the proposed repository.

DOE discusses the various methods for calculating MTHM equivalency in the ***Final*** *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-0250).

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. Geologic Survey and the other by the U.S. Bureau of Reclamation. These analyses showed differing results, ***both of which were included in the Draft EIS for public review and comment. Since publication of the Draft EIS, DOE has submitted a floodplain determination to the State of Idaho for RCRA permitting purposes based on the flood study by Koslow and Van Haaften. DOE will complete further studies in coordination with the U.S. Geological Survey and the U.S. Bureau of Reclamation to refine the projected 100-year and 500-year flood elevations and to make a final floodplain determination. DOE will consider the results of these studies in compliance***

S-39 DOE/EIS-0287

FIGURE 2

- Summaries of the public comments with responses prepared by DOE in coordination with the State of Idaho as a cooperating agency are located in Chapter 11 of this Final EIS. Copies of the written and transcribed comments are located in Appendix D.

If there are any questions concerning this EIS, the information or analysis it presents, or its availability please contact Richard Kimmel at (208) 526-5583 or by e-mail at kimmelrj@id.doe.gov.

Foreword

State of Idaho's Foreword

To the Final 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 the U.S. Department of Energy (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 this EIS and its position on 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 EIS, and request changes to preliminary drafts. The State of Idaho was not, however, able to verify every aspect of this EIS.

In addition, Idaho and DOE did not have to agree on all issues before DOE published the 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 several key policy issues related to this EIS.

Key Policy Issues

1 Idaho finds ***some alternatives and*** 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 ***alternatives and*** options ***evaluated in this EIS*** that are inconsistent with the Settlement Agreement.

One of the fundamental reasons Idaho agreed to the Settlement ***Agreement*** 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, ***any*** EIS ***alternatives or*** options ***that contain the following elements*** are inconsistent with the Settlement ***Agreement***:

- ***those*** that leave liquid waste in the INTEC Tank Farm beyond the year 2012; and
- ***those*** 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 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 ***calcine or sodium-bearing waste*** at INTEC will not meet the Settlement Agreement's intent to have all ***this waste*** treated and ***ready to be*** removed from Idaho.

Leaving calcine in the bin sets without a well-defined treatment plan would also be inconsistent with the Settlement Agreement. With this EIS, DOE and the State began negotiating a plan and schedule for calcined HLW treatment, as required by the Agreement.

The State expects to complete these negotiations as DOE develops a Record of Decision based on this EIS, with the parties agreeing to a schedule and strategy for waste characterization and other information gathering, technology development, and treatment. The Settlement Agreement gives DOE until 2009 to issue a Record of Decision to establish a date for completing treatment of all calcined waste. Because the State and DOE invested considerable resources to prepare this EIS before 2009, however, the State expects the negotiations to accelerate this Decision.

2 Idaho maintains that sodium-bearing waste in the INTEC Tank Farm is HLW *unless and until DOE reclassifies waste consistent with its regulations.*

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 ***calciner operations and*** decontamination activities. ***For the most part, DOE stored first cycle liquids separately from the second and third cycle liquids. In addition, second and third cycle liquids were typically mixed with liquids from calciner operations, decontamination activities, and some INEEL sources not associated with reprocessing. This mixture of liquids is referred to collectively as sodium-bearing waste since relatively high concentrations of sodium are present as a result of decontamination agents. In preparing the EIS, DOE and the State agreed first cycle liquids are HLW, but disagreed on how to classify the sodium-bearing waste.***

DOE's 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 ***reprocessing*** 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.

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's Order 435.1 has a process, called a "waste incidental to reprocessing (WIR) determination," ***that sets criteria for deciding if the sodium-bearing waste should be classified as high-level***, transuranic or low-level waste. Idaho maintains that DOE should manage the sodium-bearing waste as HLW unless and until it completes a WIR determination ***that classifies it as another waste type. As of the drafting of this EIS, DOE is conducting a WIR determination in consultation with the Nuclear Regulatory Commission for sodium-bearing waste. DOE has submitted justification for classifying the liquid as mixed-transuranic waste.***

As ***discussed*** above ***under key policy issue #1***, even if DOE determines some of the HLW ***(sodium bearing liquid or calcine)*** 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 a 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, ***which historically have proved difficult to obtain***, it is unlikely there will be an appropriate place to receive INEEL's HLW.

The irony of DOE's policy, which effectively precludes INEEL HLW from being accepted at the proposed repository, is that long-term storage of this waste on the INEEL is the alternative management option offered in this EIS. Yet, it was the prospect of long-term storage of HLW calcine at the INEEL that motivated the State to negotiate the language in the Settlement Agreement that directs treatment of the calcine so it can be transported to a suitable storage facility or geologic repository outside of Idaho. Thus, the State urges DOE to change its policy regarding the acceptance of waste containing certain hazardous constituents at the proposed geologic repository.

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 the DOE spent fuel ***that was reprocessed***. Thus, the amount of radioactivity in DOE HLW is a very small fraction of what is pre- sent in an equivalent amount of commercial spent fuel. A second method compares relative radiotoxicity with similar results.

Idaho advocates using either of these ***alternate*** 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.

5 Idaho's preferred alternative specifies treatment technologies to provide a more effective tool for public discussion and decision-making and to guide the pursuit of other options in case of changes in assumptions or technology developments.

DOE's preferred alternative does not specify technologies for achieving its proposed actions. Idaho's preferred alternative, however, specifies the vitrification technology to provide a clear baseline for fulfilling the objectives of removal of waste from Idaho within the timeframes envisioned by the Settlement Agreement.

In identifying a preference, Idaho considered the information in the Draft EIS, DOE's Tanks Focus Area's *Assessment of Selected Technologies for the Treatment of Idaho Tank Waste and Calcine* (PNNL-13268) and public comment. Idaho selected the alternative that we believe has the lowest technical and regulatory uncertainty for meeting waste removal goals--direct vitrification for liquid sodium-bearing waste and vitrification, with or without separations pending a technical and economic evaluation, for calcine.

In evaluating impacts for the proposed national geologic repository at Yucca Mountain, DOE has previously assumed that HLW would be transported and disposed in glass or ceramic form. Disposal requirements for HLW at a national geologic repository have not been set, however. Similarly, the Waste Isolation Pilot Plant repository for transuranic waste has not established disposal requirements for remote-handled waste. Depending on the selected waste acceptance criteria, some of the treatment or transportation proposals in this EIS may require additional regulatory action.

Given these regulatory uncertainties and uncertainties in less mature technologies for treating these waste streams, Idaho determined that a clear baseline was an important tool to facilitate negotiations required by the Settlement Agreement and to evaluate options in case circumstances change. A clear baseline allows the effective comparison of environmental impacts and potential mitigation, as well as schedule and costs impacts. It also allows decision makers to evaluate whether potential investments in technology development and regulatory actions are worthwhile, given incremental reductions in these impacts.

Idaho is willing to consider other waste treatment options arising from new technology developments or changes in assumptions regarding treatment, transportation or disposal requirements if they are comparable or better than the Direct Vitrification Alternative in terms of environmental impact, schedule and/or cost. Idaho expects DOE to have a clear strategy for evaluating pursuit and evaluation of such options.

To the extent DOE considers storage, treatment or disposal actions not discussed in detail in this or other relevant EISs in the future, however, the State expects DOE to perform required NEPA analyses and provide for appropriate public involvement.

Public Involvement Appreciated

The State of Idaho appreciates the level of public interest in the EIS process. Public comment resulted in many improvements in the Final EIS.

TABLE OF CONTENTS

TABLE OF CONTENTS

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TABLE OF CONTENTS

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TABLE OF CONTENTS

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Section **Page**

TABLE OF CONTENTS

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Acronyms & Abbreviations

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
NEPA	***National Environmental Policy Act***
NGLW	***newly generated liquid waste***
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*
Yucca Mountain EIS	***EIS for a Geologic Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, Nevada***

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 ***sometimes makes*** it appear that the totals of a column of figures are inaccurate because they are inexact, but the slight ***variation*** 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 × 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}

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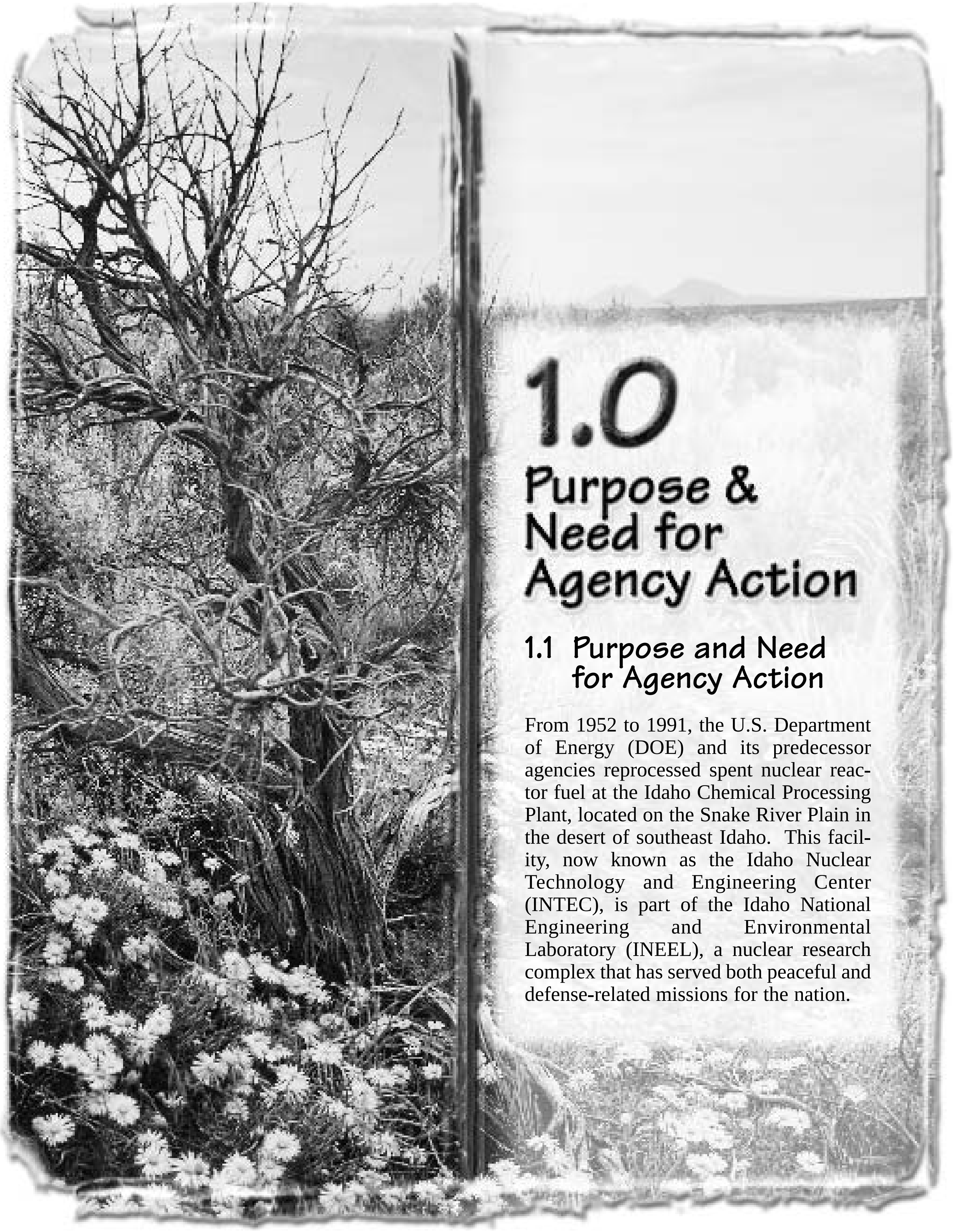
Purpose & Need for Agency Action



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Purpose & Need for Agency Action

1.1 Purpose and Need for Agency Action

From 1952 to 1991, the U.S. Department of Energy (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 high-level waste (HLW) as well as other wastes. The first extraction cycle of the reprocessing operation ***produced liquid mixed HLW***. Subsequent extraction cycles, follow-up decontamination activities, and ***mixed*** HLW treatment activities produced additional liquid waste, generally less radioactive than ***mixed*** HLW, ***that may be*** characterized as mixed transuranic waste ***(see text box on page 2-7)***. Since the decontamination solutions contained high levels of sodium, this liquid waste is referred to ***in this environmental impact statement (often referred to as the Idaho HLW & FD EIS or simply "this EIS")*** as mixed transuranic waste/sodium-bearing waste or mixed transuranic waste/SBW. At INTEC, all of these liquid wastes were stored in eleven 300,000-gallon ***below grade*** tanks. Over several years, ***first extraction cycle liquid mixed HLW and some of the liquid mixed transuranic waste/SBW were*** fed to treatment ***facilities*** and converted to a dry granular substance called ***mixed HLW*** calcine. ***In 1998, DOE completed calcining all remaining liquid mixed HLW.*** 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 ***does*** not meet current waste acceptance criteria for disposal in ***the*** geologic repository. At present, approximately ***4,400*** cubic meters of ***mixed*** HLW calcine is stored in INTEC bin sets, and ***approximately 1*** million gallons of ***mixed transuranic waste/SBW remain in the Tank Farm.***

DOE now has to decide how to treat and dispose of the mixed transuranic waste/SBW, how to place the mixed HLW calcine in a form suitable for disposal in the national geologic repository, and how to disposition HLW management facilities at INTEC including any new facilities required to treat and dispose of the waste. DOE has prepared this EIS to inform agency officials and the public of the environmental impacts of alternatives available for consideration in the decision making process, including the alternative of taking no action.

History of High-Level Waste

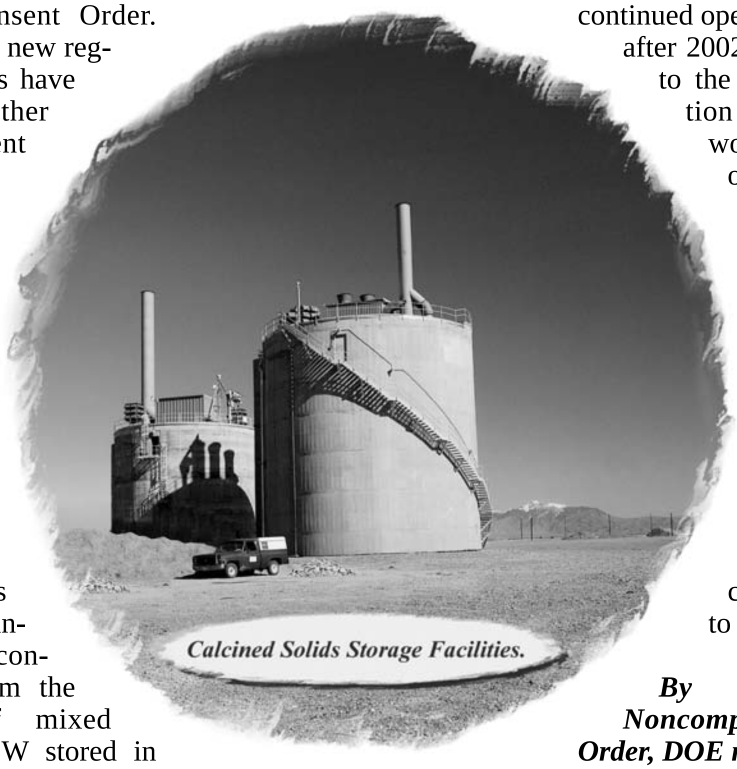
In a 1969 staff paper published by the Atomic Energy Commission ("Siting of Commercial Fuel Reprocessing Plants and Related Waste Management Facilities"), high-level liquid wastes were described as "those, which by virtue of their radionuclide concentration, half-life, and biological significance, require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

It was anticipated that the only liquid waste meeting these criteria would be the liquid generated during the first cycle of a process that extracted **fissionable nuclear material** *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.*

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

Since the 300,000-gallon ***below grade*** 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 ***the*** 1995 ***DOE Spent Nuclear Fuel Management and Idaho National Engineering Laboratory Environmental Restoration and Waste Management Programs Final Environmental Impact Statement (SNF & INEL EIS)*** 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. ***However,*** 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. ***The technical constraints for offgas sampling of the New Waste Calcining Facility calciner were resolved. Prior to placing the calciner in standby in May 2000, DOE completed offgas emission sampling for hazardous waste regulated by the Resource Conservation and Recovery Act (RCRA), using methods agreed to by the U.S. Environmental Protection Agency (EPA). The State of Idaho was kept informed during this process and observed the sampling program. In addition, some of the logistical problems associated with obtaining representative samples from the below grade tanks were resolved. Subsequently, DOE has been able to obtain and characterize some representative samples of the mixed transuranic waste/SBW stored in the below grade tanks.*** This emission and waste characteristic data is needed to support a RCRA permit, which must ***be approved by*** the State of Idaho in order to continue ***operating*** the calciner. ***In accordance with the Notice of Noncompliance Consent Order, DOE has ceased calciner operations until such a permit is granted*** (Kelly 1999).



Calcined Solids Storage Facilities.

In addition to the RCRA permit, ***another regulatory consideration is that the*** EPA has new air quality standards for hazardous waste combustion units***, which*** 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. For these reasons, DOE needed to reconsider its decision to operate the calciner and consider the relative merits of other alternatives that would ***cease use of the tanks within the*** time commitments ***made*** to the State of Idaho.

By the Notice of Noncompliance Consent Order, DOE must cease use of the five pillar and panel vault tanks by June 30, 2003, and cease use of the remaining tanks by December 31, 2012. 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 ***the*** 1995 ***SNF & INEL EIS*** 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. ***Some testing was accomplished at the INEEL and DOE continues to evaluate radionuclide partitioning technologies to determine their viability. In concert with those activities,*** DOE ***began preparation*** of this ***EIS to meet the*** 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 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 this EIS.

As required under the National Environmental Policy Act, this EIS must analyze environmental impacts associated with related project actions. In this case, actions related to selecting a treatment technology for ***mixed*** 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 ***associated HLW management*** facilities. 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 Comprehensive Environmental Response, Compensation, and Liability Act (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 ***mixed*** HLW and mixed transuranic waste/SBW.

In this EIS, DOE identifies potential risks to human health and the environment from the various ***mixed*** HLW, mixed transuranic waste/SBW, and newly generated liquid waste management options. 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. ***Therefore,*** this EIS evaluates the cumulative impacts of CERCLA actions as well as alternatives for the management of ***mixed*** HLW and mixed transuranic waste/SBW. ***(CERCLA evaluations are required to incorporate National Environmental Policy Act values under DOE policy.)***

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 ***alternative*** technologies that ***could be used for wastes requiring treatment to meet DOE commitments.*** 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 doing so 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 ***EIS*** 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 through 2012, and issuing ***an EIS*** 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 ***2002***. Thus, the timing of this EIS will enable DOE to ***better*** meet the ***milestones contained in the*** Consent Order and the Settlement Agreement.

1.3 *Proposed Action*

Based on this EIS, DOE ***proposes to:***

- ***Select appropriate technologies and construct facilities necessary to prepare INTEC mixed transuranic waste/SBW for shipment to the Waste Isolation Pilot Plant***
- ***Prepare 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 of HLW destined for a repository***
- ***Disposition INTEC HLW management facilities when their missions are completed***

1.4 Role of this EIS in the Decision-Making Process

This EIS describes the environmental impacts of the range of reasonable alternatives for meeting the purpose and need. In finalizing this EIS, DOE considered public comments received on the Draft EIS and other relevant factors and information received after the Draft EIS was published. DOE will consider the information in this EIS and other relevant information before making a decision on the proposed action.

If on the basis of this EIS, DOE proposes 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 of Idaho and DOE.

1.5 Organization of the EIS

The organization of this EIS is as follows. Chapter 2 provides background information on the INEEL and the waste management issues pertinent to this EIS. 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. 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. Chapter 7 provides a glossary of terms. Chapter 8 identifies the contents of the appendices. Chapter 9 lists the references. Chapter 10 provides the list of preparers and the conflict of interest representation statements. Chapter 11 summarizes the comments received on the Draft EIS and provides responses to those summaries. Chapters 12 and 13 provide the distribution list and index, respectively. The appendices provide technical information, including analytical methods and detailed results and copies of the actual transcribed and written comments received on the Draft EIS.

2.1.3 CURRENT MISSION

The current INEEL 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 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.

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 2-2 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 2-3. 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 250 acres and contain more than 150 buildings.

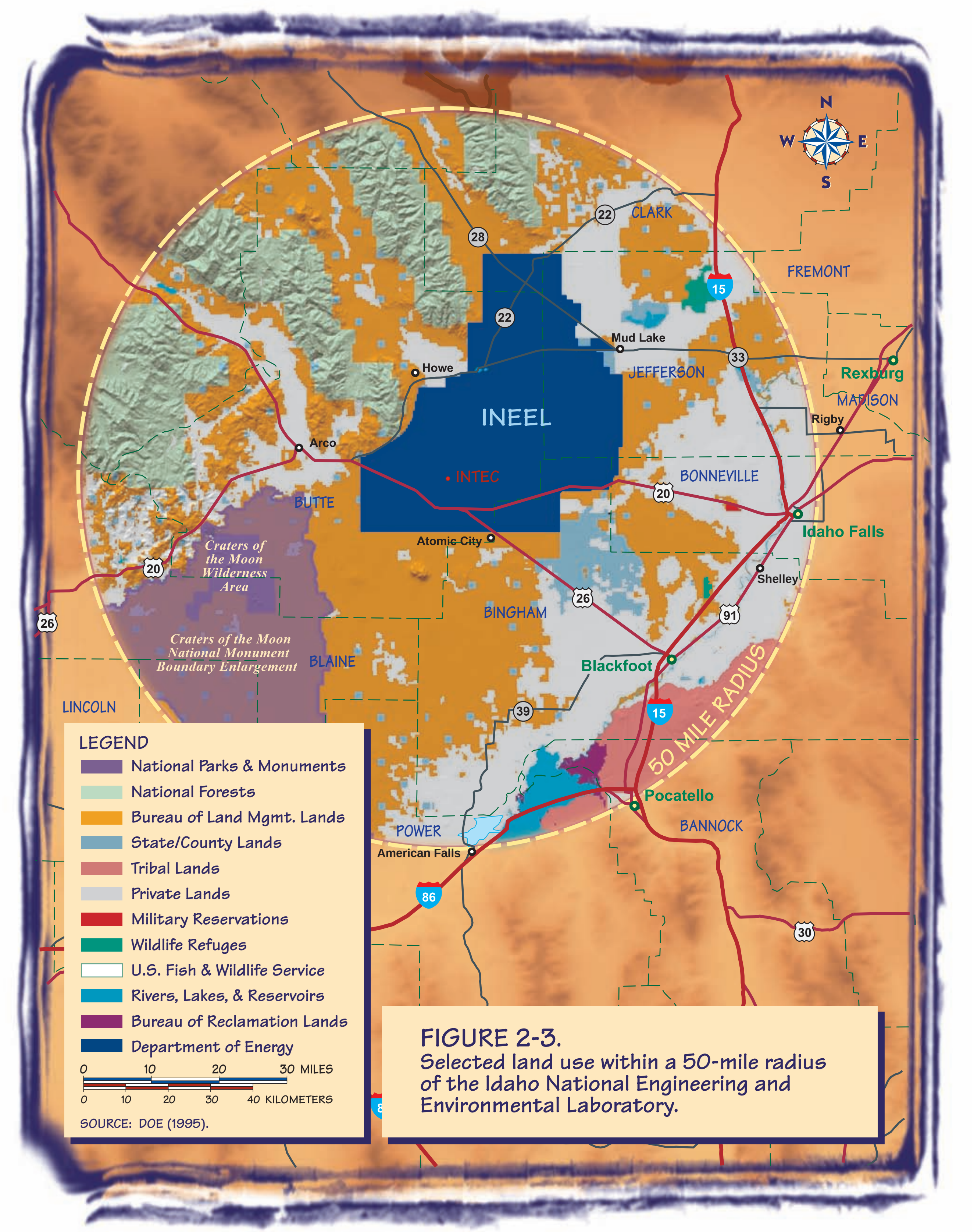
INTEC's original purpose was to function as a one-of-a-kind processing facility for government-owned nuclear fuels from research and defense reactors. The facility recovered rare gases and uranium for reuse from spent nuclear fuel. DOE stopped processing spent nuclear fuel nationwide in 1992 (DOE 1992).

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.

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



SOURCE: DOE (1995).

FIGURE 2-3.
Selected land use within a 50-mile radius of the Idaho National Engineering and Environmental Laboratory.

What is...

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 (DOE 1999a). 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 INTEC, all the liquid HLW recoverable with the use of the existing transfer equipment 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 waste subject to the Resource Conservation and Recovery Act (RCRA), as amended.

Transuranic waste?

Transuranic waste 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.

Low-level waste?

Low-level waste (LLW) is radioactive waste that is not high-level radioactive waste, spent nuclear fuel, transuranic waste, byproduct material (as defined in section 11e(2) of the Atomic Energy Act of 1954, amended), or naturally occurring radioactive material (DOE 1999a). The Nuclear Regulatory Commission regulations (10 CFR Part 61) provide a classification system for LLW. This classification system includes:

- ***Class A waste - radioactive waste that is usually segregated from other wastes at disposal sites to ensure 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 radionuclide concentrations must meet more rigorous requirements for waste form stability. Class C waste requires protective measures at the disposal facility to protect against inadvertent intrusion.***

These waste classifications are not applicable to DOE LLW. However, the terms Class A-type and Class C-type are used in this EIS to refer to DOE LLW streams that could be disposed of at offsite facilities licensed by the Nuclear Regulatory Commission.

Mixed waste?

Mixed waste is waste that contains both source, special nuclear, or by-product material subject to the Atomic Energy Act of 1954, as amended, and hazardous waste subject to RCRA, as amended (DOE 1999a). When referring to a specific classification of radioactive waste that also contains hazardous waste, “mixed” is used as an adjective, followed by high-level, transuranic, or low-level, as appropriate.

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, radioactive fission products, and activation products. Because of its high radioactivity (including gamma-ray emitters), it must be properly shielded.

Waste fractions?

Waste fractions are produced when radioactive waste is treated to separate radionuclides according to activity level. Depending upon the characteristics of resulting fractions, waste may be classified as high-level, transuranic, or low-level.

Sodium-bearing waste?

Sodium-bearing waste (SBW) is a liquid mixed radioactive waste produced from the second and third cycles of spent nuclear fuel reprocessing and waste calcination, liquid wastes from INTEC closure activities stored in the Tank Farm, solids in the bottom of the tanks, and trace contamination from first cycle reprocessing extraction waste. SBW contains large quantities of sodium and potassium nitrates. Typically, SBW is processed through an evaporator to reduce the volume, then stored in the Tank Farm. 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 components and is a mixed waste. DOE assumes that the SBW is mixed transuranic waste. This EIS refers to SBW as mixed transuranic waste/SBW (the text box on page 2-9 discusses how the waste incidental to reprocessing process will be applied with regard to how SBW will be managed).

Newly generated liquid waste?

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

Tank heel?

A tank heel is the amount of liquid remaining in each tank after lowering to the greatest extent possible by use of the existing transfer equipment, such as ejectors.

Tank residual?

The tank residual is the amount of radioactive waste remaining in each tank, the removal of which is not considered to be technically and economically practical (DOE 1999a). This could be the tank heel or the amount of radioactive waste remaining after additional removal using other methods than the existing transfer equipment.

Waste Incidental to Reprocessing Determinations Under Development at INTEC

In developing the waste processing alternatives analyzed in this EIS, DOE made certain assumptions about how the radioactive waste streams that would go into and come out of the selected treatment processes would be classified. DOE will classify all wastes in accordance with the processes described in DOE Manual 435.1-1 (DOE 1999a). The term "waste incidental to reprocessing" refers to a process for identifying wastes that might be considered HLW due to their origin, but would be managed as low-level or transuranic waste if the waste incidental to reprocessing requirements contained in DOE Manual 435.1-1 are met.

Waste Incidental to Reprocessing Determinations are being developed for several waste streams at INTEC. These waste streams include the existing mixed transuranic waste/SBW in the Tank Farm, the residual waste material projected to remain in the Tank Farm tanks after cleaning and closure, and contaminated equipment (pumps, valves, etc.) which were used in HLW process systems.

Mixed transuranic waste/SBW

The existing inventory of mixed transuranic waste/SBW in the Tank Farm tanks at INTEC includes waste streams associated with spent fuel reprocessing. However, most of the liquid wastes sent to the Tank Farm during past reprocessing operations have been removed from the tanks and solidified by the calcination process. The bulk of the remaining inventory is comprised of waste solutions from plant decontamination activities and processes ancillary to reprocessing, although a small fraction of the Tank Farm inventory is attributed directly to reprocessing extraction wastes. When compared to first cycle extraction wastes, the current inventory of mixed transuranic waste/SBW is generally much lower in radioactivity, and therefore poses significantly less risk. In fact, a comparison of the amount of curies which remain in the tanks with the amount of curies which have already been removed and treated shows that almost all the curies which were transferred into the Tank Farm have been removed during calcination or have undergone radioactive decay. A Waste Incidental to Reprocessing Determination (by the evaluation method) draft has been prepared to evaluate whether the remaining mixed transuranic waste/SBW should be managed and disposed of as transuranic waste. The Nuclear Regulatory Commission is performing a technical review of the draft Waste Incidental to Reprocessing Determination prior to its finalization by DOE, which is anticipated in 2002.

Tank Farm Residuals

Closure of the HLW tanks is planned at INTEC. As treatment of the mixed transuranic waste/SBW is completed and the Tank Farm tanks are emptied, the tanks will be flushed to maximize waste removal. Flushing activities will remove waste to the maximum extent that is technically and economically feasible, and to a level that meets regulatory requirements for long term protection of the environment. However, some amount of residual waste will likely be unable to be retrieved from the tanks. A Waste Incidental to Reprocessing Determination (by the evaluation method) has been prepared for these Tank Farm residuals, which evaluates whether the waste remaining in the tanks after closure should be managed as low-level waste. The Nuclear Regulatory Commission is performing a technical review of the draft Waste Incidental to Reprocessing Determination prior to its finalization by DOE, which is anticipated in 2003.

Contaminated Job and Equipment Wastes

A Waste Incidental to Reprocessing Citation determination has been completed for contaminated job wastes. A Waste Incidental to Reprocessing Evaluation determination for contaminated equipment and material is currently being developed. These determinations will establish whether the contaminated job wastes and equipment can be managed and disposed of as low-level or transuranic waste.

2.0

Background

2.0

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 ***is being*** managed to ***reduce the*** 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 ***presents*** the environmental consequences and regulatory issues surrounding the various management alternatives under consideration. ***This*** chapter introduces background information on the INEEL and the waste management issues pertinent to this EIS.

2.1 INEEL *Overview*

2.1.1 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 2-1 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).

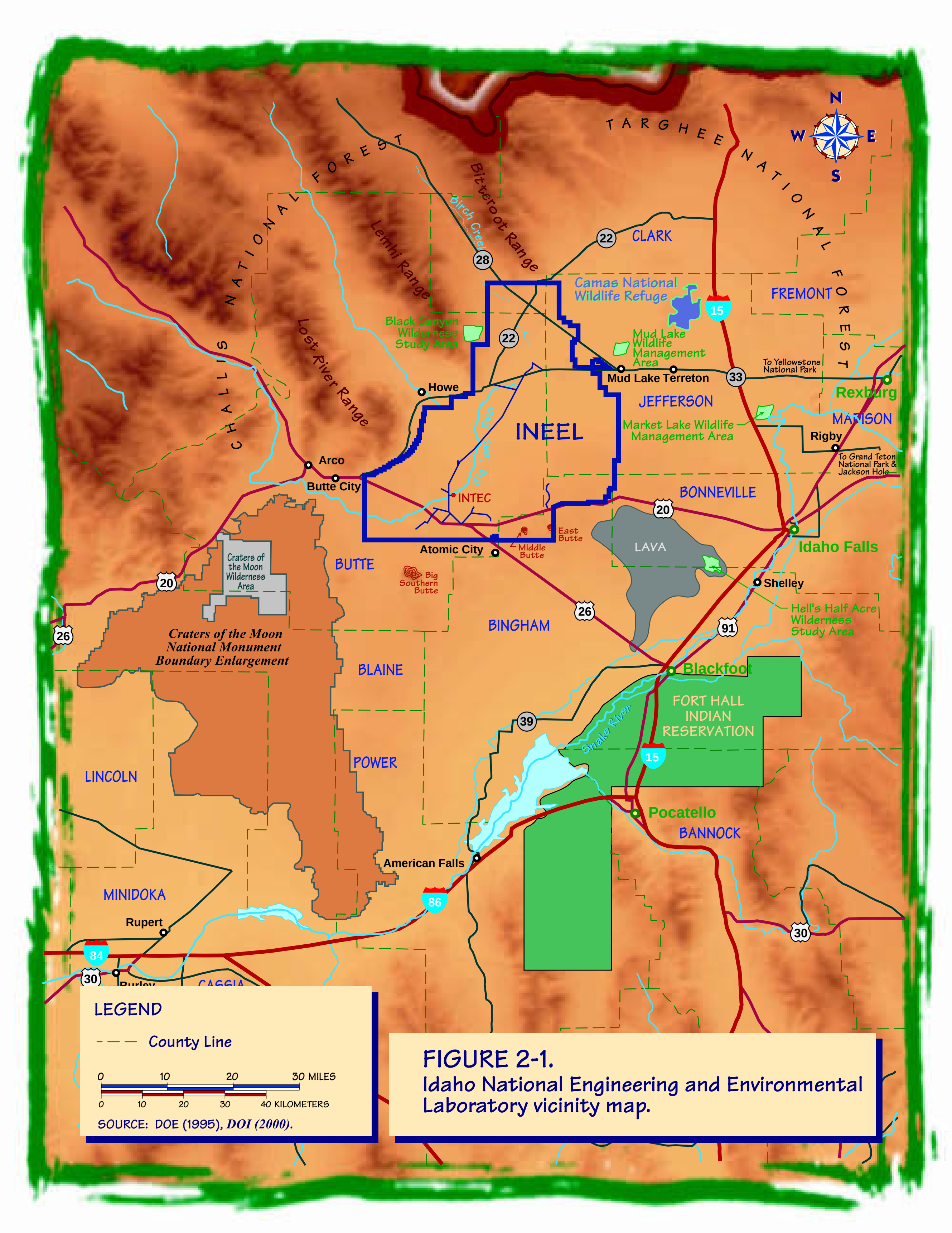
2.1.2 ORGANIZATION AND ADMINISTRATION

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 ***BWXT*** Idaho, ***LLC*** 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 2.2.5, ***Legal Requirements*** 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.



SOURCE: DOE (1995), *DOI (2000).*

FIGURE 2-1.
Idaho National Engineering and Environmental Laboratory vicinity map.

2.2 High-Level Waste Overview

2.2.1 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 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).

2.2.2 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 HLW and stored at the Tank Farm. Subsequent extraction cycles and decontamination activities generated a liquid waste that was concentrated by evaporation and stored at the Tank Farm. Because of the high sodium content from decontamination activities, this waste has been called ***mixed transuranic waste/sodium-bearing waste*** (***referred to as mixed transuranic waste/***SBW). In addition, newly generated 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 ***stored at the Tank Farm***. All of this liquid waste at the Tank Farm has been managed by the HLW program. Some of this waste has been calcined with other liquids, and added to the bin sets. ***Calcine is stored at INTEC in the Calcined Solids Storage Facilities, which are referred to in this EIS as "bin sets."***

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. ***The liquid wastes are stored in ten 300,000-gallon capacity tanks (an additional 300,000-gallon tank is available as a spare). Five of the tanks are of a design known as "pillar and panel." The Tank Farm also includes four smaller 30,000-gallon waste tanks that were flushed and removed from service in 1983. Disposition of all 15 tanks is within the scope of this EIS.***

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 2-***4*** shows a simplified flow diagram of the INTEC HLW system.

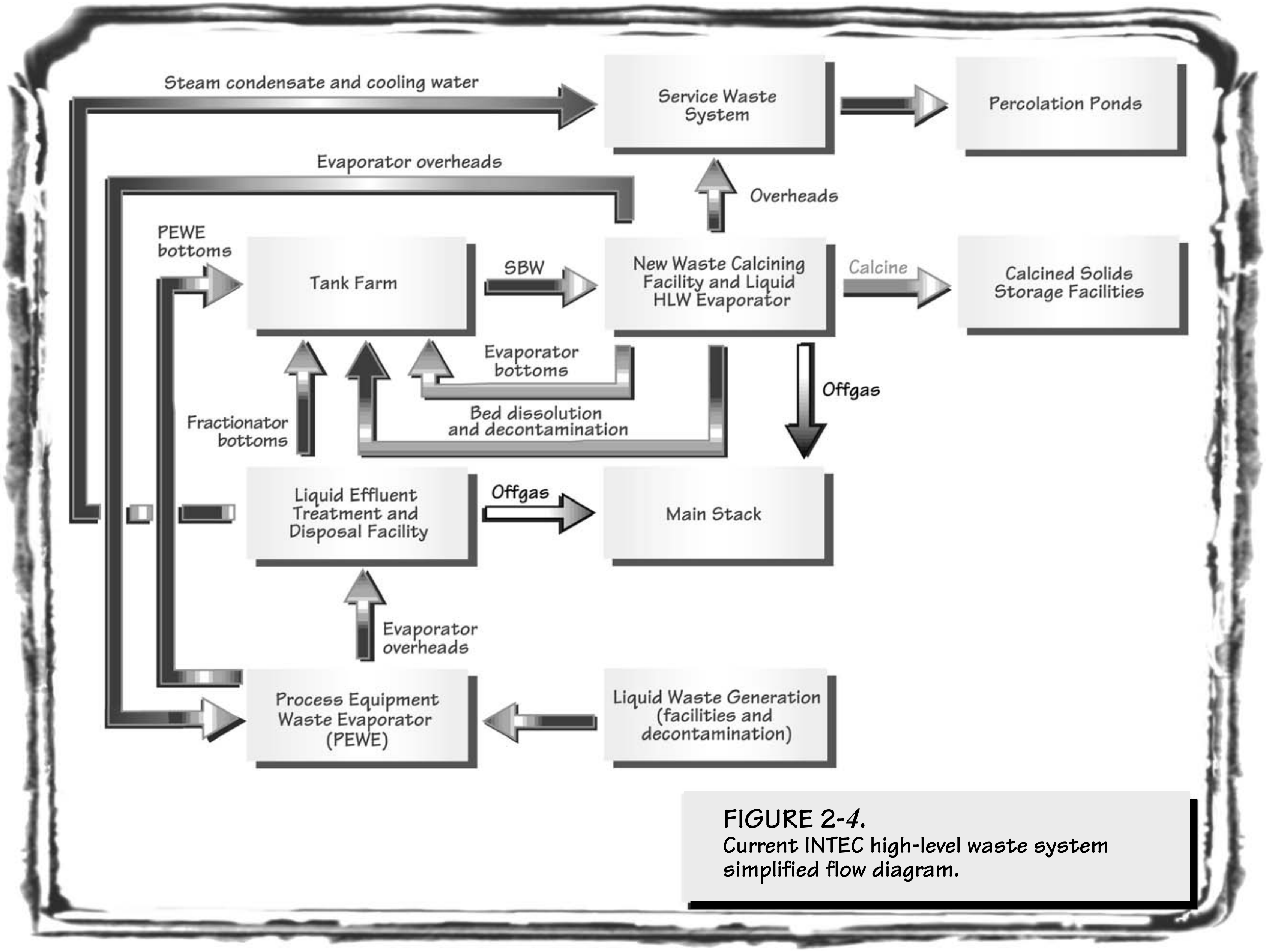


FIGURE 2-4.
Current INTEC high-level waste system simplified flow diagram.

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 ***mixed*** HLW derived from first cycle uranium extraction was converted to calcine. Calcining of the mixed transuranic waste/SBW and newly generated liquid waste remaining in the tanks ***continued through May 2000. The New Waste Calcining Facility calciner was placed in standby in May 2000 in accordance with the Notice of Noncompliance Consent Order***. ***The inventory of liquids in the INTEC Tank Farm varies depending on operations and use of the High-Level Liquid Waste Evaporator.*** There are approximately ***1 million*** gallons of liquid in the ***Tank Farm***. ***As of May 2000,*** there are approximately ***4,400*** cubic meters of mixed HLW calcine in the bin sets. Figure 2-***5*** shows the seven bin sets at INTEC (six operational and one spare).

With DOE's decision to discontinue ***spent nuclear fuel*** 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 ***Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)*** Program.

2.2.3 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 geologic 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:

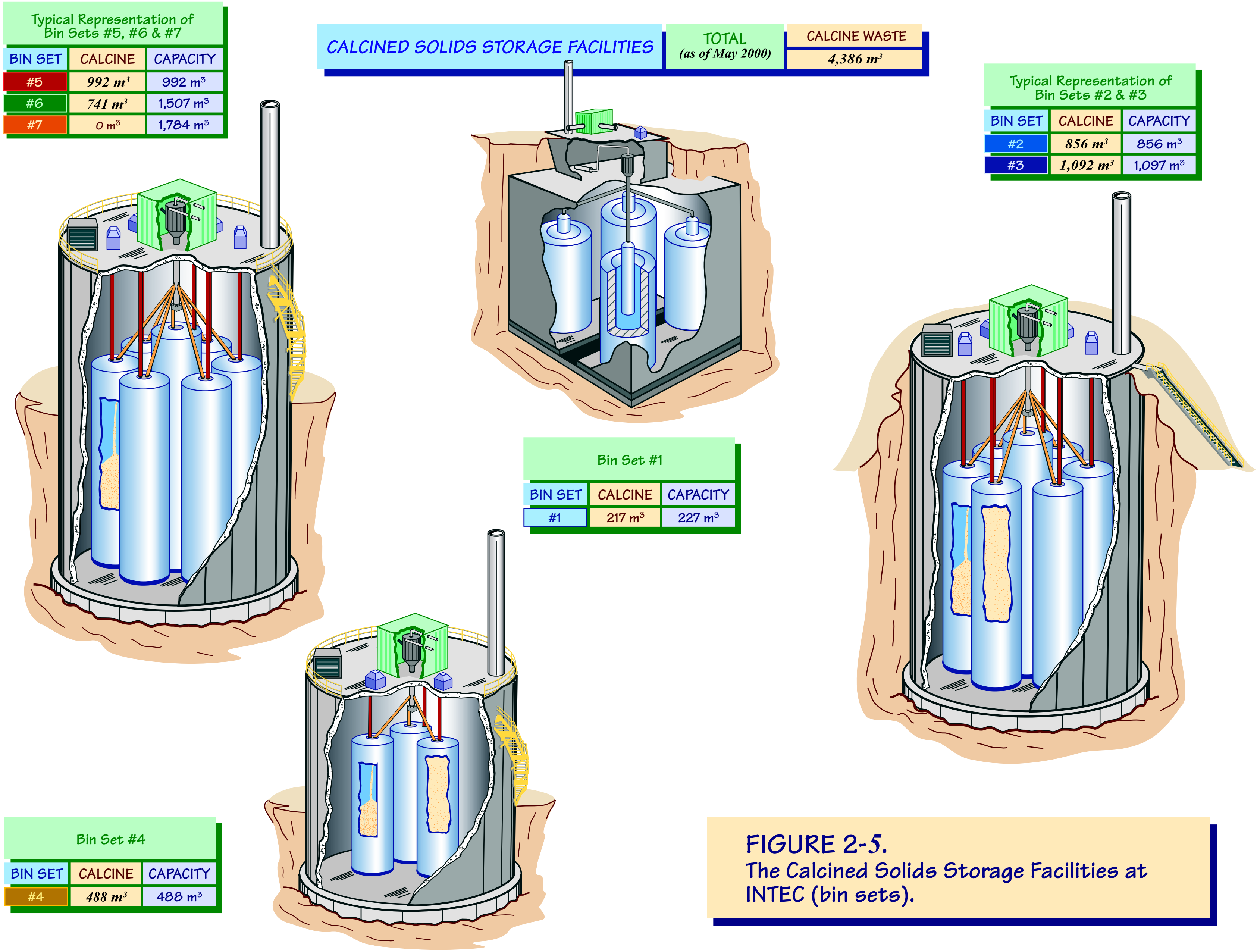
- Calcining mixed transuranic waste/SBW
- Separations technologies
- Immobilization technologies
- Removing or stabilizing tank heels
- Retrieving and dissolving calcine

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 mixed transuranic waste/SBW by December 2012, DOE studied alternative methods for calcining this waste. Two techniques emerged as viable candidates: (1) high temperature 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 ***was*** 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



CALCINED SOLIDS STORAGE FACILITIES

TOTAL (as of May 2000)	CALCINE WASTE
	4,386 m^3

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

BIN SET	CALCINE	CAPACITY
#5	992 m^3	992 m^3
#6	741 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	856 m^3	856 m^3
#3	1,092 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	488 m^3	488 m^3

FIGURE 2-5.
The Calcined Solids Storage Facilities at INTEC (bin sets).

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 ***or transuranic 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 Alternatives 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-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 2-***6*** illustrates the ***proposed process for*** tank heel removal and stabilization.

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.

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

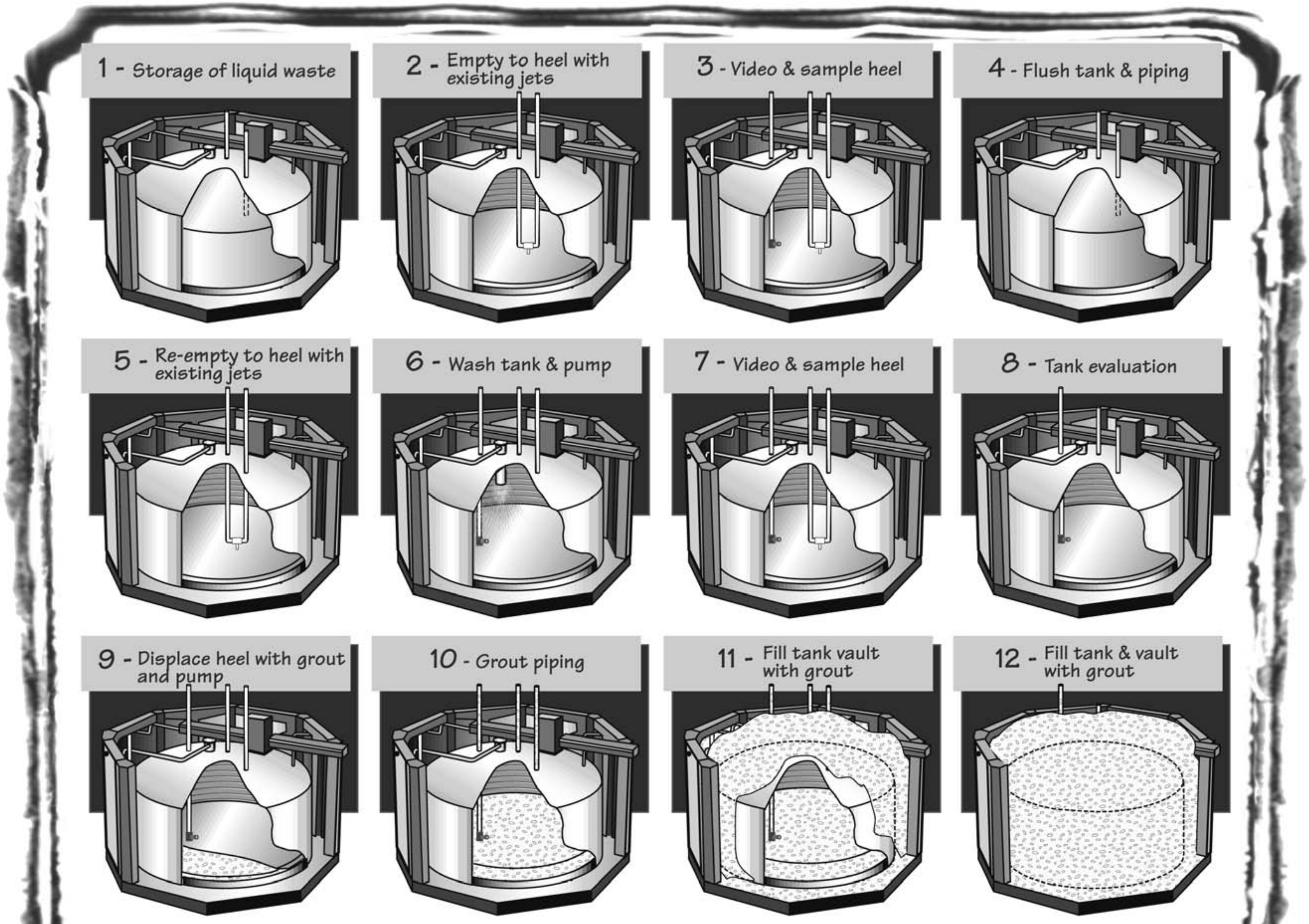


FIGURE 2-6. Tank heel removal and stabilization.

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.

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.

2.2.4 HIGH-LEVEL WASTE MANAGEMENT IN A NATIONAL CONTEXT

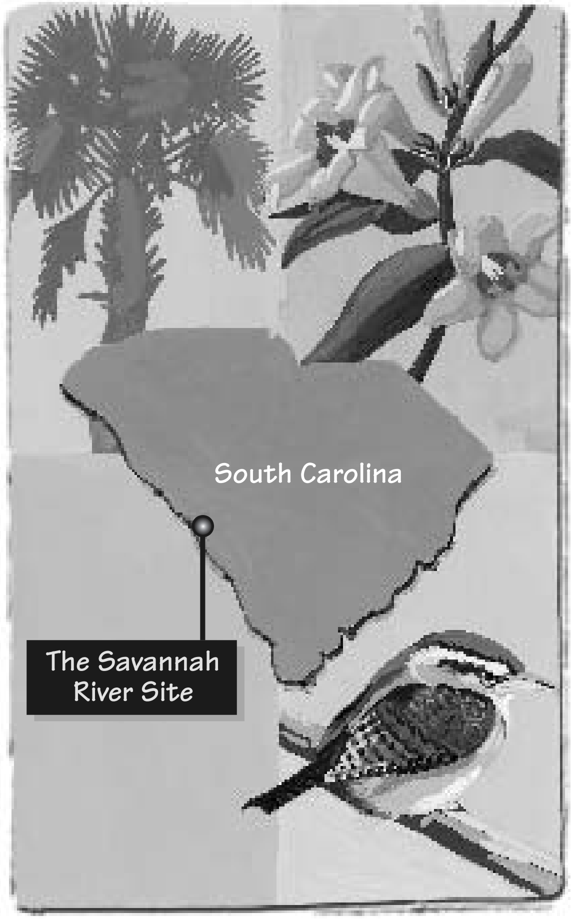
Four DOE sites now manage HLW: INEEL, the Savannah River Site in South Carolina, the Hanford Site in Washington, and the West Valley Demonstration Project in New York. DOE processed spent nuclear fuel at the first three sites. Although the West Valley Demonstration Project was a commercial spent nuclear 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. ***To date, treatment decisions at the Savannah River Site, West Valley Demonstration Project, and Hanford Site have generally involved solidification of HLW via 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 ***projected quantity of*** INEEL HLW ***represents*** approximately ***6*** percent of the total DOE inventory of immobilized HLW canisters. DOE plans to dispose of the ***immobilized HLW*** canisters in a geologic repository (DOE ***2002a***).

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 locations of these DOE sites.

Savannah River Site

The Savannah River Site currently manages approximately 34 million gallons of HLW in two 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, ***a low-level waste grout*** and disposal facility, 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 publication of the 1982 EIS. In a Record of Decision for a supplemental EIS (DOE 1994), DOE decided to ***operate*** the Defense Waste Processing Facility system ***with the modifications.***

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. ***A second HLW tank was also closed in 1997 using the same closure configuration. DOE has prepared an EIS (DOE 2002b) that evaluates alternatives for closure of the remaining HLW tanks at the Savannah River Site.***

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.

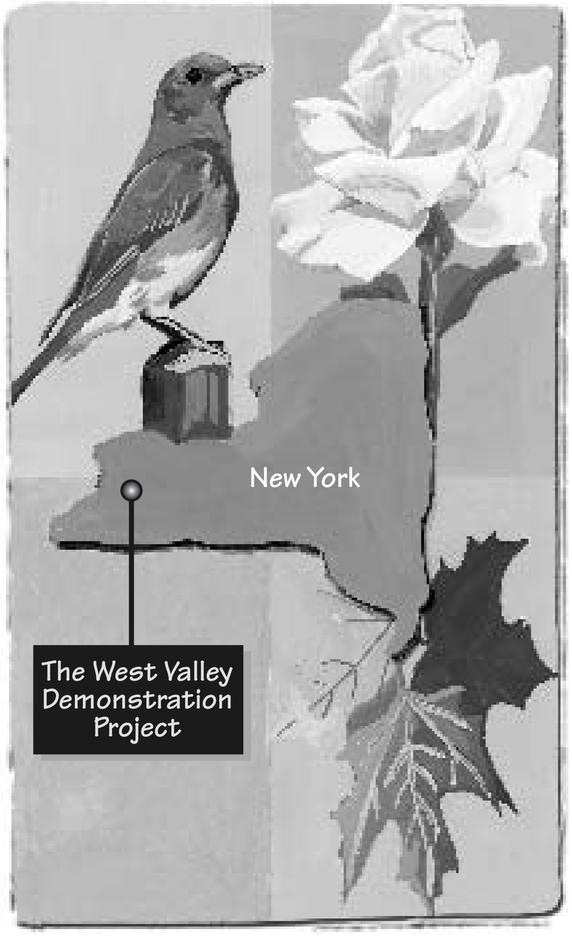
In 1992, DOE established the Tank Waste Remediation System Program to manage, retrieve, treat, immobilize, and dispose of the Hanford Site tank wastes in a safe, environmentally sound, and cost-effective manner. In FY 2001, as directed by Congress, the Tank Waste Remediation System Program was renamed the River Protection Project and is managed by the Office of River Protection. A major objective of the project is to immobilize 10 percent of the tank waste by volume and 25 percent of the tank waste by radioactivity by 2018. In May 2000, DOE terminated the privatized construction contact with British Nuclear Fuel Limted (BNFL), Inc. and awarded a competitively bid, non-privatized design and construction contract for the Waste Treatment and Immobilization Plant (WTP) to Bechtel National, Inc. (BNI) in December 2000. The facility consists of a Pretreatment Plant, a Low Level Waste (LLW) Vitrification Facility, a HLW Vitrification Facility as well as an analytical laboratory and support facilities. The facilities have been designed to support production of up to 30 metric tons of glass per day of immobilized LLW and 1.5 metric tons of glass per day of immobilized HLW. The BNI contract requires that hot commissioning of the facility begin by December 2007 and conclude by January 2011. After hot commissioning is completed, the WTP will then be turned over to an operations contractor in 2011. The Department is continuing to accelerate the project by providing contractor fee incentives to optimize life-cycle performance, cost, and schedule, including the process design, facility design, and technologies.

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 ***will be*** 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 that evaluated alternatives for completion of the West Valley Demonstration Project (DOE 1996c, 1997c). ***DOE and the New York State Energy Research and Development Authority have revised their strategy for completing this review (66 FR 16447, March 26, 2001). DOE now intends to prepare and issue for public comment a revised Draft EIS that***

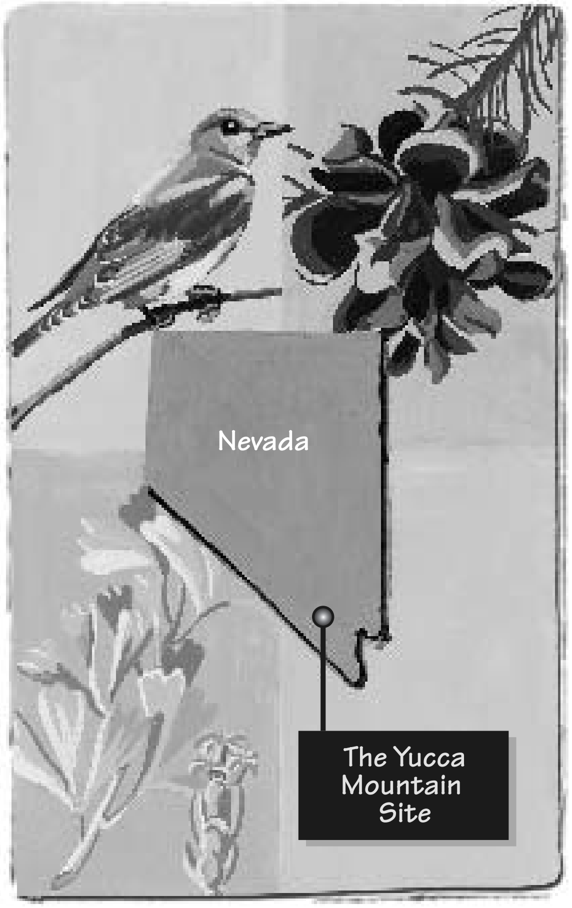


will focus on DOE's actions to decontaminate West Valley facilities and manage wastes controlled by DOE under the Project. DOE also intends to issue a second EIS with the New York State Energy Research and Development Authority as a joint lead agency, that would focus on site closure and/or long-term stewardship at West Valley.

The Nuclear Regulatory Commission ***has developed*** decommissioning criteria for the ***West Valley Demonstration Project site***. ***The Commission has issued a policy that would apply the License Termination Rule (10 CFR 20, Subpart E), which sets the decommissioning requirements for all NRC licensees, as decommissioning criteria for the West Valley Demonstration Project site. Following completion of the EIS and identification of a preferred alternative, NRC will verify that the criteria proposed by DOE are within the License Termination Rule, and will prescribe specific criteria for the site (67 FR 5003, February 1, 2002).***

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, ***DOE*** is to undertake the physical characterization of the Yucca Mountain site. ***Upon the Secretary of Energy's recommendation for*** approval of the site and the ***President's determination that*** the site ***is*** 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 then 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 repository 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.

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 ***of this EIS*** *more fully describes issues related to MTHM.*

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 approximately 8,315 canisters (the equivalent of 4,667 MTHM) ***of HLW*** that DOE would ship to the repository (DOE ***2002a***). 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 ***of this EIS***. Though DOE has recognized these other equivalency techniques; 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. ***For status of Yucca Mountain site approval process, see Section 2.3.1: EIS for a Geologic Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain.*** 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 evaluated alternative treatments for the ***mixed*** HLW at INEEL based on the current waste acceptance criteria for the ***proposed geologic*** repository (DOE 1996d, 1999c; TRW 1997).

2.2.5 *LEGAL REQUIREMENTS* FOR HIGH-LEVEL WASTE MANAGEMENT

Environmental restoration and waste management activities at ***the*** INEEL are subject to ***a number of*** 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 ***mixed*** 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's compliance status.

Federal and state requirements for the management of ***mixed*** 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
- Notice of Noncompliance Consent Order.
- Site Treatment Plan (under the Federal Facility Compliance Act)

Table 2-1 identifies site-specific agreements between DOE and the State of Idaho that affect the management of mixed 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 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.

Table 2-1. 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 is currently in effect.
1994 Modification to Notice of Noncompliance Consent Order	- DOE must calcine all ***liquid*** HLW by January 1, 1998	***The deadline for completing calcination of liquid HLW was changed to June 30, 1998 by the 1995 Settlement Agreement/Consent Order.***
	- DOE must evaluate and select ***treatment*** technologies for SBW and calcine by June 1, 1995	***DOE met this milestone with the issuance of the SNF & INEL EIS Record of Decision in May 1995.***
1995 Settlement Agreement/Consent Order, resolving the cases of Public Service Co. of Colorado v. Batt and United States v. Batt	- DOE shall complete the process of calcining all the remaining liquid HLW by June 30, 1998	***DOE completed calcination of the remaining liquid HLW in February 1998, by lowering the liquid level to the greatest extent possible by use of existing equipment, in accordance with the second modification to the Notice of Noncompliance Consent Order paragraph VIII.G.***
	- DOE shall commence calcination of SBW by June 1, 2001	***DOE met this milestone by commencing calcination of SBW in February 1998.***
	- Begin negotiation of a plan and schedule for treatment of calcined waste by December 1999	***In conjunction with this EIS, DOE and the State of Idaho commenced negotiation for treatment of calcined waste in September 1999.***
	- Complete calcination of SBW by December 31, 2012 - Treat all ***HLW currently at INEL*** so that it is ***ready to be moved out of*** Idaho ***for disposal by a target date of 2035***	DOE is currently in compliance with this Settlement Agreement/Consent Order. Ability to meet commitments for calcination may be affected by subsequent decisions regarding treatment technologies ***and disposal requirements.***

Table 2-1. Agreements between DOE and the State of Idaho for operations at INTEC (continued).

Agreement	Summary of milestones	Status of milestones/comments
1998 Modification to Notice of Noncompliance Consent Order	- DOE must cease use of the pillar and panel ***vault*** tanks by June 30, 2003 - DOE must cease use of the remaining tanks by December 31, 2012 - ***Closure plans developed for these tanks will address the remaining heel and vaults, and the use of these tanks and equipment for closure including any flushing or other cleaning of the tanks***	These milestones are in effect, except for the requirement regarding operation of the calciner (see below). ***DOE and the State of Idaho have agreed to define "cease use" as emptying the tanks to their heels (i.e., the liquid level remaining in each tank after lowering to the greatest extent possible by use of the existing transfer equipment). DOE intends to segregate newly generated liquid waste in 2005. DOE could employ RCRA-compliant storage after 2012, if necessary*** .
	- ***DOE shall submit a closure plan for at least one pillar and panel vault tank by December 31, 2000***	***DOE submitted a closure plan for two tanks in December 2000.***
	- 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	***The date for operation of the calciner was extended to June 1, 2000 by the 1999 Modification to the Notice of Noncompliance Consent Order.***

Table 2-1. Agreements between DOE and the State of Idaho for operations at INTEC (continued).

Agreement	Summary of milestones	Status of milestones/comments
1999 Modification to Notice of Noncompliance Consent Order	- The date for operation of the calciner is extended to June 1, 2000	***DOE placed the calciner in standby prior to the extended deadline of June 1, 2000. Shutdown activities included flushing the system. DOE submitted a two-phased, partial closure plan on August 29, 2000, for the calciner portion of the New Waste Calcining Facility that is consistent with the Consent Order milestone and 40 CFR 265.112(a). The closure plan describes and accommodates the EIS decision-making process and schedule. If DOE decides in the Record of Decision for this EIS to upgrade and permit the calciner, DOE would modify the closure plan accordingly through the permitting process.*** The potential lack of availability of the calciner after June 1, 2000 could impact the milestone for completion of calcination by December 31, 2012.
	- Begin, ***by June 7, 1999***, submitting monthly ***calciner*** air emission reports ***until one month after the calciner is placed in standby***	***DOE began the monthly submittals to the State of Idaho by June 7, 1999 and continued until one month after the calciner was placed in standby.***
	- Complete a plan and schedule for inspection and corrosion coupon evaluation of the tanks by November 15, 1999	***DOE met this milestone by submitting the plan and schedule to the State of Idaho by November 15, 1999.***

These standards provide for isolation of the radioactive portion of the waste in order to limit 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 (40 CFR 197, "Environmental Protection Standards for Yucca Mountain, Nevada") ***have been*** developed. ***These standards*** may therefore be applicable to residual materials left in the tanks or bins at INTEC if DOE determines the residue ***will*** be ***managed*** as HLW or transuranic waste.

On ***June 13, 2001 (66 FR 32074)***, EPA ***promulgated*** "Environmental Radiation Protection Standards for Yucca Mountain, Nevada" codified in 40 CFR 197. These regulations 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 ***mixed*** HLW, mixed transuranic waste/SBW, and associated wastes managed at INTEC ***con-***

tain a combination of "characteristic" (e.g., toxic or corrosive) and "listed" hazardous wastes that are regulated under 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 forms (HLW and any transuranic or low-level wastes) would still be considered "mixed waste" under RCRA. Under the current waste acceptance criteria (DOE 1999c), DOE would not accept RCRA-regulated HLW at the potential geologic repository at Yucca Mountain. It would be necessary for DOE to obtain a "delisting" for the treated HLW or obtain a RCRA permit for the repository. The Waste Isolation Pilot Plant is permitted to receive certain RCRA-regulated transuranic wastes. However, it may be necessary to modify the Waste Isolation Pilot Plant's RCRA permit, or seek a delisting, in order to dispose of the transuranic waste portion of the INTEC waste. INEEL has no mixed low-level waste disposal capacity. Consequently, any mixed low-level waste fraction would need to be treated to meet land disposal restriction standards and delisted prior to onsite disposal. Further, DOE's Record of Decision for the Waste Management PEIS states that Hanford or the Nevada Test Site would serve as the regional disposal facilities for DOE's mixed low-level waste. These offsite disposal options along with available commercial facilities would be considered for any INEEL mixed low-level waste treated to meet land disposal restriction standards but not delisted.

The existing INTEC waste management facilities are regulated by the Idaho ***Department*** 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 ***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 disposition decisions ***under this EIS*** 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 ***Department*** 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. ***DOE placed the calciner in standby prior to the deadline of June 1, 2000 and submitted a two-phased, partial closure plan on August 29, 2000, for the calciner portion of the New Waste Calcining Facility that is consistent with the Consent Order milestone and 40 CFR 265.112(a). If DOE decides in the Record of Decision for this EIS to upgrade and permit the calciner, DOE would modify the closure plan accordingly through the permitting process.***

Settlement Agreement/ Consent Order

In October 1995, the State of Idaho, the Department of the Navy, and DOE settled the case 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 ***mixed*** 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 ***(begun September 1999)***

- 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

- Treat all ***HLW currently*** at INEEL ***so that it is ready to be moved out*** of Idaho ***for disposal*** by a target date of 2035

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, ***Section J.4 of the Agreement provides a process where*** DOE may request ***a modification to the Settlement Agreement requirements*** 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 with which DOE must comply 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.

2.3 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

In August 2000, the Tanks Focus Area also conducted a follow-up independent technical review (TFA 2001) of a proposed steam-reforming treatment process for mixed transuranic waste/SBW to determine its feasibility, applicability, and cost realism, and provided the following recommendations:

- *Maintain and pursue direct vitrification as the baseline technology for treating and immobilizing mixed transuranic waste/SBW.*
- *Do not pursue further steam reforming initiatives for treatment of mixed transuranic waste/SBW to produce waste forms for direct disposal in a HLW geologic repository or at the Waste Isolation Pilot Plant.*
- *Follow a multi-step process with appropriate go/no go decision points to properly evaluate further steam reforming of mixed transuranic waste/SBW to produce an interim solid form suitable for subsequent vitrification.*
- *Consider the application of steam reforming to the treatment of the offgas that would be generated by direct vitrification of the mixed transuranic waste/SBW.*

DOE considered the Tanks Focus Area reports and recommendations as a part of its analysis of the EIS alternatives.

DOE Management Assessment of Alternatives - *In September 2001 the DOE Assistant Secretary for Environmental Management requested an assessment of the preferred alternative recommended by the DOE and State of Idaho Decision Management Team and approved in October 2000. The assessment was to be conducted under the following assumptions:*

- *Sodium bearing waste may be managed as mixed transuranic waste*
- *Treated SBW may be disposed of at WIPP*
- *Calcine is an acceptable final waste form for disposal at the geologic repository*
- *Steam reforming is an acceptable treatment technology for the SBW*
- *The mixed transuranic/SBW can be grouted in place*
- *The calciner may be operated in its present interim status configuration.*

The assessment team decided to add the Steam Reforming Option to the Final EIS in response to public and agency comment and additional information received from private sector industry.

The option of containerizing the mixed HLW calcine and shipping it to the geologic repository was added to this EIS as part of the Non-Separations Alternative in the Steam Reforming Option.

The option of grouting the mixed transuranic/SBW in place was eliminated from detailed analysis in this EIS because the waste would have to be removed from the tanks and the process involved to neutralize and grout the waste would result in a substantial increase in waste volumes with no long term reduction in risk to the environment.

The option of operating the calciner in its interim status configuration is not included in the detailed analysis in the Final EIS based on programmatic considerations.

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 ***Department*** 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. ***DOE placed the calciner in standby prior to the deadline of June 1, 2000 and submitted a two-phased, partial closure plan on August 29, 2000, for the calciner portion of the New Waste Calcining Facility that is consistent with the Consent Order milestone and 40 CFR 265.112(a). If DOE decides in the Record of Decision for this EIS to upgrade and permit the calciner, DOE would modify the closure plan accordingly through the permitting process.***

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- Start negotiations with the State of Idaho by December 31, 1999 regarding a plan and schedule for treatment of calcined waste ***(begun September 1999)***
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2.3 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

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 **and alternatives** 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.

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. Council on Environmental Quality regulations require 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.

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 the National Environmental Policy Act as discussed in the Western Governors' Associations' Policy Statement (WGA 1996).

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 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 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 ***progress*** 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 ***to*** 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. ***This*** 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."

2.3.1 OTHER RELATED NEPA AND CERCLA *REVIEWS*

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 mixed 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

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 ***within*** a transportation cask. The transportation cask will be designed for protection during normal, incident-free transportation, as well as protection 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 ***the potential Yucca Mountain*** 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.

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 *Programmatic Spent Nuclear Fuel Management and Idaho National Engineering Laboratory Environmental Restoration and Waste Management Programs EIS* (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 the 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.

Initially, DOE had questions regarding the ability of bin set 1 (one of seven bin sets available for the storage of mixed HLW calcine) to meet current seismic design standards, and if confirmed, DOE may have been required to move mixed HLW calcine from bin set 1 to bin set 6 or 7. However, the resultant Unresolved Safety Question concerning the structural integrity of bin set 1 has been resolved and, based on the Safety Analysis Report (DOE 2000a), the mixed HLW calcine in bin set 1 will not have to be transferred to another bin set. However, DOE continues to evaluate the structural integrity of bin set 1.

This EIS analyzes the environmental impacts of ***mixed*** 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 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 in 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 Waste Management PEIS Record of Decision for disposal of low-level waste and mixed low-level waste was issued February 25, 2000 (65 FR 10061). DOE has decided to establish regional low-level waste and mixed low-level waste disposal at two DOE sites: Hanford and the Nevada Test Site. (The term "regional" does not impose restrictions on which DOE sites may ship waste to a disposal site.) In addition, DOE will continue, to the

extent practicable, disposal of onsite low-level waste at INEEL, the Los Alamos National Laboratory, the Oak Ridge Reservation, and the Savannah River Site. INEEL and the Savannah River Site also will continue to dispose of low-level waste generated by the Naval Nuclear Propulsion Program. This decision, based on the Waste Management PEIS, does not preclude DOE's use of commercial disposal facilities, consistent with current DOE orders and policy. 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 that each site would specifically evaluate these waste fractions as part of its site-specific EIS. ***Therefore, as each site would specifically evaluate the waste fractions as part of its site-specific EIS, DOE has analyzed in this EIS that low-level and mixed low-level waste will be disposed of consistent with the Waste Management PEIS Records of Decision.***

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

EIS for the Treatment and Management of Sodium-Bonded Spent Nuclear Fuel (DOE 2000*b*) - This EIS, issued in July ***2000***, 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 the Savannah River Site. The 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. ***The Record of Decision to proceed with DOE's preferred alternative to electrometallurgically treat some of the sodium-bonded spent nuclear fuel (e.g., fuel from Experimental Breeder Reactor-II) at Argonne National Laboratory-West was issued September 19, 2000 (65 FR 56565). DOE also decided to continue to store some of the sodium-bonded spent nuclear fuel (fuel from Fermi-1) while alternative treatments are evaluated.***

CERCLA Record of Decision for Waste Area Group 3 – The INEEL ***CERCLA*** 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. DOE, through the CERCLA Record of Decision for the Operable Unit 3-13 portion of Waste Area Group 3 (DOE 1999***d***), 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 ***was submitted to*** the State of Idaho in ***March 2000***. ***In accordance with the CERCLA Record of Decision***, the existing ponds are not expected to receive wastewater after ***December 2003*** and the new ponds are planned to be operational by ***December 2003***. The impacts resulting from this decision and other remedial actions at INTEC carried out by the INEEL ***CERCLA*** Program are presented as cumulative impacts in this EIS.

The Waste Isolation Pilot Plant Disposal Phase Final Supplemental EIS (DOE 1997*d*) – This supplemental EIS analyzes the treatment and storage of transuranic waste and disposal of such waste at the Waste Isolation Pilot Plant ***near*** 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 *2002a*) – ***DOE prepared a draft EIS for a geologic repository at Yucca Mountain that evaluates potential environmental impacts from the construction, operation and monitoring, and eventual closure of the repository, including potential long-term post-closure effects. A supplement to the draft EIS was issued May 4, 2001 (66 FR 22540). This supplement to the draft EIS addresses the latest repository design information and the corresponding environmental impact analyses. The final EIS was completed in February 2002 (67 FR 9048, February 27, 2002) and accompanied the Secretary of Energy's recommendation to the President in early February 2002 as required by the Nuclear Waste Policy Act (Abraham 2002a). The President submitted his recommendation of the Yucca Mountain site to Congress on February 15, 2002 (Bush 2002). The Governor of the State of Nevada vetoed the recommendation on April 8, 2002. On July 9, 2002, Congress passed a resolution affirming the President's decision to designate the Yucca Mountain site for the repository. President Bush signed the resolution on July 23, 2002.***

Final Environmental Impact Statement, Tank Waste Remediation System (DOE 1996*b*) – 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.

Final Programmatic Environmental Impact Statement for Accomplishing Expanded Civilian Nuclear Energy Research and Development and Isotope Production Missions in the United States, Including the Role of the Fast Flux Test Facility (NI PEIS) (DOE 2000c) ***– The NI PEIS evaluated the environmental impacts of four alternative strategies for meeting DOE's responsibility to ensure the availability of isotopes for medical, industrial and research applications, meeting the nuclear material needs of other Federal agencies, and undertaking research and development activities related to development of nuclear power for civilian use. In addition, the NI PEIS evaluated the environmental impacts of permanently deactivating the Fast Flux Test Facility at Hanford. The NI PEIS included an alternative to process irradiated neptunium-237 targets at the Fluorinel Dissolution Process Facility at INTEC, although that alternative was not preferred. The final NI PEIS was issued in December 2000. The Record of Decision was issued on January 26, 2001 (66 FR 7877). DOE decided to use the existing infrastructure to the extent possible and consider opportunities to enhance the existing facilities to maximize the agency's ability to address future mission needs.***

2.3.2 OTHER ACTIONS

Prospective Coal Fired Power Plant - A coal fired steam plant previously used for INTEC heating may be converted to a commercial coal fired power plant under a lease agreement with a private entity. This possibility is being discussed within DOE and with prospective applicants but at this point the action is considered speculative. Before DOE decides to lease the coal-fired plant, the private entity applicant must fund the preparation an environmental assessment (EA). DOE will release the EA for public review before deciding whether an EIS is required or whether a finding of no significant impact is appropriate, and before deciding whether to lease the coal fired plant. It is expected air emissions would be the primary issue and that a new cumulative air impact analysis for the INEEL would be conducted and presented in the EA.

2.3.3 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 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 ***notify*** the public ***of*** 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 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 ***commentors*** support the Settlement Agreement/Consent Order. Some ***commentors*** advocated 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 ***this*** 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 1999***e***). To the extent that public comments on these documents affect ***issues within the scope of this EIS, they are*** addressed.

2.3.4 PUBLIC COMMENT PROCESS ON THE DRAFT ENVIRONMENTAL IMPACT STATEMENT

DOE published the Notice of Availability of the Draft EIS in the Federal Register on January 21, 2000 (65 FR 3432). The Notice of Availability provided information on how the public could obtain copies of the Draft EIS and the locations, dates, and times of the public hearings. The public was provided an opportunity to comment at public hearings held in Idaho Falls, Pocatello, Twin Falls, and Boise, Idaho; Jackson, Wyoming; Portland, Oregon; and Pasco, Washington. At these public hearings, DOE officials and the Manager of the State of Idaho INEEL Oversight Program presented overviews of the Draft EIS from their respective points of view. Members of the public were provided an opportunity to ask questions of the DOE and State representatives and to provide oral and/or written comments on the EIS. DOE initially established a 60-day public comment period. In response to public requests, DOE subsequently extended the public comment period to 90 days (65 FR 9257, February 24, 2000). DOE also held an additional public hearing in Fort Hall, Idaho.

DOE provided a variety of opportunities for the public to review and comment on the Draft EIS. In addition to the public hearings, other activities included radio announcements in four Western states, newspaper advertisements in nine states, distribution of Draft EIS information to more than 1,400 individuals and organizations in 27 states and the District of Columbia, and briefings for interested groups and individuals. Briefings were held with government and tribal officials, interest groups, INEEL employees, DOE citizens advisory boards in Idaho and Washington, and state and Federal agencies.

DOE received more than 1,000 comments from about 100 individuals and organizations, all of which have been considered in preparing the Final EIS (See the Comment Response Document, Chapter 11, which summarizes the comments received and provides responses to those summaries. See Appendix D for comment documents.). In developing its responses, DOE assembled a group including representatives of the INEEL Citizen's Advisory Board, Shoshone-Bannock Tribes, State of Idaho, and the management and operating contractor for INEEL to summarize key concerns identified during the public comment period. Based on these efforts, the key issues of concern to the public include:

Preference for treatment alternatives - ***Commentors expressed opinions in support of, or against, various alternatives.***

Calciner operations and thermal treatment - ***Comments relating to operation of the New Waste Calcining Facility generally fell into two groups: those supporting the use of the calciner, and those who opposed its use. Although commentors expressed a range of positions relating to technologies (and thus alternatives) that employ thermal treatment, many opposed thermal treatment such as incineration.***

Schedule for treatment - ***Some commentors urged DOE to treat liquid waste first because it represents a more serious threat to the environment than HLW calcine.***

Reclassification of waste - ***Commentors were divided in their positions as to whether waste could or should be reclassified as mixed transuranic waste.***

Repository issues - ***Commentors expressed concerns about the methods of calculating MTHM, including the uncertainties about the availability of the proposed repository for INEEL HLW and the waste acceptance criteria that precludes disposal of RCRA listed waste.***

Impacts to air and water, including the Snake River Plain Aquifer - ***Commentors generally agreed that protection of air and water resources, particularly the Snake River Plain Aquifer, should be a primary concern.***

*Public involvement - **Commentors asked for continuing opportunities to participate in making decisions about HLW management.***

*Decision-making and obligations to states/tribes versus funding constraints - **Commentors submitted a range of comments relating to the costs of implementing the EIS alternatives. Some recommended that costs not be considered in decision-making while others were concerned that the cost estimates provided would result in biased decision-making or that alternatives were biased because of high costs. Commentors requested information about funding and asked to be involved if DOE has to re-prioritize cleanup and waste management activities because of budget shortfalls.***

*Meeting agreements/requirements versus making sound technical decisions - **Commentors were divided as to which should receive a higher priority: expediting treatment to meet Settlement Agreement/Consent Order and regulatory milestones, or taking more time to decide on an alternative that is potentially more technically sound.***

*Honoring policies/agreements/treaties with tribes - **Shoshone-Bannock Tribe members maintained that DOE must honor all its promises to Native Americans.***

DOE considered the public comments in the preparation of this EIS. Some comments resulted in changes to the EIS. Other comments required responses to answer technical questions, improve readers' understanding, or explain DOE policies. Some of the comments addressed activities outside the scope of this EIS (e.g., DOE actions that are unrelated or being evaluated in other National Environmental Policy Act documentation). These concerns were forwarded to the DOE organizations responsible for these National Environmental Policy Act evaluations. DOE and the State of Idaho considered public comments along with other factors such as programmatic need, health and safety, technical feasibility, and cost in arriving at their respective Preferred Alternatives.

Consideration of public comments on the draft EIS helps ensure the EIS provides information to support decision making. This EIS has been enhanced, as appropriate, in response to public comments. These enhancements include, but are not limited to, the following:

- ***Identification of the DOE and State of Idaho Preferred Alternatives selected based on consideration of public comment and other information, such as DOE's top-to-bottom review of the Environmental Management Program (Abraham 2002b).***

- ***Sections discussing flood studies and the potential for flooding were clarified.***

- ***Appendix C.9 has been updated to include the results of quantitative sensitivity analyses of the effects of changes in assumed time of grout failure, infiltration rate, and distribution coefficients on the resulting radiation dose to human receptors.***

- ***Sections of the EIS detailing the terms of the Settlement Agreement/Consent Order have been updated to be more internally consistent and to update the status of related milestones.***

- ***A number of editorial changes were made to the EIS to correct errors, and to clarify discussions viewed by some commentors as misleading.***

2.3.5 OTHER INFORMATION AND TECHNOLOGIES REVIEWED

*Cost Analysis of Alternatives - **Although a cost report is not required as part of the National Environmental Policy Act process, DOE published a separate document, Cost Analysis of Alternatives for the Idaho High-Level Waste and Facilities Disposition Environmental Impact Statement (or Cost Report) (DOE 2000d), at the time the Draft EIS was released.***

National Academy of Sciences Assessment of Alternatives - In January 1998, DOE requested the National Academy of Sciences' National Research Council to conduct an independent review of the technologies being considered for treatment of the mixed HLW calcine and the mixed transuranic waste/SBW at INEEL.

In December 1999, the National Academy of Sciences issued its report Alternative High-Level Waste Treatments at the Idaho National Engineering and Environmental Laboratory (NAS 1999). This report addressed several issues and provided recommendations, including:

- *The need for DOE to develop and implement a sampling and characterization plan to obtain adequate characterization data for mixed HLW and mixed transuranic waste/SBW*
- *The need for DOE to conduct integrated testing of waste processing steps*
- *The need for DOE to resolve waste form and disposal uncertainties*
- *Recommendation to maintain interim storage of mixed HLW calcine until it is known where HLW can be sent, in what waste form, and by what transportation pathway*
- *Recommendation to confirm the useful lifetime of bin sets for interim storage of mixed HLW*
- *Recommendation to solidify mixed transuranic waste/SBW as soon and as simply as possible, without further calcination*
- *Recommendation to conduct a comparative risk analysis to determine "cost/benefit" of waste processing versus little or no processing*
- *Recommendation to consider six additional treatment options for processing mixed transuranic waste/SBW. The recommended treatment options were reviewed and evaluated by subject matter experts. Section 3.3.9 and Appendix B of this EIS provide information on the results of the evaluation.*

DOE considered the National Academy of Sciences' report and its recommendations in its analysis of the alternatives evaluated in this EIS.

Tanks Focus Area Assessment of Technologies - In June 2000 the Tanks Focus Area, at DOE's request, conducted an independent technical review of a narrowed list of waste treatment technologies under consideration by the DOE Decision Management Team tasked with conducting analyses and developing a recommended preferred alternative for this EIS. The Tanks Focus Area review focused on assessments of technical maturity, research and development status, and identification of technology gaps and uncertainties. Their report (TFA 2000) provided the following recommendations:

- *Adopt vitrification as a baseline.*
- *Pursue cesium ion exchange as an option to backup vitrification.*
- *Eliminate universal solvent extraction from further consideration.*
- *Consider methods that maximize heel solids retrieval, but not to the detriment of meeting the Notice of Noncompliance Consent Order milestone to cease use of the HLW tanks by December 2012.*
- *Aggressively pursue completion of a waste incidental to reprocessing determination for mixed transuranic waste/SBW.*
- *Consider a "phased" decision for calcine treatment. Carry forward vitrification and separations options to a future decision date consistent with plans to meet the 2035 "road-ready" compliance date in the Settlement Agreement/Consent Order.*
- *Eliminate the Hot Isostatic Pressed Waste Option.*

In August 2000, the Tanks Focus Area also conducted a follow-up independent technical review (TFA 2001) of a proposed steam-reforming treatment process for mixed transuranic waste/SBW to determine its feasibility, applicability, and cost realism, and provided the following recommendations:

- ***Maintain and pursue direct vitrification as the baseline technology for treating and immobilizing mixed transuranic waste/SBW.***
- ***Do not pursue further steam reforming initiatives for treatment of mixed transuranic waste/SBW to produce waste forms for direct disposal in a HLW geologic repository or at the Waste Isolation Pilot Plant.***
- ***Follow a multi-step process with appropriate go/no go decision points to properly evaluate further steam reforming of mixed transuranic waste/SBW to produce an interim solid form suitable for subsequent vitrification.***
- ***Consider the application of steam reforming to the treatment of the offgas that would be generated by direct vitrification of the mixed transuranic waste/SBW.***

DOE considered the Tanks Focus Area reports and recommendations as a part of its analysis of the EIS alternatives.

DOE Management Assessment of Alternatives - ***In September 2001 the DOE Assistant Secretary for Environmental Management requested an assessment of the preferred alternative recommended by the DOE and State of Idaho Decision Management Team and approved in October 2000. The assessment was to be conducted under the following assumptions:***

- ***Sodium bearing waste may be managed as mixed transuranic waste***
- ***Treated SBW may be disposed of at WIPP***
- ***Calcine is an acceptable final waste form for disposal at the geologic repository***
- ***Steam reforming is an acceptable treatment technology for the SBW***
- ***The mixed transuranic/SBW can be grouted in place***
- ***The calciner may be operated in its present interim status configuration.***

The assessment team decided to add the Steam Reforming Option to the Final EIS in response to public and agency comment and additional information received from private sector industry.

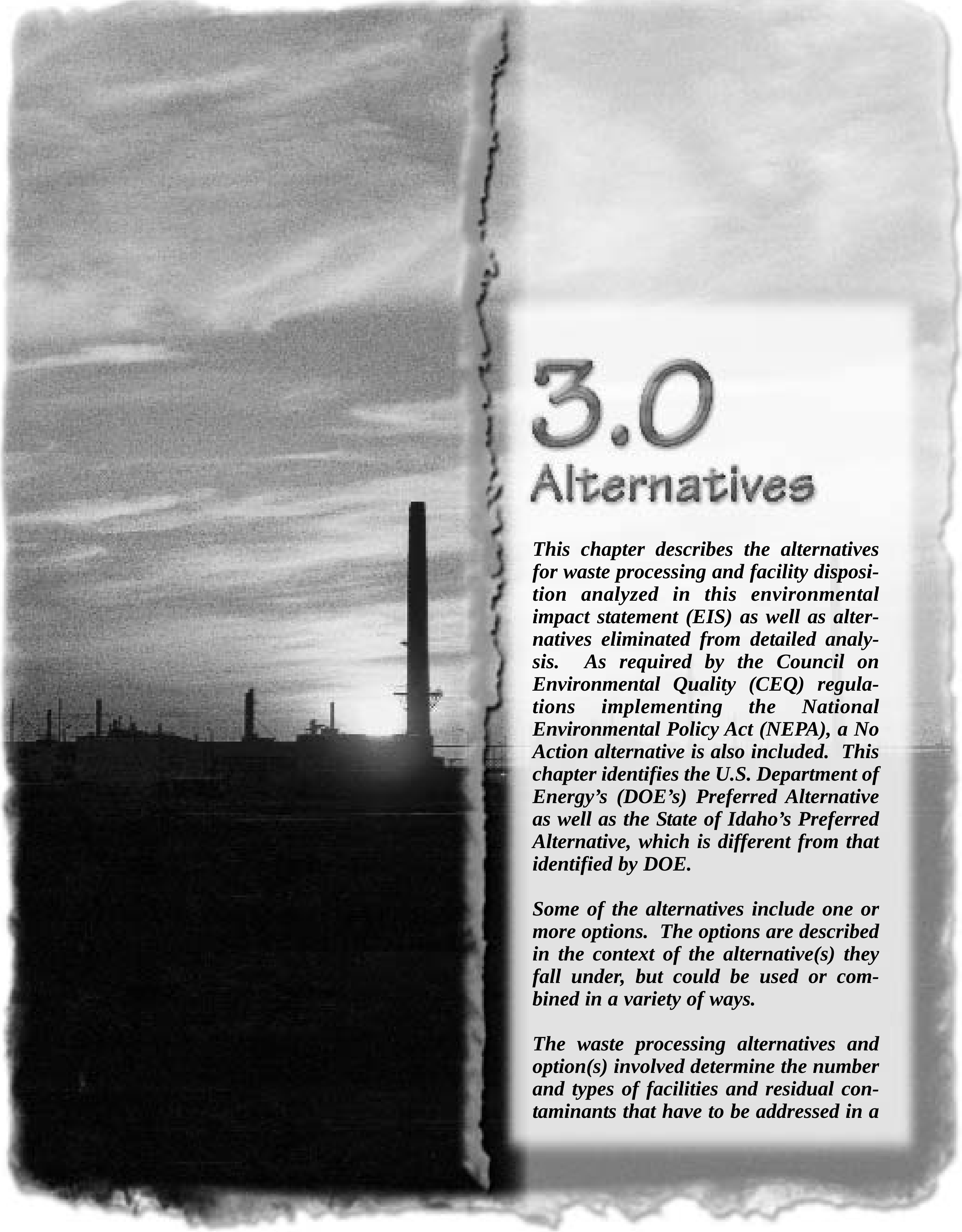
The option of containerizing the mixed HLW calcine and shipping it to the geologic repository was added to this EIS as part of the Non-Separations Alternative in the Steam Reforming Option.

The option of grouting the mixed transuranic/SBW in place was eliminated from detailed analysis in this EIS because the waste would have to be removed from the tanks and the process involved to neutralize and grout the waste would result in a substantial increase in waste volumes with no long term reduction in risk to the environment.

The option of operating the calciner in its interim status configuration is not included in the detailed analysis in the Final EIS based on programmatic considerations.

3.0

Alternatives



3.0

Alternatives

This chapter describes the alternatives for waste processing and facility disposition analyzed in this environmental impact statement (EIS) as well as alternatives eliminated from detailed analysis. As required by the Council on Environmental Quality (CEQ) regulations implementing the National Environmental Policy Act (NEPA), a No Action alternative is also included. This chapter identifies the U.S. Department of Energy's (DOE's) Preferred Alternative as well as the State of Idaho's Preferred Alternative, which is different from that identified by DOE.

Some of the alternatives include one or more options. The options are described in the context of the alternative(s) they fall under, but could be used or combined in a variety of ways.

The waste processing alternatives and option(s) involved determine the number and types of facilities and residual contaminants that have to be addressed in a

facility disposition alternative. The facility disposition alternatives describe possible scenarios that could be used under each waste processing alternative and option. Appendix B describes the alternative selection process.

Legal Requirements Timeline and Milestones Under the Alternatives and Options

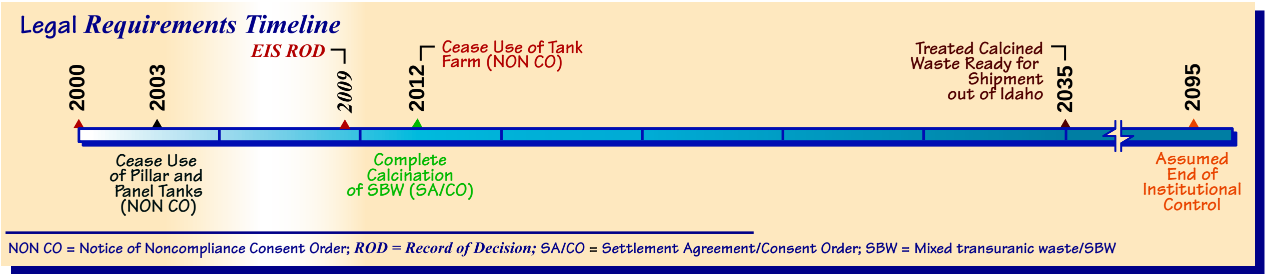
Each of the alternatives and options has an associated timeline that takes into consideration the time required for facility construction and waste treatment. The alternatives also identify, in the year 2005, DOE's intent to divert all newly generated liquid waste to tanks that are compliant with state and federal regulations. The legal requirements timeline shows dates committed to by DOE, and compliance dates contained in the Settlement Agreement/Consent Order and Notice of Noncompliance Consent Order. For comparison, these timelines are shown on Figure 3-13.

The 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 high-level waste (HLW) treated and ready to be shipped to a storage facility or repository outside of Idaho. Specifically, this agreement ***requires*** that all the liquid in the eleven 300,000-gallon, below-grade tanks would be treated and ready to be transported out of Idaho by a target date of December 31, 2035.

The ***legal requirements*** timeline ***is*** shown below. Interim milestones shown on this time***line*** represent key commitments DOE has made with respect to management of the ***waste*** in the eleven 300,000-gallon below grade tanks and calcine in the bin sets. ***First,*** the timeline reflects a commitment by DOE to cease use of the five pillar and panel tanks by ***June 30***, 2003. ***Second, the Settlement Agreement/Consent Order required an EIS to evaluate and analyze alternatives for treatment of calcined waste with a record of decision in the year 2009. Third,*** the Settlement Agreement/Consent Order specifies that calcination shall be complete by ***December 31,*** 2012. Treatment of ***HLW*** 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, timeframes for the remaining waste processing alternatives adhere to a completion date of 2035. However, ***the timeframes for mixed transuranic waste/sodium bearing waste (SBW) treatment under most of the EIS alternatives would not meet the interim date of December 31, 2012. These timeframes would be*** dictated by the amount of time ***required*** to design, construct, and ***operate treatment and storage facilities. In these cases, DOE could employ regulatory-compliant tanks in order to cease use of the existing Tank Farm by December 2012. DOE may be able to accelerate the schedule analyzed in this EIS to meet the 2012 milestone, if sufficient resources are made available.***

For environmental consequence calculations, waste processing alternatives analyzed in this EIS assume that treated waste destined for storage or disposal outside of Idaho will be ready for shipment by 2035. Impacts associated with storage of ***road ready*** HLW at the Idaho National Engineering and Environmental Laboratory (INEEL) are presented on an annual basis out to the year 2095. From 2035 to 2095, DOE would no longer be processing waste but would disposition 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 Waste Area Group 3 under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). Loss of institutional control means DOE would no longer control the site and therefore ***could*** no longer ensure that impacts to the public are within established limits. However, DOE ***will continue to ensure that the future use and management of these lands are in accordance with the Land Withdrawal Public Land Orders and*** is ***statutorally*** required to maintain controls on radioactive waste or materials under its jurisdiction until such 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." ***This allows for negotiations of Settlement Agreement/Consent Order requirements based on actions selected under NEPA.***

3.1 Waste Processing Alternatives

DOE's ***six*** waste processing alternatives and their options for implementation are described in Sections 3.1.1 through 3.1.***6***. 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 project. This modular approach allows DOE, in its Record of Decision, to select ***a waste processing method*** containing elements of more than one alternative described in this chapter, producing a hybrid alternative. ***In general, the waste processing alternatives apply the same pretreatment (e.g., separations) and treatment technologies to both the mixed transuranic waste/SBW and mixed HLW calcine. The products resulting from these different technologies would be managed as low-level, transuranic, or high-level wastes based on their characteristics.***

For any of the waste processing alternatives or options the schedule could be accelerated to meet the treatment of mixed transuranic waste/SBW by 2012. A number of processes would have to be accelerated, such as funding would have to be available, so that conceptual design could begin, followed by accelerated permitting, procurement, and construction.

The major Idaho Nuclear Technology and Engineering Center (INTEC) facilities that would be constructed under the ***six*** 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 ***as of*** the year 2000. It assumes the calciner at the New Waste Calcining Facility would ***remain*** in standby. 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 ***additional*** mixed transuranic waste would be calcined. The ***Process Equipment Waste and*** High-Level Liquid Waste Evaporators would continue ***operations*** 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

Table 3-1. Major INTEC facilities[a, b, c] or activities required for each waste processing alternative.

											State of Idaho's Preferred Alternative	
		DOE's Preferred Alternative										
			Separations Alternative			Non-Separations Alternative					Direct Vitrification Alternative	
	No Action	Continued Current Operations	Full Separations	Planning Basis	Transuranic Separations	Hot Isostatic Pressed Waste	Direct Cement Waste	Early Vitrification	Steam Reforming	Minimum INEEL Processing	Vitrification without Calcine Separations	Vitrification with Calcine Separations
Calcine SBW including New Waste Calcining Facility Upgrades	–	P1A	–	P1A	–	P1A	P1A	–	–	–	–	–
Newly Generated Liquid Waste and Tank Farm Heel Waste Management	–	P1B	–	P1B	–	P1B	P1B	–	P2001	–	–	–
Full Separations	–	–	P9A	P23A	–	–	–	–	–	–	–	P9A
Vitrification Plant	–	–	P9B	P23B	–	–	–	–	–	–	P88	P88
Class A Grout Plant	–	–	P9C	P23C	–	–	–	–	–	–	–	P9C
New Analytical Laboratory	–	–	P18	P18	P18	P18	P18	P18	–	P18	P18	P18
Interim Storage of Vitrified Waste	–	–	P24	P24	–	–	–	P61	–	P24	P61	P24
Packaging and Loading Vitrified HLW at INTEC for Shipment to a Geologic Repository	–	–	P25A	P25A	–	–	–	P62A	–	P25A	P62A	P25A
Class A Grout Disposal in new INEEL Low-Activity Waste Disposal Facility	–	–	P27	–	P27[d]	–	–	–	–	P27[e]	–	–
Class A Grout Packaging and Shipping to new INEEL Low-Activity Waste Disposal Facility	–	–	P35D	–	–	–	–	–	–	–	–	–
Class A Grout Packaging and Loading for Offsite Disposal	–	–	P35E	P35E	–	–	–	–	P35E[f]	P35E	–	P35E
Packaging and Loading Remote-Handled Transuranic Waste at INTEC for Shipment to WIPP	–	–	–	–	P39A	–	–	–	P117A	–	–	–
Transuranic Separations	–	–	–	–	P49A	–	–	–	–	–	–	–
Class C Grout Plant	–	–	–	–	P49C	–	–	–	–	–	–	–
Class C Grout Packaging and Shipping to New INEEL Low-Activity Waste Disposal Facility	–	–	–	–	P49D	–	–	–	–	–	–	–
Class C Grout Packaging and Loading for Offsite Disposal	–	–	–	–	P49E	–	–	–	–	–	–	–
Calcine Retrieval and Transport	P1E[g]	P1E[g]	P59A	P59A	P59A	P59A	P59A	P59A	P59A	P59A	P59A	P59A
Mixing and Hot Isostatic Pressing	–	–	–	–	–	P71	–	–	–	–	–	–
Hot Isostatic Pressed HLW Interim Storage	–	–	–	–	–	P72	–	–	–	–	–	–

Table 3-1. Major INTEC facilities[a, b, c] or activities required for each waste processing alternative (continued).

											State of Idaho's Preferred Alternative	
		DOE's Preferred Alternative										
			Separations Alternative			Non-Separations Alternative					Direct Vitrification Alternative	
	No Action	Continued Current Operations	Full Separations	Planning Basis	Transuranic Separations	Hot Isostatic Pressed Waste	Direct Cement Waste	Early Vitrification	Steam Reforming	Minimum INEEL Processing	Vitrification without Calcine Separations	Vitrification with Calcine Separations
Packaging & Loading Hot Isostatic Pressed Waste at INTEC for Shipment to a Geologic Repository	–	–	–	–	–	P73A	–	–	–	–	–	–
Direct Cement Process	–	–	–	–	–	–	P80	–	–	–	–	–
Unseparated Cementitious HLW Interim Storage	–	–	–	–	–	–	P81	–	–	–	–	–
Packaging and Loading Cementitious Waste at INTEC for Shipment to a Geologic Repository	–	–	–	–	–	–	P83A	–	–	–	–	–
Packaging and Loading Vitrified SBW at INTEC for Shipment to WIPP	–	–	–	–	–	–	–	P90A	–	–	P62A	P25A
Early Vitrification with Maximum Achievable Control Technology	–	–	–	–	–	–	–	P88	–	–	–	–
Steam Reforming	–	–	–	–	–	–	–	–	P2002A	–	–	–
SBW and Newly Generated Liquid Waste Treatment with Cesium Ion Exchange to Contact-Handled Transuranic Grout and Low-Level Waste Grout	–	–	–	–	–	–	–	–	–	P111	–	–
Packaging and Loading Contact-Handled Transuranic Waste for Shipment to WIPP	–	–	–	–	–	–	–	–	–	P112A	–	–
Calcine Packaging and Loading for Transport to Hanford or NGR	–	–	–	–	–	–	–	–	P117A	P117A	–	–
Separations Organic Incinerator	–	–	P118	P118	P118	–	–	–	–	–	–	–

Table 3-1. Major INTEC facilities[a, b, c] or activities required for each waste processing alternative (continued).

											State of Idaho's Preferred Alternative	
		DOE's Preferred Alternative										
			Separations Alternative			Non-Separations Alternative					Direct Vitrification Alternative	
	No Action	Continued Current Operations	Full Separations	Planning Basis	Transuranic Separations	Hot Isostatic Pressed Waste	Direct Cement Waste	Early Vitrification	Steam Reforming	Minimum INEEL Processing	Vitrification without Calcine Separations	Vitrification with Calcine Separations
Waste Treatment Pilot Plant	–	–	P133	P133	P133	P133	P133	P133	–	P133	P133	P133
New Storage Tanks	–	–	–	–	–	–	–	–	P13	–	P13	P13

a. Some of the facilities listed are not stand-alone facilities but projects that would be implemented in another facility. For example, packaging and loading activities (P39A) would occur in the Waste Separations Facility (P49A). PXXX numbers refer to projects and associated data presented in Appendix C.6.

b. The EIS analyzes treatment of post-2005 newly generated liquid waste as SBW for comparability of impacts between alternatives. DOE could treat the post-2005 newly generated liquid waste by grouting (see Project P2001 in Appendix C.6), which would result in 1,300 cubic meters of grouted waste and a small reduction in the treated SBW volume. The grout would be managed as transuranic or low-level waste depending on its characteristics.

c. If it appears that it will take longer than 2012 to complete treatment of SBW, untreated waste could be transferred to tanks permitted in accordance with hazardous waste regulations. Such tanks may be constructed (see Project P13 in Appendix C.6), or may be obtained by other means.

d. For disposal of low-level waste Class C type grout.

e. For vitrified low-level waste fraction returned from Hanford.

f. For disposal of grouted remote-handled transuranic waste.

g. Calcine retrieval for bin set 1 only.

NGR = national geologic repository ; WIPP = Waste Isolation Pilot Plant.

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

Alternatives	Product waste volume[a,b]	Primary treatment technology	Product waste disposal	Transportation	Indefinite or road-ready storage[c]
No Action Alternative	None[d]	None	Untreated waste remains at INEEL	None	Untreated mixed transuranic waste/SBW and mixed HLW calcine stored indefinitely in Tank Farm and bin sets, respectively
Continued Current Operations Alternative[e]	110 m^3 RH TRU waste (from tank heels)	Calcine mixed transuranic waste/SBW Grout mixed transuranic waste/NGLW[f] and tank heel waste	RH TRU waste to WIPP	280 RH TRU containers[g] to WIPP ***140 truck shipments or 70 rail shipments***	Mixed HLW and mixed transuranic waste/SBW calcine stored indefinitely in bin sets
Separations Alternative[e]					
Full Separations Option	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[h] to NGR ***780 truck shipments or 160 rail shipments*** 25,000 LLW containers[i] to disposal facility ***4,200 truck shipments or 1,300 rail shipments***	Vitrified HLW storage pending disposal at NGR
Planning Basis Option	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[f] 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 ***780 truck shipments or 160 rail shipments*** 28,000 LLW containers to disposal facility ***4,700 truck shipments or 1,400 rail shipments*** 280 RH TRU containers to WIPP ***140 truck shipments or 70 rail shipments***	Vitrified HLW storage pending disposal at NGR

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

Alternatives	Product waste volume[a,b]	Primary treatment technology	Product waste disposal	Transportation	Indefinite or road-ready storage[c]
Separations Alternative[e] (continued)					
Transuranic Separations Option	220 m^3 RH TRU waste 23,000 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 ***280 truck shipments or 140 rail shipments*** 21,000 LLW containers to disposal facility ***7,000 truck shipments or 2,100 rail shipments***	None
Non-Separations Alternative[e]					
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[f] and tank heel waste	HIP HLW to NGR RH TRU waste to WIPP	5,700 HLW canisters to NGR ***5,700 truck shipments or 1,100 rail shipments*** 280 RH TRU containers to WIPP ***140 truck shipments or 70 rail shipments***	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[f] and tank heel waste	Cemented HLW to NGR RH TRU waste to WIPP	18,000 HLW canisters to NGR ***18,000 truck shipments or 3,600 rail shipments*** 280 RH TRU containers to WIPP ***140 truck shipments or 70 rail shipments***	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	12,000 HLW canisters to NGR ***12,000 truck shipments or 2,400 rail shipments*** 900 RH TRU containers to WIPP ***450 truck shipments or 230 rail shipments***	Vitrified HLW storage pending disposal at NGR

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

Alternatives	Product waste volume[a,b]	Primary treatment technology	Product waste disposal	Transportation	Indefinite or road-ready storage[c]
Non-Separations Alternative[e] (continued)					
Steam Reforming Option	***4,400 m^3 calcined HLW***		***Calcined HLW to NGR***	***6,100 HLW canisters to NGR*** ***6,100 truck shipments or 1,200 rail shipments***	***Just-in-time retrieval of HLW calcine from storage in the bin sets***
	1,300 m^3 steam reformed SBW	***Steam reform SBW***	***Steam reformed SBW to WIPP***	***3,300 RH TRU containers (from SBW) to WIPP*** ***1,600 truck shipments or 810 rail shipments***	
	1,300 m^3 grouted NGLW	***Grout NGLW***	***Grouted NGLW to WIPP***	***3,200 RH TRU containers (from NGLW) to WIPP*** ***1,600 truck shipments or 800 rail shipments***	
Minimum INEEL Processing Alternative					
At INEEL[e]	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	***36,000*** CH TRU containers[j] to WIPP ***1,300 truck shipments or 670 rail shipments*** ***3,000*** HLW canisters[k] to NGR ***3,000 truck shipments or 750 rail shipments*** 5,600 LLW containers[l] to disposal facility ***620 truck shipments or 310 rail shipments*** 3,700 HLW canisters containing calcine to Hanford ***3,700 truck shipments or 920 rail shipments***	Vitrified HLW storage pending disposal at NGR
At Hanford	14,000 m^3 vitrified LLW fraction from calcine ***3,500*** 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	5,600 LLW containers to INEEL ***620 truck shipments or 310 rail shipments*** ***3,000*** HLW canisters to INEEL ***3,000 truck shipments or 750 rail shipments***	None

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

Alternatives	Product waste volume[a,b]	Primary treatment technology	Product waste disposal	Transportation	Indefinite or road-ready storage[c]
Direct Vitrification Alternative - State of Idaho's Preferred Alternative [e]					
Vitrification without Calcine Separations Option	***8,500 m^3 vitrified HLW (from calcine)*** ***440 m^3 vitrified SBW*** [m]	***Vitrify SBW and calcine***	***Vitrified HLW to NGR*** ***Vitrified SBW to NGR or WIPP***	***12,000 HLW canisters to NGR*** ***12,000 truck shipments or*** ***2,400 rail shipments*** ***610 vitrified SBW canisters to NGR or WIPP*** ***610 truck shipments or*** ***120 rail shipments***	***Vitrified HLW storage pending disposal at NGR***
Vitrification with Calcine Separations Option	***470 m^3 vitrified HLW (from calcine)*** ***440 m^3 vitrified SBW*** ***24,000 m^3 MLLW/LLW grout***	***Vitrify SBW and separated mixed HLW fraction from calcine*** [n] ***Grout separated MLLW fraction from calcine***	***Vitrified HLW to NGR*** ***Vitrified SBW to NGR or WIPP*** ***MLLW/LLW grout to offsite disposal facility***	***650 HLW canisters to NGR*** ***650 truck shipments or*** ***130 rail shipments*** ***610 vitrified SBW canisters to NGR or WIPP*** ***610 truck shipments or*** ***120 rail shipments*** ***22,000 MLLW/LLW containers to disposal facility*** ***3,700 truck shipments or*** ***1,100 rail shipments***	***Vitrified HLW storage pending disposal at NGR***

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a. Product wastes are a direct result of the treatment of calcine, mixed transuranic waste/SBW, and newly generated liquid waste. These treated waste forms are further categorized as HLW, transuranic waste, and low-level waste.

b. The EIS analyzes treatment of post-2005 newly generated liquid waste as SBW for comparability of impacts between alternatives. DOE could treat the post-2005 newly generated liquid waste by grouting (see Project P2001 in Appendix C.6), which would result in 1,300 cubic meters of grouted waste and a small reduction in the treated SBW volume. The grout would be managed as transuranic or low-level waste depending on its characteristics.

c. 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.

d. The No Action Alternative would not produce a waste form suitable for disposal. The ***approximately 1,000,000*** gallons of mixed transuranic waste/SBW, ***which includes newly generated liquid waste***, and ***4,400*** cubic meters of mixed HLW would remain untreated.

e. DOE's Preferred Alternative.

f. For purposes of analysis, mixed transuranic waste/NGLW grout was assumed to be managed as low-level (process) waste.

g. 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.

h. 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).

i. INEEL LLW containers are assumed to be concrete cylinders with a capacity of approximately 1 cubic meter.

j. CH TRU waste containers are assumed to be 55-gallon drums (***0.208*** cubic meters).

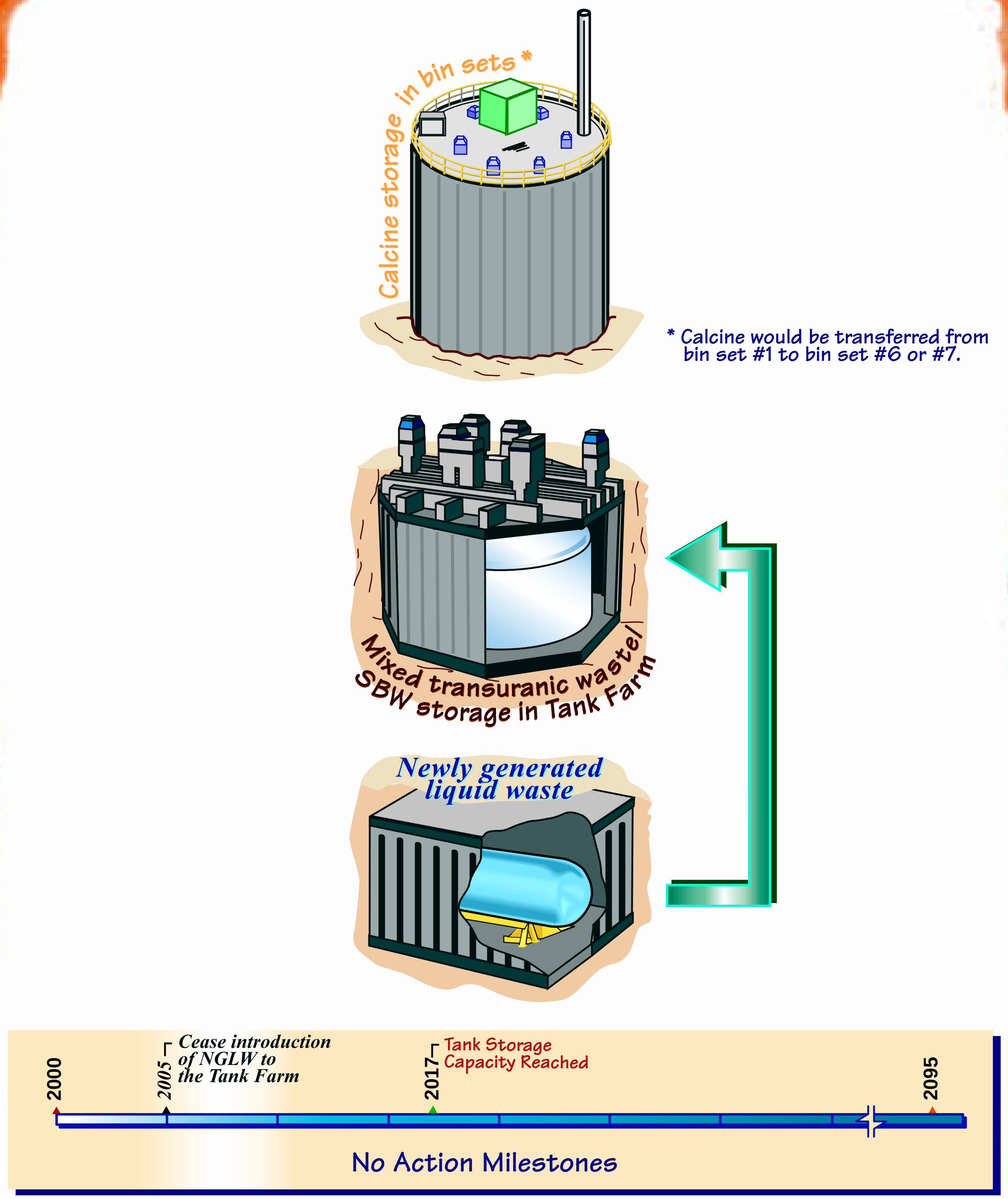
k. Hanford HLW canisters are assumed to be similar to those used for the Tank Waste Remediation System (2 feet in diameter and 15 feet long).

l. 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.

m. This EIS analyzes impacts of SBW treatment, storage, and disposal as HLW at a NGR, but treatment and disposal of SBW at the WIPP as mixed transuranic waste is an option pending the outcome of the Waste Incidental to Reprocessing determination.

n. Vitrification of HLW fraction could occur at INEEL or Hanford.

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

NGLW 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 treatment 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 **Process Equipment Waste and** High-Level Liquid Waste Evaporators (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.

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

The HEPA Filter Leach System treats contaminated high-efficiency particulate air (HEPA) filters, using chemical extraction to remove radionuclides and hazardous constituents. 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 **are** 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 2-**4**, Current INTEC high-level waste system simplified flow diagram) (DOE 1998a).

The Debris Treatment and Containment Storage **Unit** 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 **Unit** 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 **Unit** (such as spent decontamination solution) are managed in the INTEC liquid radioactive waste treatment system.

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 would be transferred to bin set 6 or 7, as described in the *Spent Nuclear Fuel Management and Idaho National Engineering Laboratory Environmental Restoration and Waste Management Programs Final EIS* (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 ***calcine*** 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 ***or*** to make its mixed HLW road ready by 2035.

Facilities required for the No Action Alternative 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.

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, ***and*** bin sets. The New Waste Calcining Facility calciner ***which was*** placed in standby in ***May*** 2000, in accordance with the Notice of Noncompliance Consent Order, ***would be*** upgraded to comply with the Maximum Achievable Control Technology air emissions requirements. The upgrades would be completed by 2010. The ***Process Equipment Waste and*** High-Level Liquid Waste Evaporators 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 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 ***removed directly from the offgas system and treated would be disposed of as mixed low-level waste. Mercury returned to the Tank Farm from the offgas system during operation of the calciner would be treated with*** the tank heels 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 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: a high-level waste fraction suitable for disposal in a geologic repository and a 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 ***perform a*** waste incidental to reprocessing ***citation or evaluation determination, before undertaking the separations process, to determine if the waste frac-***

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 ***or*** to make its mixed HLW road ready by 2035.

Facilities required for the No Action Alternative 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.

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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 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 ***removed directly from the offgas system and treated would be disposed of as mixed low-level waste. Mercury returned to the Tank Farm from the offgas system during operation of the calciner would be treated with*** the tank heels 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 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.

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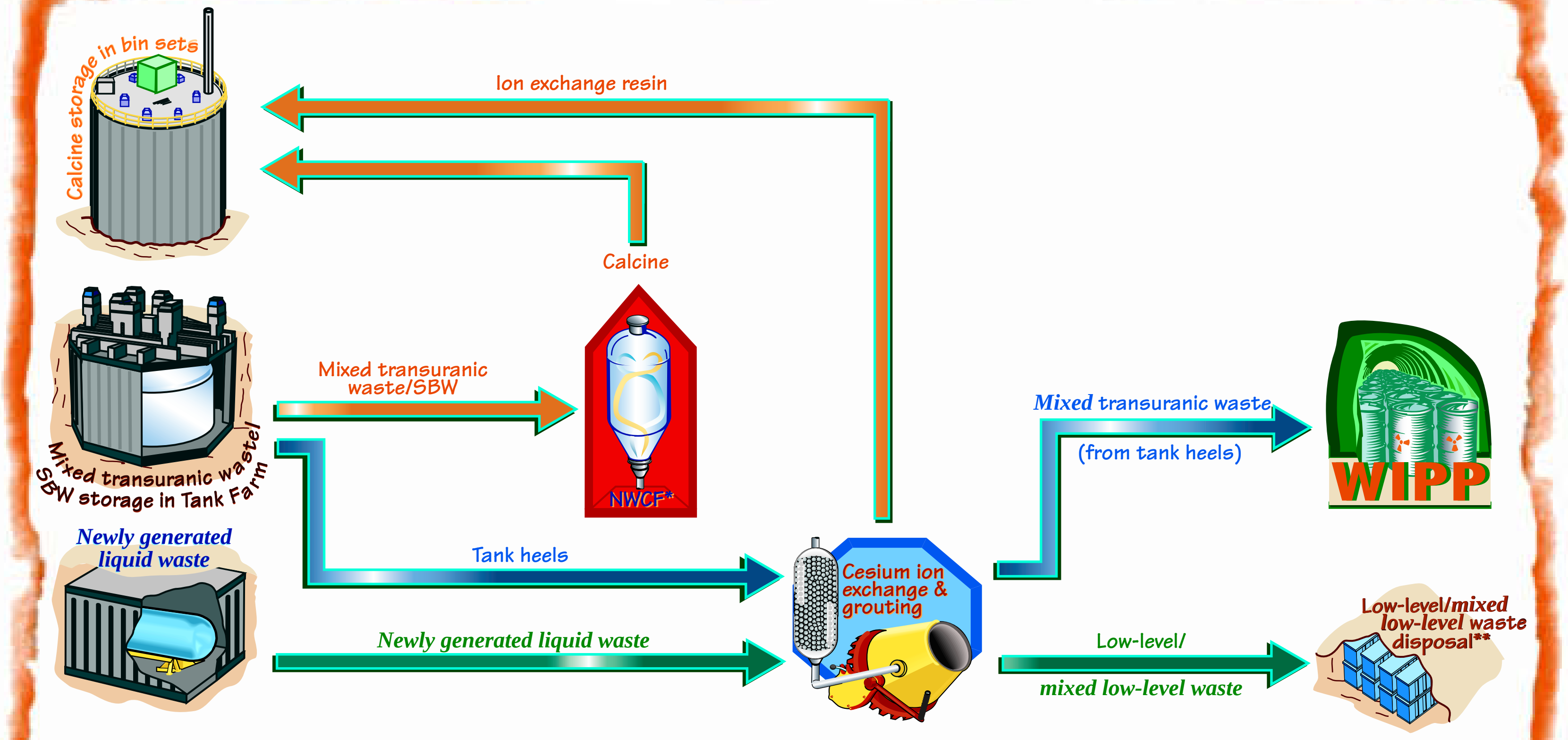


LEGEND

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

Continued Current Operations Milestones

FIGURE 3-2.
Continued Current Operations Alternative.

tions could be managed as low-level or transuranic waste. 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: ***Full Separations***, Planning Basis, 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 mixed transuranic waste/SBW to their final waste forms by eliminating the intermediate processing step of calcination. This option also offers the 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.

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.

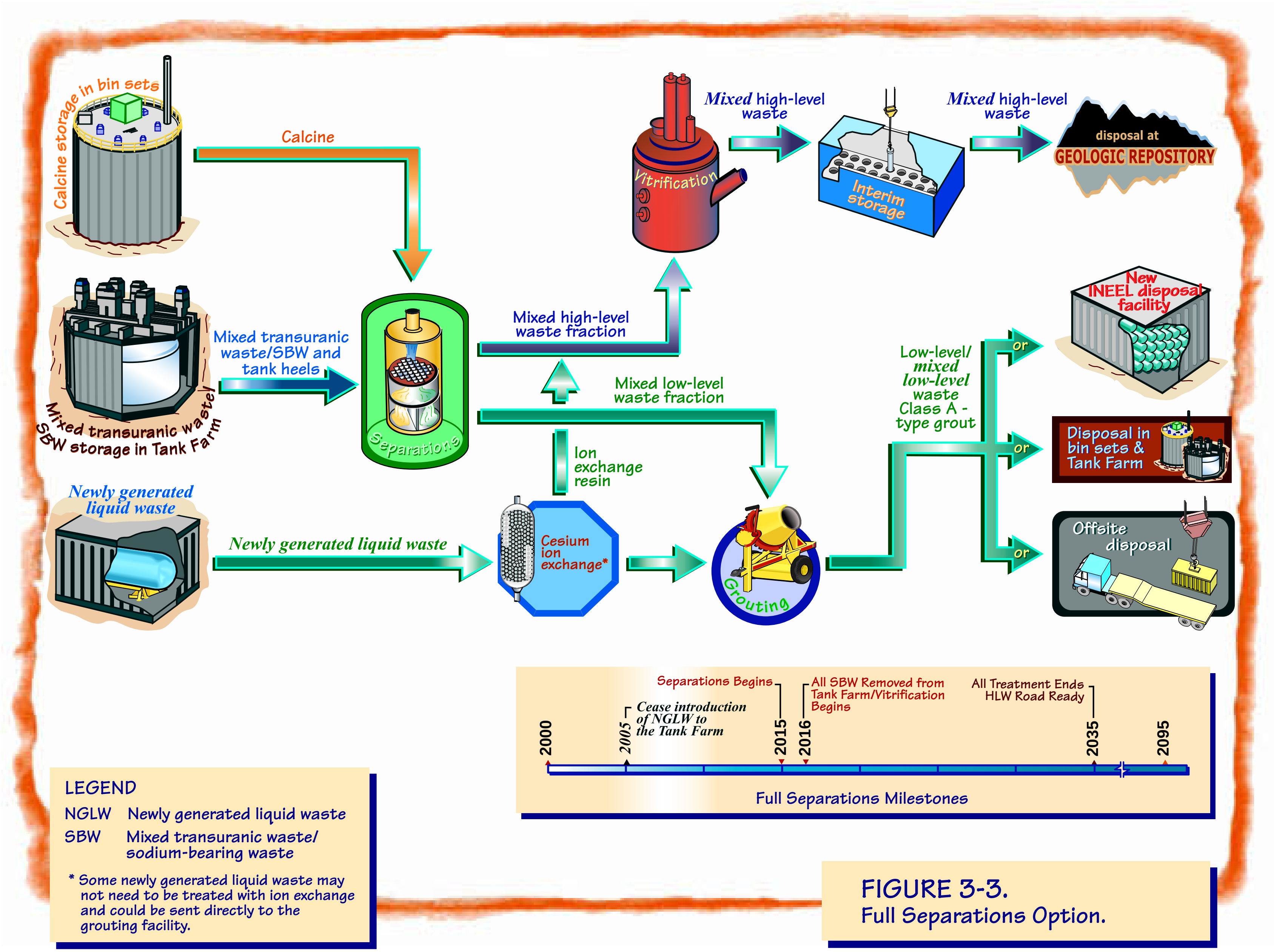
3.1.3.1 Full Separations Option

The Full Separations Option would retrieve and dissolve the calcine and separate it into high-level and low-level waste fractions. 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 Radioactive Waste Management Complex is ***expected*** to ***stop accepting*** contact-handled low-level waste and remote-handled low-level waste in ***2020 (Seitz 2002)***. The Waste Management Programmatic EIS record of decision ***provides*** 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 ***referred to in this EIS*** 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



LEGEND

NGLW	Newly generated liquid waste
SBW	Mixed transuranic waste/ sodium-bearing waste

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

FIGURE 3-3.
Full Separations Option.

Environmental Policy Act analysis. ***Transportation for this option includes shipping vitrified HLW to a geologic repository and potentially shipping the low-level waste Class A type grout to an offsite facility.***

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. The inclusion of this facility in this EIS is for illustrative purposes only.

In addition, DOE has analyzed in Section 5.2.9, the impacts of several stand-alone projects involving transportation of the 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.

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 ***was placed in standby in May*** 2000, as required by the Notice of Noncompliance Consent Order with the State of Idaho. 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, transuranics, 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 mixed transuranic waste***/SBW***. The HLW fraction would then be vitrified, packaged in Savannah River Site-type stainless steel canisters and stored onsite until shipped to a geologic repository.

It is assumed the process stream remaining after separating out the HLW fraction could be managed as a low-level waste. The low-level waste would 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 option, 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 ***removed directly from the offgas system and treated would be disposed of as mixed low-level waste. Mercury returned to the Tank Farm from the offgas system during operation of the calciner would be treated with*** the tank heels 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 ***the*** DOE plan *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, so that conceptual design could 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 were to be met. Delays in obtaining the RCRA permit or some other interruption could also stress an already tight and optimistic schedule.

Figure 3-***4*** 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 option 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.

3.1.3.3 Transuranic Separations Option

The Transuranic Separations Option would retrieve and dissolve the calcine and would treat the dissolved calcine, the mixed transuranic waste/SBW, and the tank heels flushed out of the tanks with the same process. The process would use a chemical separations facility to remove transuranics from the process stream. The transuranic fraction accounts for most of the long-lived radioactive constituents of HLW and mixed transuranic waste/SBW. The transuranic fraction would then be dried to a powder using a wiped film evaporator or with the addition of a drying additive, then packaged, loaded, and shipped to the Waste Isolation Pilot Plant for disposal.

The process stream remaining after removing the transuranics would be managed as low-level waste. The low-level waste fraction would be solidified in a grouting facility. Because the low-level waste fraction would contain both cesium and strontium components, 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, suitable for disposal in a near-surface landfill. In addition to the low-level waste fraction from the transuranic separations facility, the grouting facility would receive newly generated liquid waste.

Figure 3-***5*** illustrates some of the details of the Transuranic 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 liquid mixed transuranic waste/SBW and enable DOE to cease use of the pillar and panel tanks in 2003.

DOE analyzed three potential methods for disposing of the low-level waste Class C 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. For purposes of analysis, this option assumes that the new INEEL 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 evaluation. For purposes of the transportation analysis, DOE used the commercial radioactive waste disposal site operated by Chem-Nuclear Systems in Barnwell, South Carolina. The inclusion of this facility in this EIS is for illustrative purposes only.

The major facilities and projects required to implement the Transuranic Separations Option, including the variations in implementation are listed in Appendix C.6, except for transportation projects which are addressed in Appendix C.5.

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 by the year 2035 for subsequent shipment to a geologic repository. The ***four*** options considered in the Non-Separations Alternative are: (1) Hot Isostatic Pressed Waste Option, (2) Direct Cement Waste Option, (3) Early Vitrification Option***, and (4) Steam Reforming Option***. ***In the Hot Isostatic Pressed Waste and Direct Cement Waste Options***, all liquid mixed transuranic waste/SBW would be calcined

2010 if the 2012 deadline were to be met. Delays in obtaining the RCRA permit or some other interruption could also stress an already tight and optimistic schedule.

Figure 3-***4*** 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 option 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.

3.1.3.3 Transuranic Separations Option

The Transuranic Separations Option would retrieve and dissolve the calcine and would treat the dissolved calcine, the mixed transuranic waste/SBW, and the tank heels flushed out of the tanks with the same process. The process would use a chemical separations facility to remove transuranics from the process stream. The transuranic fraction accounts for most of the long-lived radioactive constituents of HLW and mixed transuranic waste/SBW. The transuranic fraction would then be dried to a powder using a wiped film evaporator or with the addition of a drying additive, then packaged, loaded, and shipped to the Waste Isolation Pilot Plant for disposal.

The process stream remaining after removing the transuranics would be managed as low-level waste. The low-level waste fraction would be solidified in a grouting facility. Because the low-level waste fraction would contain both cesium and strontium components, 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, suitable for disposal in a near-surface landfill. In addition to the low-level waste fraction from the transuranic separations facility, the grouting facility would receive newly generated liquid waste.

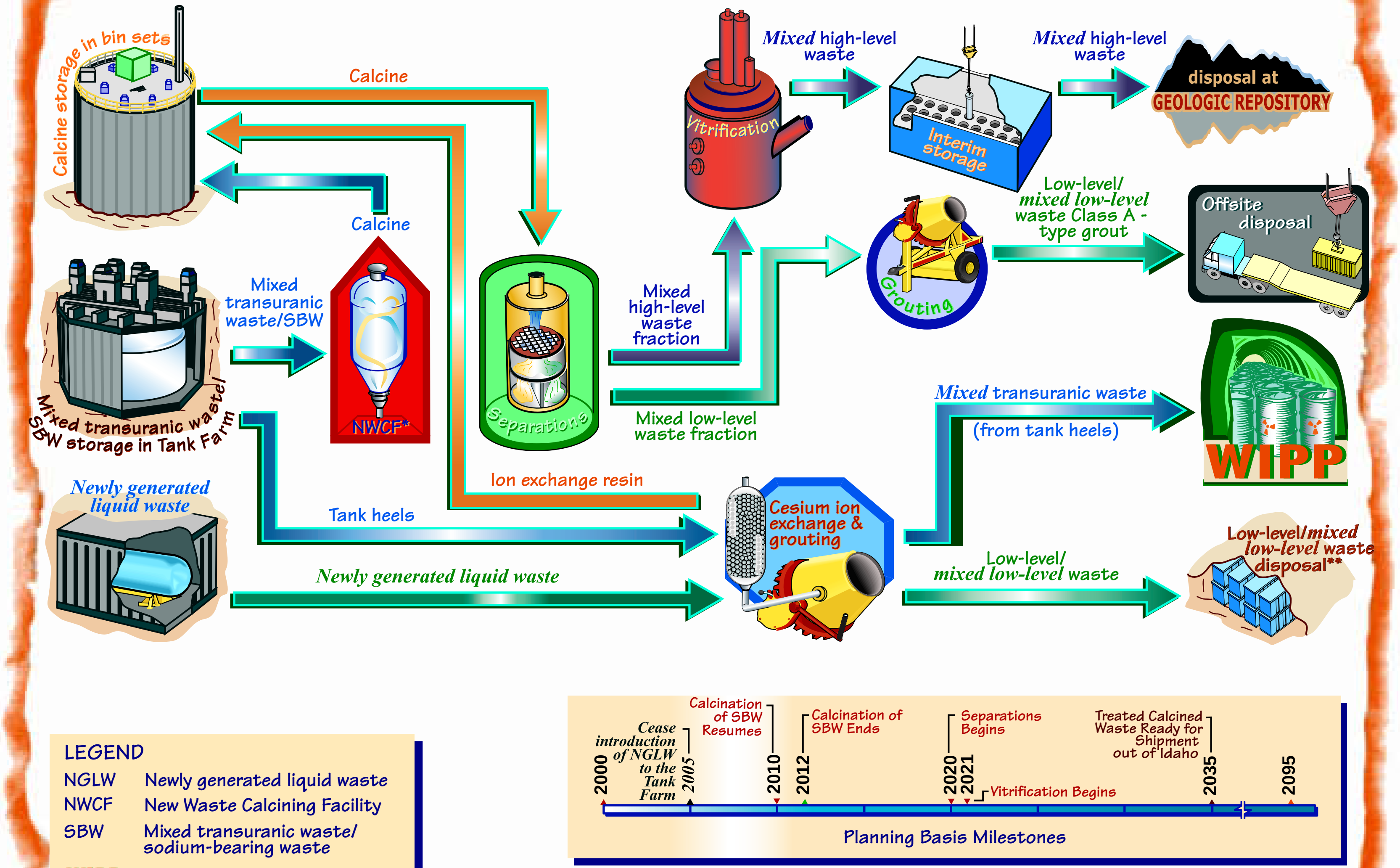
Figure 3-***5*** illustrates some of the details of the Transuranic Separations Option. Although not depicted on the figure, the High-Level Liquid Waste Evaporator, Liquid Effluent Treatment and Disposal Facility, and Process Equipment Waste Evaporator would continue to operate to reduce the volume of liquid mixed transuranic waste/SBW and enable DOE to cease use of the pillar and panel tanks in 2003.

DOE analyzed three potential methods for disposing of the low-level waste Class C 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. For purposes of analysis, this option assumes that the new INEEL 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 evaluation. For purposes of the transportation analysis, DOE used the commercial radioactive waste disposal site operated by Chem-Nuclear Systems in Barnwell, South Carolina. The inclusion of this facility in this EIS is for illustrative purposes only.

The major facilities and projects required to implement the Transuranic Separations Option, including the variations in implementation are listed in Appendix C.6, except for transportation projects which are addressed in Appendix C.5.

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 by the year 2035 for subsequent shipment to a geologic repository. The ***four*** options considered in the Non-Separations Alternative are: (1) Hot Isostatic Pressed Waste Option, (2) Direct Cement Waste Option, (3) Early Vitrification Option***, and (4) Steam Reforming Option***. ***In the Hot Isostatic Pressed Waste and Direct Cement Waste Options***, all liquid mixed transuranic waste/SBW would be calcined



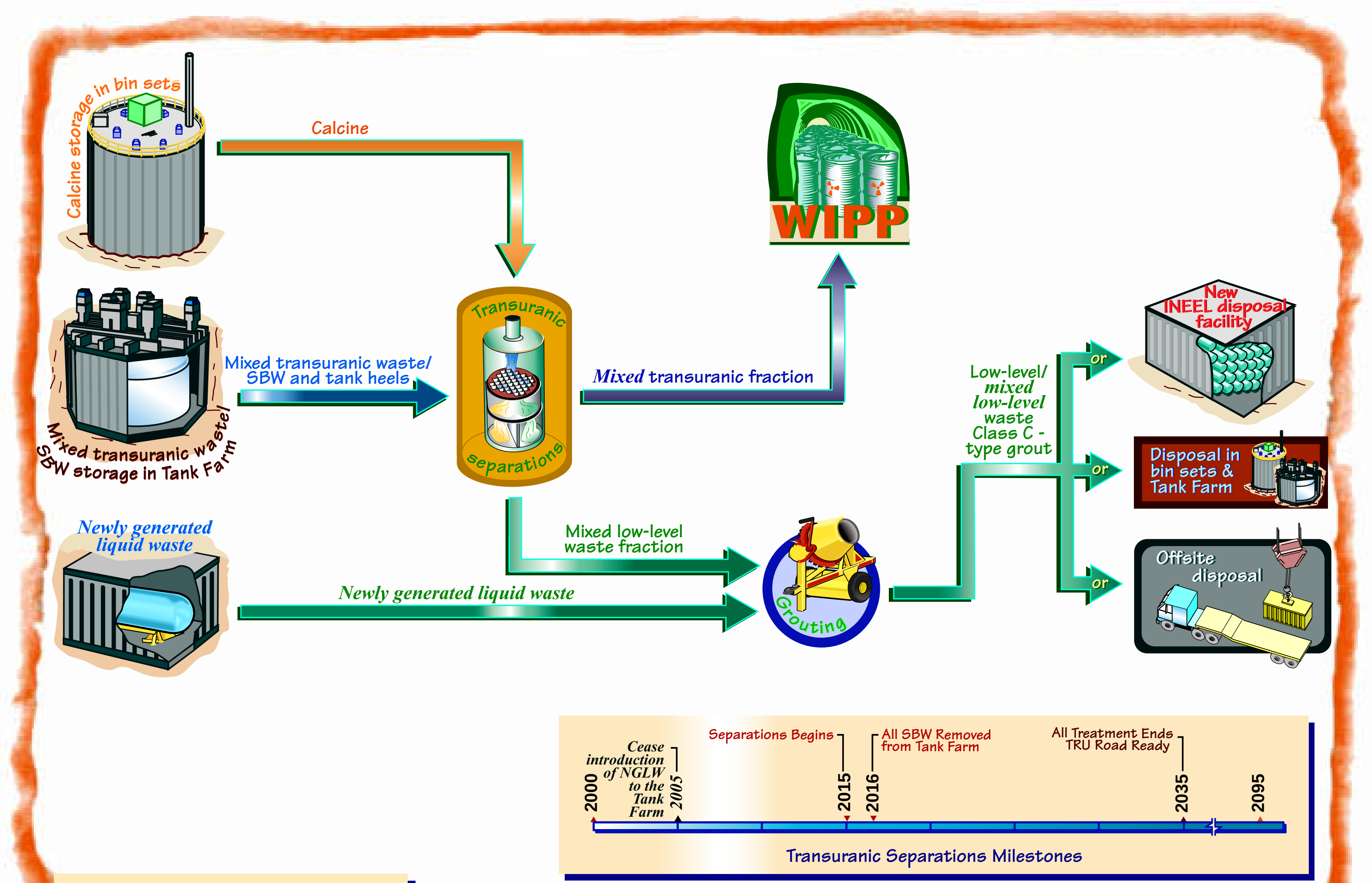
LEGEND

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

FIGURE 3-4.
Planning Basis Option.



LEGEND

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

FIGURE 3-5.
Transuranic Separations Option.

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 mixed transuranic waste/SBW would be retrieved from the Tank Farm and sent directly to a vitrification facility, bypassing calcination. ***In the Steam Reforming Option, the mixed transuranic waste/SBW would be sent directly to the steam reformer.***

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

- The Hot Isostatic Pressed Waste Option ***would*** use 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 ***would be*** used to immobilize the mixed HLW and mixed transuranic waste calcine. The hot isostatic press technology differs from vitrification in that waste ***would be*** treated in individual containers rather than melted in batches and then containerized and allowed to harden.

- ***In*** the Direct Cement Waste Option, ***the mixed transuranic waste/SBW would be calcined and a*** non-thermal process ***would be used*** to immobilize the mixed HLW and mixed transuranic waste calcine. The calcine ***would be*** blended with additives (i.e., clay, slag, and caustic soda), poured into canisters, and cured. The material ***would*** then ***be*** baked to remove any free water prior to sealing the containers. Although heat ***would be*** used in the curing and water removal processes, the temperatures involved (around 250ºC) ***would be*** much lower than those associated with vitrification or hot isostatic press. The resulting waste form ***would be*** 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 mixed transuranic waste/SBW into high-level and low-level ***waste*** fractions, the two wastes would be treated separately by processing first mixed transuranic waste/SBW and then mixed HLW calcine in a vitrification facility.

- ***In the Steam Reforming Option, all of the existing mixed transuranic waste/SBW would be converted to a solid form using steam reforming. The steam-reformed product would be managed as remote-handled transuranic waste. The mixed HLW calcine would be retrieved from the bin sets and packaged in Savannah River Site-type stainless steel canisters for disposal in a geologic repository.***

The hot isostatic pressed and hydroceramic cemented waste forms ***presumed containerized calcine*** 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 ***approved*** for disposal in a HLW geologic repository. DOE would also need to conduct testing and evaluation to qualify any non-vitrified waste forms under the waste acceptance criteria for a HLW geologic repository (DOE 1996a; 1999).

Except for Steam Reforming, the ***non-separations*** treatment ***processes*** would produce a glass-ceramic, cement, or glass form. ***The steam reforming process would produce a calcine-like waste form, which as with HLW calcine would be containerized.*** The 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 ***four*** 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 ***with a waste volume reduction of about 50 percent. After cooling, the Hot Isostatic Pressed Waste cans would be loaded into Savannah River Site-type stainless steel canisters, which would be welded closed and placed in an INEEL interim storage facility for*** subsequent disposal in a geologic repository. For the final waste form, this option would require an equivalency determination from the U.S. Environmental Protection Agency as discussed in Section 6.3.2.3.

Figure 3-***6*** 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 ***removed directly from the offgas system and treated would be disposed of as mixed low-level waste. Mercury returned to the Tank Farm from the offgas system during operation of the calciner would be treated with*** the tank heels 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.

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 ***a grout mixture consisting of*** 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 an equivalency determination from the U.S. Environmental Protection Agency as described in Section 6.3.2.3. Figure 3-***7 shows*** 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 ***removed directly from the offgas system and treated would be disposed of as mixed low-level waste. Mercury returned to the Tank Farm from the offgas system during operation of the calciner would be treated with*** the tank heels and sent to the Waste Isolation Pilot Plant for disposal.

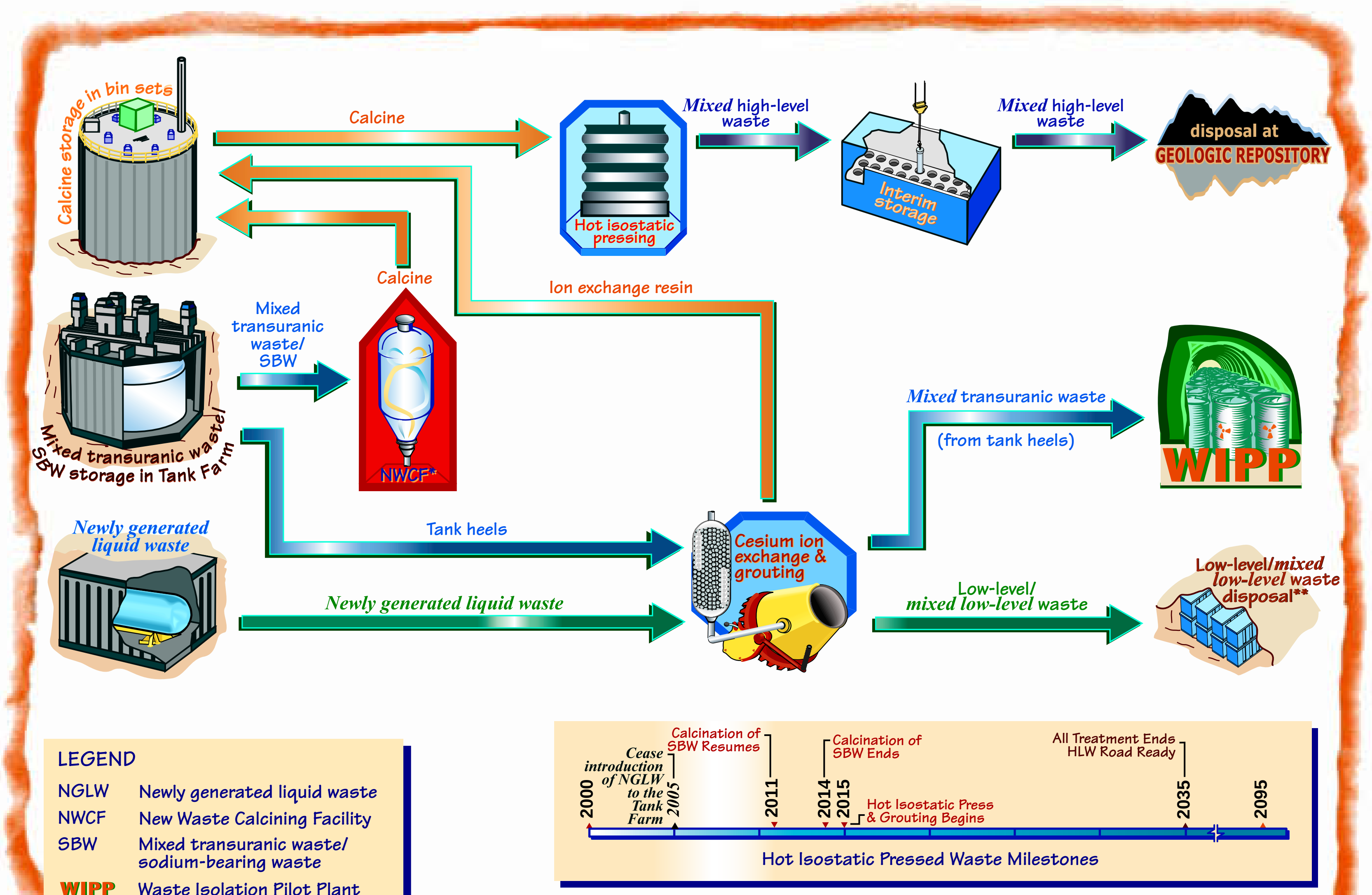
The major facilities and projects necessary to implement the Direct Cement Waste Option are listed in Appendix C.6, except for transportation projects, which are addressed in Appendix C.5.

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 waste would be remote-handled ***mixed*** 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.

The mixed transuranic waste/SBW and calcine would be treated in separate vitrification operations. The mixed transuranic waste/SBW would be processed from early 2015 through 2016. The waste would be blended with glass frit to form a slurry that would be fed to the melter at the Early Vitrification Facility. Glass would be poured into standard transuranic waste remote-handled containers for disposal at the Waste Isolation Pilot Plant.

The HLW calcine would be processed from 2016 through 2035. ***The calcine would be blended with glass frit and fed to the melter in a dry state.*** Glass from the HLW calcine would be



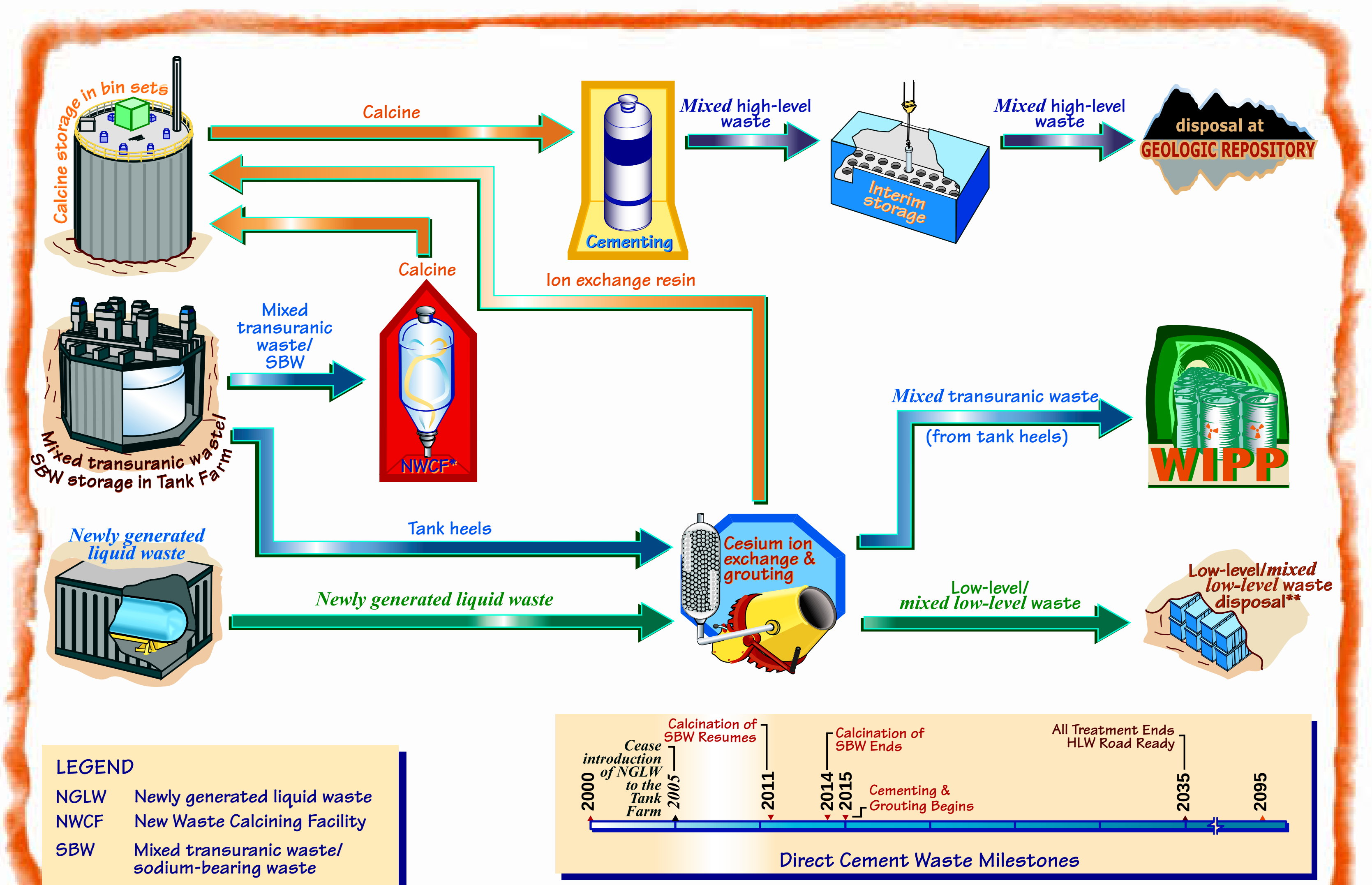
LEGEND

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

FIGURE 3-6.
Hot Isostatic Pressed Waste Option.



LEGEND

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

FIGURE 3-7.
Direct Cement Waste Option.

poured into Savannah River Site-type stainless steel canisters. Figure 3***-8 illustrates*** 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.

3.1.4.4 Steam Reforming Option

Under the Steam Reforming Option, the mixed transuranic waste/SBW stored in the Tank Farm would be converted to a solid form using steam reforming. The Steam Reforming Option would require approximately two years to process all remaining mixed transuranic waste/SBW after the necessary facilities were constructed. The steam reformed product would be packaged in Savannah River Site-type stainless steel canisters. This material would be managed as remote-handled transuranic waste suitable for disposal at the Waste Isolation Pilot Plant.

The mixed HLW calcine would be retrieved from the bin sets and packaged in Savannah River Site-type stainless steel canisters for disposal in a geologic repository. The retrieval and packaging of HLW calcine would occur from 2016 to 2035 on a "just-in-time" basis to avoid the need for interim storage pending disposal in a geologic repository. This requires an equivalency determination from the U.S. Environmental Protection Agency as described in Section 6.3.2.3.

After September 30, 2005, DOE intends to segregate newly generated liquid waste from the mixed transuranic waste/SBW. The post-2005 newly generated liquid waste could be steam reformed in the same facility as the mixed transuranic waste/SBW or DOE could construct a separate facility to grout the newly generated liquid waste. The steam reformed or grouted waste would be disposed of as low-level or transuranic waste, depending on its characteristics. For purposes of assessing transportation impacts, DOE assumed the grouted waste would be characterized as remote-handled transuranic waste and transported to the Waste Isolation Pilot Plant for disposal.

Figure 3-9 shows the Steam Reforming Option. The steam reforming, calcine retrieval and packaging, and treatment of newly generated liquid waste are not interdependent and could be implemented separately. The major facilities and projects required to implement the Steam Reforming Option are listed in Appendix C.6, except for transportation projects, which are addressed in Appendix C.5.

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. 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 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.

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.

poured into Savannah River Site-type stainless steel canisters. Figure 3*-**8 illustrates*** 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.

3.1.4.4 Steam Reforming Option

Under the Steam Reforming Option, the mixed transuranic waste/SBW stored in the Tank Farm would be converted to a solid form using steam reforming. The Steam Reforming Option would require approximately two years to process all remaining mixed transuranic waste/SBW after the necessary facilities were constructed. The steam reformed product would be packaged in Savannah River Site-type stainless steel canisters. This material would be managed as remote-handled transuranic waste suitable for disposal at the Waste Isolation Pilot Plant.

The mixed HLW calcine would be retrieved from the bin sets and packaged in Savannah River Site-type stainless steel canisters for disposal in a geologic repository. The retrieval and packaging of HLW calcine would occur from 2016 to 2035 on a "just-in-time" basis to avoid the need for interim storage pending disposal in a geologic repository. This requires an equivalency determination from the U.S. Environmental Protection Agency as described in Section 6.3.2.3.

After September 30, 2005, DOE intends to segregate newly generated liquid waste from the mixed transuranic waste/SBW. The post-2005 newly generated liquid waste could be steam reformed in the same facility as the mixed transuranic waste/SBW or DOE could construct a separate facility to grout the newly generated liquid waste. The steam reformed or grouted waste would be disposed of as low-level or transuranic waste, depending on its characteristics. For purposes of assessing transportation impacts, DOE assumed the grouted waste would be characterized as remote-handled transuranic waste and transported to the Waste Isolation Pilot Plant for disposal.

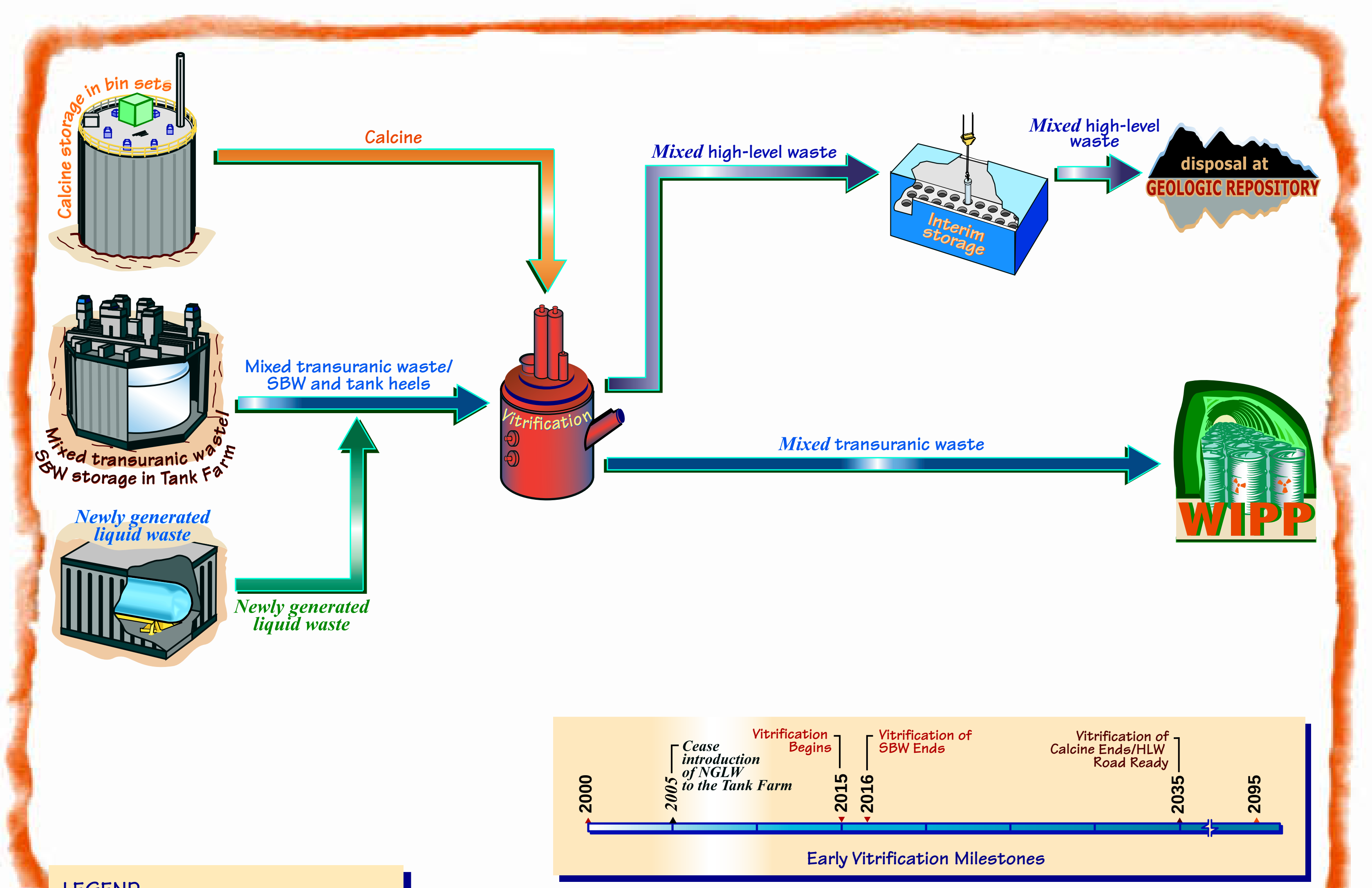
Figure 3-9 shows the Steam Reforming Option. The steam reforming, calcine retrieval and packaging, and treatment of newly generated liquid waste are not interdependent and could be implemented separately. The major facilities and projects required to implement the Steam Reforming Option are listed in Appendix C.6, except for transportation projects, which are addressed in Appendix C.5.

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. 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 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.

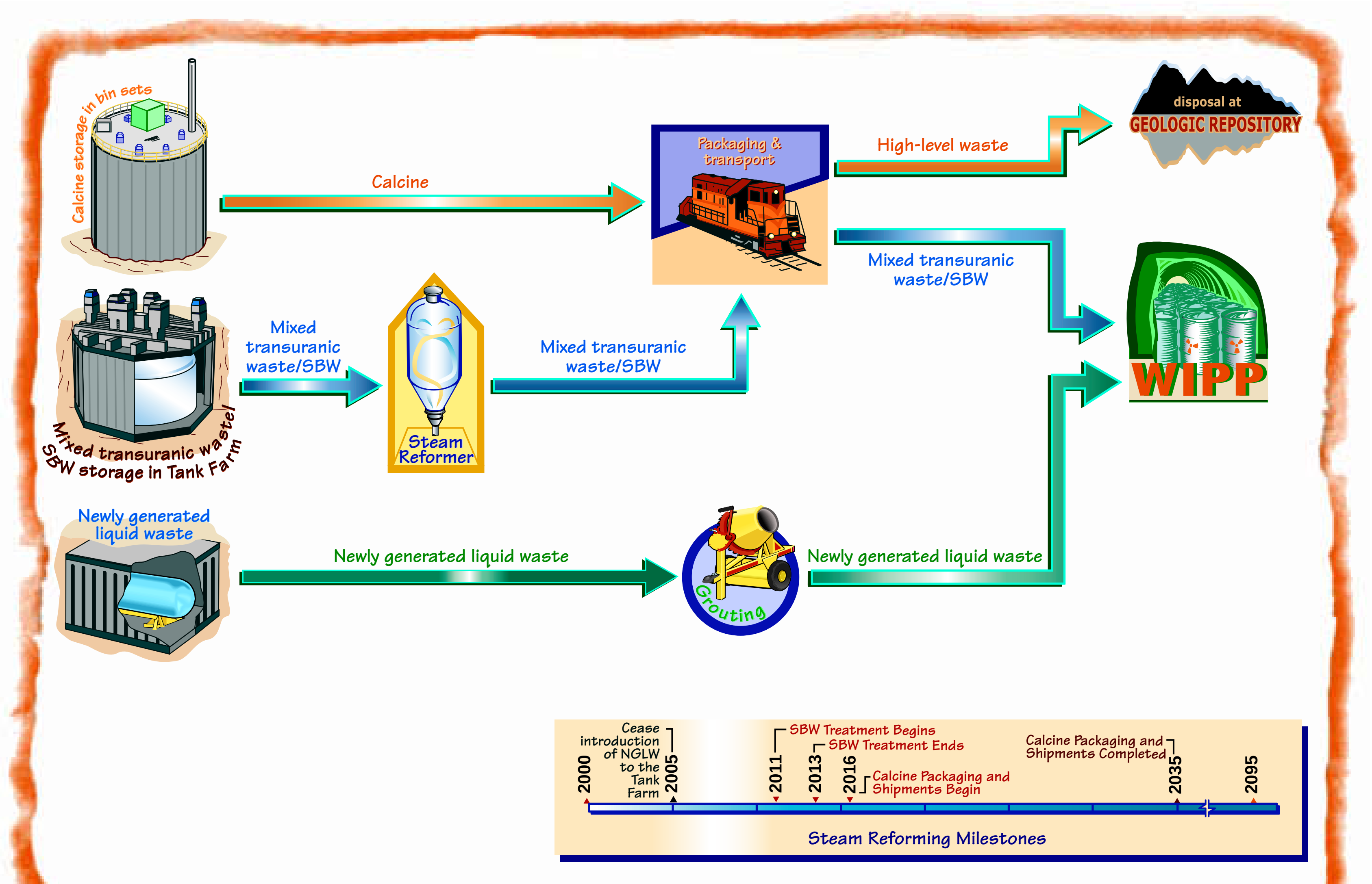
The Minimum INEEL Processing Alternative could substantially reduce the amount of onsite construction, handling, and processing of HLW at INEEL. The alternative includes transport of HLW calcine to Hanford followed by a return of treated HLW and low-level waste to INEEL for storage and disposal, respectively. It provides an opportunity to evaluate the use of comparable DOE or privatized waste treatment facilities in the region.



LEGEND

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

FIGURE 3-8.
Early Vitrification Option.



LEGEND

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

FIGURE 3-9.
Steam Reforming Option.

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. ***A major objective of the Waste Treatment and Immobilization Plant (WTP) is to immobilize 10 percent of the tank waste by volume and 25 percent of the tank waste by radioactivity by 2018. The facility consists of a Pretreatment Plant, a Low Level Waste (LLW) Vitrification Facility, a HLW Vitrification Facility, as well as an analytical laboratory and support facilities. The facilities have been designed to support production of up to 30 metric tons of glass per day of immobilized LLW and 1.5 metric tons of glass per day of immobilized HLW. The Bechtel National, Inc. contract requires that hot commissioning of the facility begin by December 2007 and conclude by January 2011. After hot commissioning is completed, the WTP will then be turned over to an operations contractor in 2011. The Department is continuing to accelerate the project by providing contractor fee incentives to optimize life-cycle performance, cost, and schedule, including the process design, facility design, and technologies.***

Assuming the ***project*** is successful, the facilities could be ***modified to treat*** 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 ***process has*** operating experience.

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 ***would be*** 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 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 ***mixed transuranic*** waste 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 3-1*0* 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.

3.1.6 DIRECT VITRIFICATION ALTERNATIVE

The Direct Vitrification Alternative is to vitrify the mixed transuranic waste/SBW and vitrify the calcine with or without separations. In addition, newly generated liquid waste could be vitrified in the same facility as the mixed transuranic waste/SBW or DOE could construct a separate facility to grout the newly generated liquid waste. DOE has identified two options for vitrification.

The option to vitrify the mixed transuranic waste/SBW and calcine without separations would be similar to the Early Vitrification Option. Mixed transuranic waste/SBW would be retrieved from the INTEC Tank Farm and vitrified. Calcine would be retrieved from the bin sets, vitrified, and interim stored pending disposal in a geologic repository.

The option to vitrify the mixed transuranic waste/SBW and vitrify the HLW fraction after calcine separations would be similar to the Full Separations Option and would be selected if it were technically and economically practical. Mixed transuranic waste/SBW would be retrieved from the INTEC Tank Farm and vitrified. The calcine would be retrieved and chemically separated into a HLW fraction and transuranic or low-level waste fractions depending on the characteristics. The HLW fraction would be vitrified and interim stored pending disposal in a geologic repository. The transuranic or low-level waste fractions would be disposed of at an appropriate disposal facility.

The waste vitrification facility would be designed, constructed, and operated to treat the mixed transuranic waste/SBW and the calcine. The vitrified glass waste form would be poured into stainless steel canisters for transport and disposal out of Idaho. Although the EIS assumes that treatment of the mixed transuranic waste/SBW under this alternative would not be completed until 2015, it may be possible to either complete treatment or transfer any remaining waste to RCRA-compliant tanks by December 2012 in order to meet the Notice of Noncompliance Consent Order requirement to cease use of the HLW tanks by that date. If it is technically and economically practical, chemical separations would be integrated into the INTEC vitrification facility for the treatment of calcine.

Figure 3-11 shows the Vitrification without Calcine Separations Option under the Direct Vitrification Alternative. Figure 3-12 shows the Vitrification with Calcine Separations Option under this alternative. The major facilities and projects required to implement the Direct Vitrification Alternative are listed in Appendix C.6, except for transportation projects, which are addressed in Appendix C.5.

3.1.6.1 Mixed Transuranic Waste/ SBW Treatment

A program would be implemented to determine the specific vitrification technology to be used and would result in the design and construction of a facility with module(s) or unit(s) sized to treat the mixed transuranic waste/SBW and removable tank heels. DOE would cease use of the 11 tanks that comprise the INTEC Tank Farm by December 31, 2012. All mixed transuranic waste/SBW would be vitrified and placed in a road-ready form suitable for transport out of Idaho by a target date of 2035. This would satisfy the Notice of Noncompliance Consent Order (modified on August 18, 1998)

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 3-1*0* 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.

3.1.6 DIRECT VITRIFICATION ALTERNATIVE

The Direct Vitrification Alternative is to vitrify the mixed transuranic waste/SBW and vitrify the calcine with or without separations. In addition, newly generated liquid waste could be vitrified in the same facility as the mixed transuranic waste/SBW or DOE could construct a separate facility to grout the newly generated liquid waste. DOE has identified two options for vitrification.

The option to vitrify the mixed transuranic waste/SBW and calcine without separations would be similar to the Early Vitrification Option. Mixed transuranic waste/SBW would be retrieved from the INTEC Tank Farm and vitrified. Calcine would be retrieved from the bin sets, vitrified, and interim stored pending disposal in a geologic repository.

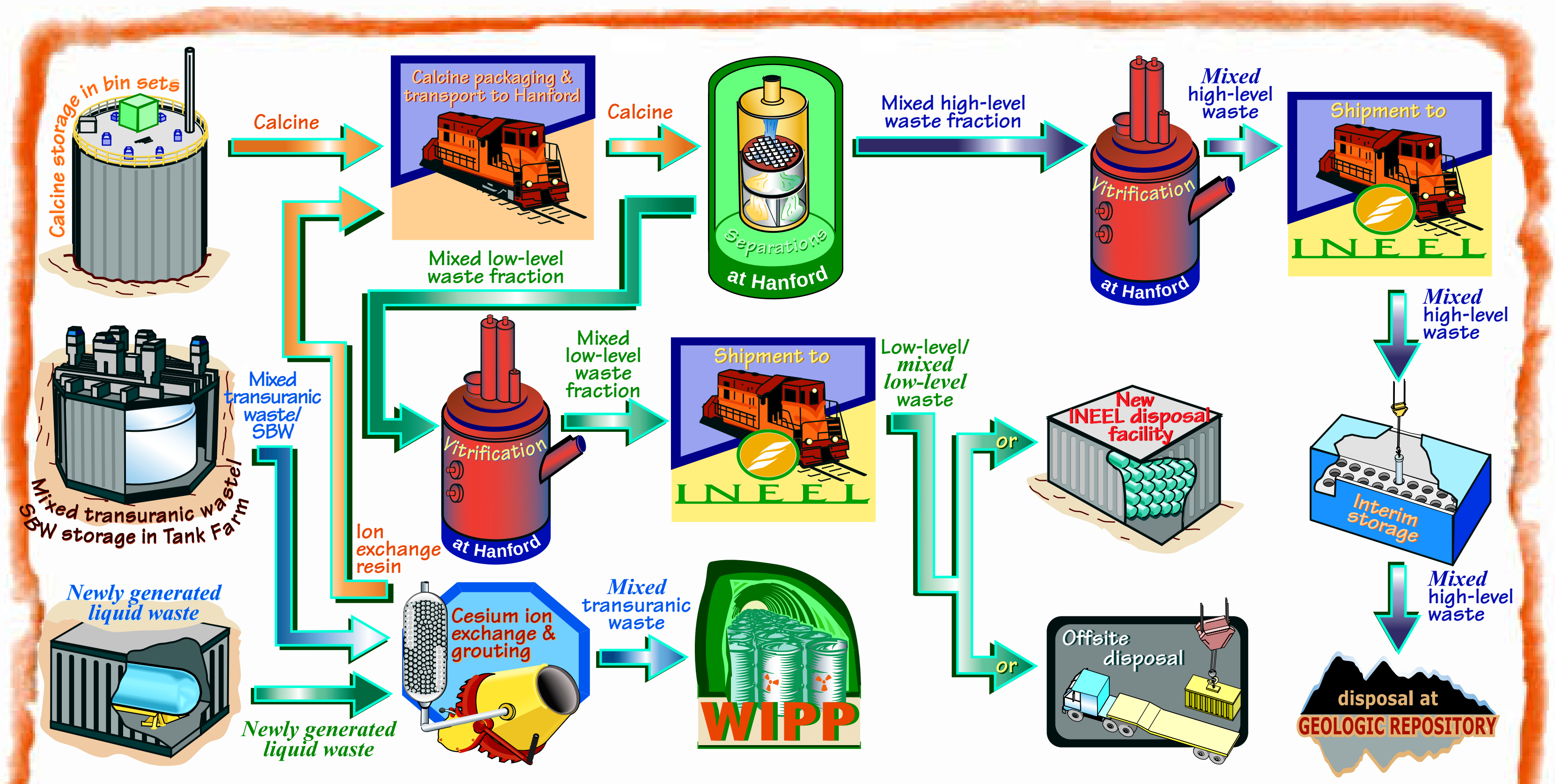
The option to vitrify the mixed transuranic waste/SBW and vitrify the HLW fraction after calcine separations would be similar to the Full Separations Option and would be selected if it were technically and economically practical. Mixed transuranic waste/SBW would be retrieved from the INTEC Tank Farm and vitrified. The calcine would be retrieved and chemically separated into a HLW fraction and transuranic or low-level waste fractions depending on the characteristics. The HLW fraction would be vitrified and interim stored pending disposal in a geologic repository. The transuranic or low-level waste fractions would be disposed of at an appropriate disposal facility.

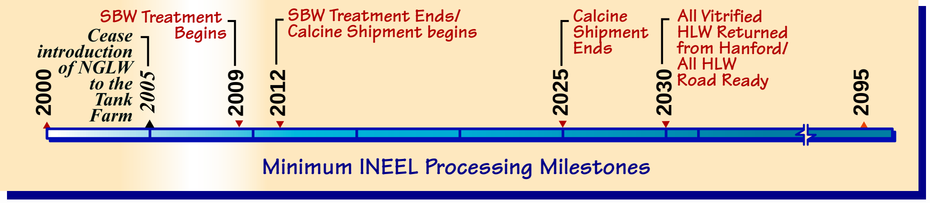
The waste vitrification facility would be designed, constructed, and operated to treat the mixed transuranic waste/SBW and the calcine. The vitrified glass waste form would be poured into stainless steel canisters for transport and disposal out of Idaho. Although the EIS assumes that treatment of the mixed transuranic waste/SBW under this alternative would not be completed until 2015, it may be possible to either complete treatment or transfer any remaining waste to RCRA-compliant tanks by December 2012 in order to meet the Notice of Noncompliance Consent Order requirement to cease use of the HLW tanks by that date. If it is technically and economically practical, chemical separations would be integrated into the INTEC vitrification facility for the treatment of calcine.

Figure 3-11 shows the Vitrification without Calcine Separations Option under the Direct Vitrification Alternative. Figure 3-12 shows the Vitrification with Calcine Separations Option under this alternative. The major facilities and projects required to implement the Direct Vitrification Alternative are listed in Appendix C.6, except for transportation projects, which are addressed in Appendix C.5.

3.1.6.1 <u>Mixed Transuranic Waste/ SBW Treatment</u>

A program would be implemented to determine the specific vitrification technology to be used and would result in the design and construction of a facility with module(s) or unit(s) sized to treat the mixed transuranic waste/SBW and removable tank heels. DOE would cease use of the 11 tanks that comprise the INTEC Tank Farm by December 31, 2012. All mixed transuranic waste/SBW would be vitrified and placed in a road-ready form suitable for transport out of Idaho by a target date of 2035. This would satisfy the Notice of Noncompliance Consent Order (modified on August 18, 1998)

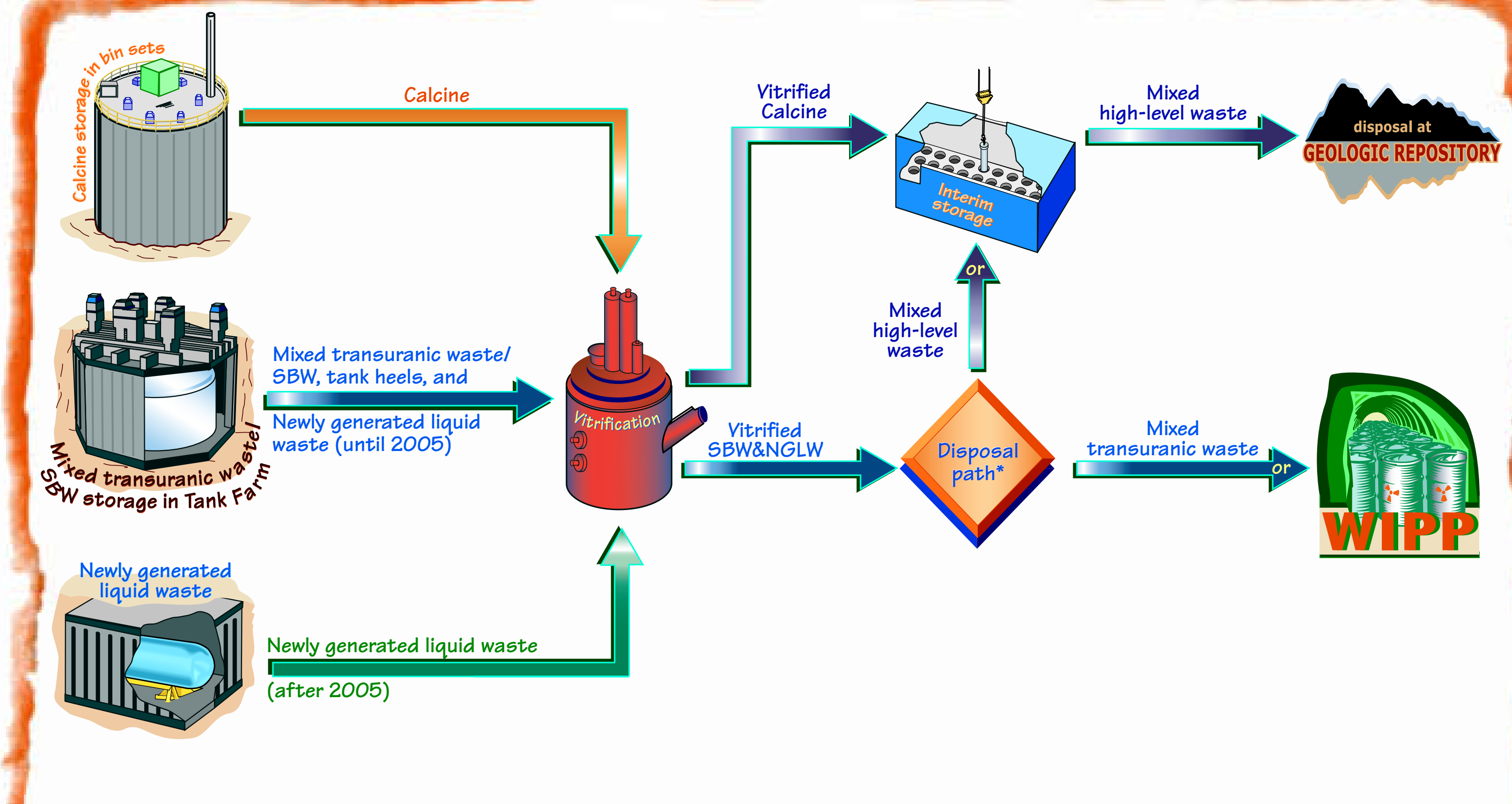


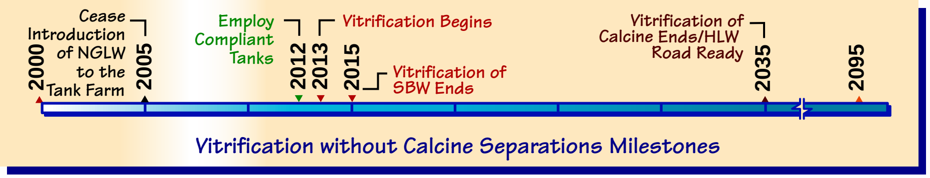


LEGEND

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

FIGURE 3-10.
Minimum INEEL Processing Alternative.



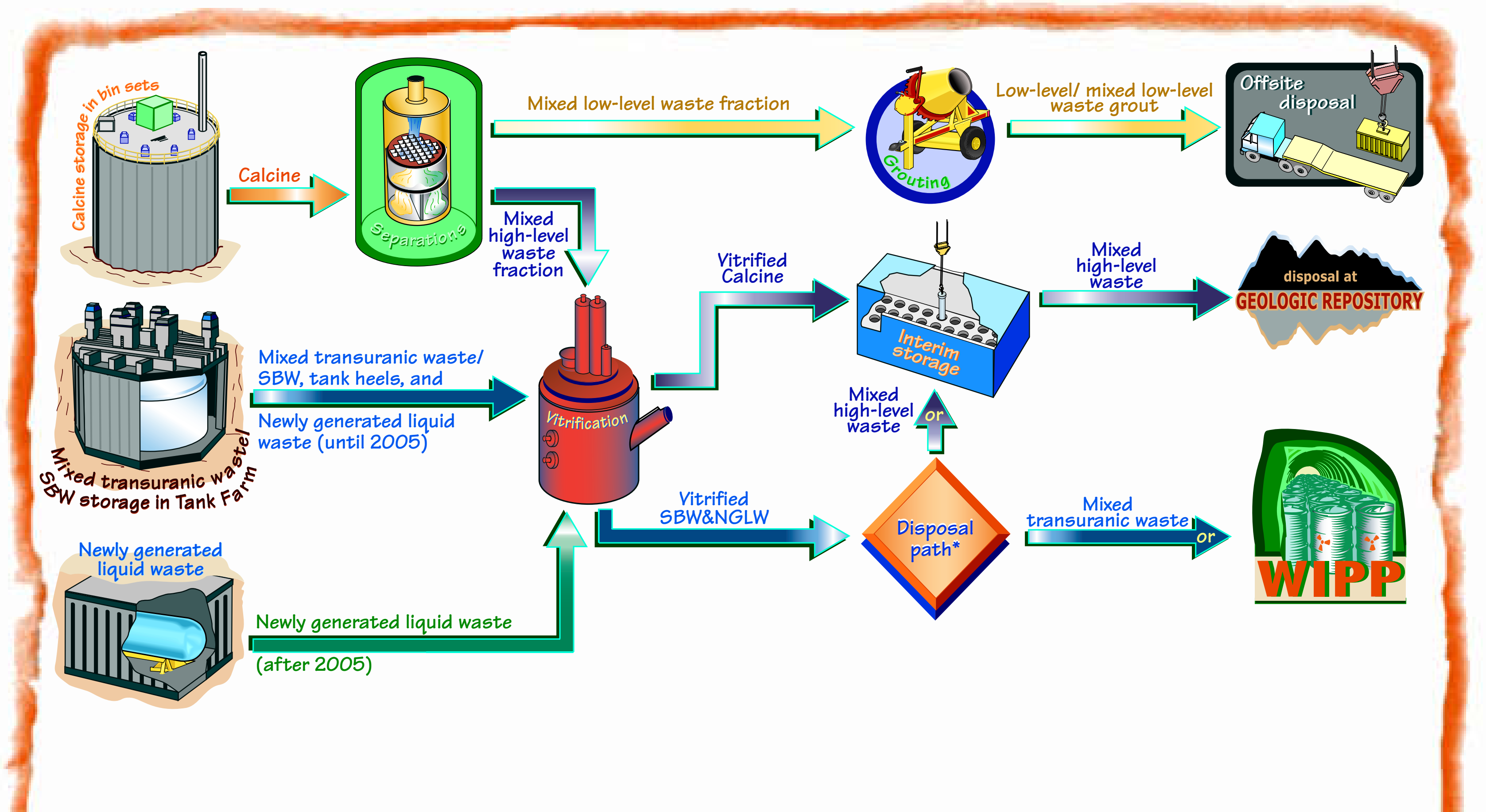


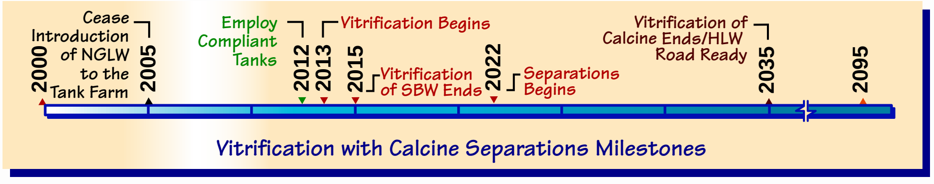
LEGEND

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

* Disposal path based on Waste Incidental to Reprocessing Determination.

FIGURE 3-11.
Vitrification without Calcine Separations Option.





Vitrification with Calcine Separations Milestones

LEGEND

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

* Disposal path based on Waste Incidental to Reprocessing Determination.

FIGURE 3-12.
Vitrification with Calcine Separations Option.

and comply with requirements of the Settlement Agreement/Consent Order.

If the waste incidental to reprocessing determination results in a decision to treat and dispose of the SBW as transuranic waste, DOE would vitrify the waste and transport it to the Waste Isolation Pilot Plant. However, if the waste incidental to reprocessing determination results in a decision to treat, store, and dispose of the SBW as HLW, then DOE would vitrify the waste and dispose of it in a geologic repository. If a repository is not immediately available, the treated HLW would be stored at INTEC in an interim storage facility until a repository was available. Chapter 5 presents the impacts associated with interim storage and transportation of the treated SBW for both possible outcomes of the waste incidental to reprocessing determination.

3.1.6.2 Calcine Treatment

The Direct Vitrification Alternative for calcine treatment is to retrieve the calcine presently stored in the six bin sets at INTEC, vitrify it, and place it in a form to enable compliance with the current legal requirement to have HLW road ready by a target date of 2035. Concurrent with the program to design, construct, and operate the vitrification facility for mixed transuranic waste/SBW, DOE would initiate a program to characterize the calcine, and develop methods to construct and install the necessary equipment to retrieve calcine from the bin sets. DOE would focus technology development on the feasibility and benefits of performing calcine separations as well as refine cost and engineering design. Conditioned on the outcome of future technology development and resulting treatment decisions, DOE may design and construct the appropriate calcine separations capability at INEEL.

For calcine vitrification at INEEL, the mixed transuranic waste/SBW vitrification facility could be scaled-up by a new modular addition or modification of unit(s) to accommodate calcine treatment. The size of the vitrification facility would depend on whether the entire inventory of calcine or only a separated mixed HLW fraction would need to be vitrified. Vitrified calcine or any vitrified mixed HLW fraction resulting from calcine separations would be stored in an interim storage facility to be constructed at INTEC pending transport to a storage facility or national geologic repository outside of Idaho. Alternatively, if calcine were separated at INEEL, DOE could decide to send the HLW fraction to Hanford for vitrification. DOE would evaluate the advantages of this option as the Hanford vitrification facility is being developed (see Appendix C.8 and Section 3.1.5).

If separations technologies are used, DOE would make a waste incidental to reprocessing determination under DOE Order 435.1 and Manual 435.1-1 to determine if the non-HLW fractions would be managed as transuranic waste or low-level waste. If it were determined that a waste fraction was transuranic, then it would be treated, containerized, and shipped to the Waste Isolation Pilot Plant. Low-level or mixed low-level waste fractions would be packaged and disposed of at licensed commercial facilities or at the Hanford Site or Nevada Test Site in accordance with the DOE's Record of Decision for the Final Waste Management Programmatic EIS (65 FR 10061, February 25, 2000). 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.

3.1.6.3 Newly Generated Liquid Waste Treatment

After September 30, 2005, DOE intends to segregate newly generated liquid waste from the mixed transuranic waste/SBW. The post-2005 newly generated liquid waste could be vitrified in the same facility as the mixed transuranic waste/SBW or DOE could construct a separate facility to grout the newly generated liquid waste. The vitrified or grouted waste would be packaged and disposed of as low-level or transuranic waste, depending on its characteristics.

Under this alternative, DOE analyzed impacts of treating newly generated liquid waste as mixed transuranic waste/SBW (by vitrification). This was done for comparability of impacts with the other waste processing alternatives, which assumed newly generated liquid waste would be treated in the same manner as the mixed

transuranic waste/SBW. The EIS also presents the impacts for a grout facility (see Project P2001 in Appendix C.6) that could be used to treat the waste generated after 2005. For purposes of assessing transportation impacts, DOE assumed the grouted waste would be characterized as remote-handled transuranic waste and transported to the Waste Isolation Pilot Plant for disposal (see Appendix C.5).

3.2 Facility Disposition Alternatives

The waste processing alternatives described in Section 3.1 do not include any specific facility disposition ***alternatives*** 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).

The facility disposition analysis considers 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.

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-***1*** identifies the major facilities that would be constructed for each waste processing alternative.

Facility Disposition

Facility disposition would include activities performed under multiple regulatory programs to address INTEC facilities that no longer **had** *a mission and* **required placement** *in a condition consistent with 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.

transuranic waste/SBW. The EIS also presents the impacts for a grout facility (see Project P2001 in Appendix C.6) that could be used to treat the waste generated after 2005. For purposes of assessing transportation impacts, DOE assumed the grouted waste would be characterized as remote-handled transuranic waste and transported to the Waste Isolation Pilot Plant for disposal (see Appendix C.5).

3.2 Facility Disposition Alternatives

The waste processing alternatives described in Section 3.1 do not include any specific facility disposition ***alternatives*** 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).

The facility disposition analysis considers 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.

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-***1*** identifies the major facilities that would be constructed for each waste processing alternative.

Facility Disposition

Facility disposition would include activities performed under multiple regulatory programs to address INTEC facilities that no longer **had** a mission and **required placement** in a condition consistent with 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.

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 risk to human health and the environment. The U.S. 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 ***through*** 2035, many of the facilities identified in Table 3-***3*** could be deactivated. This means that bulk chemicals would be removed and the facility could be de-energized. 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 ***through*** 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 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 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 – ***Under the Clean Closure Alternative,*** 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.

Table 3-3. Facility disposition alternatives *analyzed in this EIS*.

	Performance-Based Closure Methods				
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
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 3-3. Facility disposition alternatives *analyzed in this EIS* (continued).

	Performance-Based Closure Methods				
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
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.

Performance-Based Closure – ***Under the Performance-Based Closure Alternative, contamination would remain that is below the levels that would impact human health and the environment as established by regulations, and*** closure methods would be dictated on a case-by-case basis. ***These levels, commonly referred to as action levels, are either risk-based (e.g., residual contaminant levels established by requirements) or performance-based (e.g., drinking water standards). Once the performance-based levels are achieved, the unit/facility is deemed closed according to RCRA and/or DOE requirements. Other activities may then occur to the unit/facility such as decontamination and decommissioning or future operations (where non-hazardous waste can enter the unit/facility).*** Most above-grade facilities/units would be ***demolished*** and most below-grade facilities/units (tanks, vaults, and transfer piping) would be stabilized and left in place. ***The*** residual contaminants would no longer pose any unacceptable exposure (or risk) to workers, the public, ***and the environment***.

Closure to Landfill Standards – ***Under the Closure to Landfill Standards Alternative,*** the facilities would be closed in accordance with state, Federal ***and/or DOE*** requirements for closure of landfills. ***For landfill closures, wastes are removed to the extent practicable. However, quantities remaining would not meet clean closure or performance-based closure action levels. Therefore, there is a greater potential risk from a landfill closure when compared to a Performance-Based or Clean Closure. Because of this, capping and post-closure monitoring would be required to protect the health and safety of the workers and the public from releases of contaminants from the facility.*** Waste residuals within tanks, vaults, and piping would be stabilized in order to minimize the release of contaminants into the environment. Once waste residues ***were*** stabilized, protection of the environment ***would be ensured*** 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, ***to protect the health and safety of the workers and the public from releases of contaminants from the facility/unit in accordance with the closure performance standards. The unit/facility cap requires maintenance and ground water monitoring of the landfill for 30 years (a waiver may be applied for after 5***

years). Also, a landfill closure is required to have a Corrective Action Plan that would be implemented in the event any contamination is detected beyond the boundary of the landfill. Implementing a corrective action resets the time for maintenance and monitoring for another 30 years.

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 evaluates two additional facility disposition alternatives for the Tank Farm and bin sets ***as follows.***

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 program (Federal Facility Agreement and Consent Order), DOE, the U.S. Environmental Protection Agency, and the State of Idaho have made decisions regarding the disposition of environmental media, such as contaminated soils and water. While this program is not the subject of this EIS, decisions regarding disposition of HLW facilities are being coordinated with decisions made ***under Waste Area Groups***. ***Waste Area Group 3*** activities also contribute to the cumulative impacts presented in Section 5.4 of this EIS. Chapter 6 provides ***additional regulatory discussion.***

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 impact analysis 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 each significant HLW ***management*** facility, DOE considered which of the facility disposition alternatives would be most appropriate ***for analysis in the EIS***. The determination of the applicable disposition methods was based on the facility and residual waste characteristics. ***The EIS does not analyze all potential facility disposition alternatives for each of the HLW management facilities. However, as explained below, the alternative(s) selected for analysis are representative of the impacts that would be expected for the entire range of facility disposition alternatives. Consequently, for a specific HLW management facility, DOE may select from the full range of facility disposition alternatives (Clean Closure, Performance-Based***

Closure, or Closure to Landfill Standards) based on the analyses in this EIS. A list of the existing HLW management facilities and the corresponding facility disposition alternatives ***analyzed in the EIS*** is provided in Table 3-***3***.

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 ***management*** facilities. ***In general, DOE selected the Closure to Landfill Standards alternative for analysis because it represents the maximum impacts for facility disposition. In some cases, the contaminants associated with a facility posed very small residual risk and DOE selected the Clean Closure Alternative for analysis to maximize the potential short-term impacts associated with facility disposition activities. T***he New Waste Calcining Facility and the Fuel Processing Building and related facilities ***present slightly higher residual risk than the remainder of the other INTEC HLW management facilities. DOE evaluated a second facility disposition alternative, Performance-Based Closure, for these two facilities to determine whether the potential impacts would vary between alternatives.***

For the new HLW ***management*** facilities identified in Table 3-***1***, DOE analyzed the Clean Closure alternative. This facility disposition assumption is ***consistent with the objectives and requirements of DOE Order 430.1A, Life Cycle Management, and DOE Manual 435.1-1, Radioactive Waste Management Manual, that all newly constructed facilities necessary to implement*** the waste processing alternatives would be designed ***and constructed consistent with measures that facilitate clean closure.***

3.3 Alternatives Eliminated from Detailed Analysis

This section identifies those alternatives that have been eliminated from detailed analysis in this EIS and briefly ***discusses*** why they have been eliminated [40 CFR 1502.14(a)]. CEQ regulations direct all ***federal*** agencies to use the NEPA process to identify and assess ***the*** range of ***reasonable*** 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 CEQ 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 describes 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

Closure, or Closure to Landfill Standards) based on the analyses in this EIS. A list of the existing HLW management facilities and the corresponding facility disposition alternatives ***analyzed in the EIS*** is provided in Table 3-***3***.

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 ***management*** facilities. ***In general, DOE selected the Closure to Landfill Standards alternative for analysis because it represents the maximum impacts for facility disposition. In some cases, the contaminants associated with a facility posed very small residual risk and DOE selected the Clean Closure Alternative for analysis to maximize the potential short-term impacts associated with facility disposition activities. T***he New Waste Calcining Facility and the Fuel Processing Building and related facilities ***present slightly higher residual risk than the remainder of the other INTEC HLW management facilities. DOE evaluated a second facility disposition alternative, Performance-Based Closure, for these two facilities to determine whether the potential impacts would vary between alternatives.***

For the new HLW ***management*** facilities identified in Table 3-***1***, DOE analyzed the Clean Closure alternative. This facility disposition assumption is ***consistent with the objectives and requirements of DOE Order 430.1A, Life Cycle Management, and DOE Manual 435.1-1, Radioactive Waste Management Manual, that all newly constructed facilities necessary to implement*** the waste processing alternatives would be designed ***and constructed consistent with measures that facilitate clean closure.***

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- 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
- ***Grout-in-Place***

Subsequent to issuing the Draft EIS, several new waste processing methods were identified and evaluated. Most of these methods were variations on the waste processing alternatives presented in the Draft EIS. In addition, several new technologies and variations of previously studied treatment options were suggested. For the reasons discussed in Appendix B, these alternatives were eliminated from detailed evaluation in this EIS.

3.3.1 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 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 was 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 ***A*** Type Grout) Option is similar, has ***more*** complex separations processing, and is ***more*** costly than the Transuranic Separations/Class ***C*** 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 ***detailed analysis*** in this EIS.

3.3.2 NON-SEPARATIONS/ VITRIFIED WASTE OPTION

In the Vitrified Waste Option under the Non-Separations Alternative, ***the New Waste Calcining Facility would be upgraded to comply with the Maximum Achievable Control Technology emission requirements, and*** all the mixed transuranic waste/SBW in the Tank Farm would be calcined. 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 include a ***New Waste Calcining Facility upgrade to meet Maximum Achievable Control Technology requirements,*** Calcine Retrieval, High-Activity Waste Vitrification Plant (larger scale than for the Full Separations Option), HLW Interim Storage, 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 Vitrified Waste Option requires 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.

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. 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 ***detailed analysis*** in this EIS.

3.3.3 NON-SEPARATIONS/ 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 mixed transuranic waste/SBW. The combined slurry would be calcined 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 ***or a greater confinement disposal facility***. 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.

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 which eliminates the need to include the Cement-Ceramic Waste 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. Reconfiguring the New Waste Calcining Facility to process a liquid mixed transuranic waste/SBW and calcine slurry would 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 ***detailed analysis*** 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 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 indicate 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 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 ***detailed analysis*** 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 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 ***vitrification*** operations at West Valley ***in 2002 (Sullivan 2002)***. 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 was beyond design basis life or constructed of materials that were incompatible with INEEL HLW.

Therefore, shipment of HLW to the West Valley Site or the Savannah River Site for vitrification was eliminated from ***detailed analysis*** 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 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 mixed transuranic waste/SBW. The 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 accumulated 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 ***detailed*** 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 ***would be*** 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***, which*** would require ***process*** modifications. Second, modifications to the off-gas systems at the Hanford HLW vitrification facility would be required to address higher concentrations of contaminants such as mercury and higher ***levels*** 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 ***detailed analysis*** 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 INEEL ***British Nuclear Fuels Limited*** Advanced Mixed Waste Treatment Project for treatment, with the resulting waste form then being shipped to the Waste Isolation Pilot Plant for disposal. 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 employs multiple treatment technologies (including supercompaction, macroencapsulation, and microencapsulation) to produce final waste forms that ***can*** 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. 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 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. In addition, because of the highly acidic nature of the mixed transuranic 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 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 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 ***detailed analysis*** in this EIS.

3.3.8 GROUT-IN-PLACE

This alternative would grout the mixed transuranic waste/SBW in the tanks and the calcine in the bin sets. For the mixed transuranic waste/SBW, the grout/waste mixture would be entombed directly in the tanks. The calcine would either be mixed with grout and entombed in the bin sets, or the vaults surrounding the bin sets could be filled with clean grout. This alternative was eliminated from detailed analysis for the following reasons:

- ***Tests on simulated acidic waste (i.e., a non-radioactive equivalent to mixed transuranic waste/SBW) revealed that attempting to transform the waste into a stable in situ solid form in the tanks could result in waste stratification and precipitation. Although it may be possible to stabilize the waste by adding a grout mixture directly to the tanks without exceeding their capacity (assuming a 30 percent waste loading and tanks completely filled), there are technical uncertainties related to the solidification of such a large volume of waste in this manner. Therefore, no credit could be taken for the performance of this method of grouting as a means to meet disposal requirements. As a result, it was determined that it would be necessary to remove the mixed transuranic waste/SBW from the tanks and treat it in a new remote handled grouting facility to neutralize and stabilize the waste to avoid stratification and precipitation. The resultant waste and grout slurry could then be placed into the tanks. For the calcine, there is not enough capacity in the bin sets to grout the calcine in place. If the calcine were encased in clean grout around the bin sets, the potential long-term impacts would be similar to the Continued Current Operations and No Action Alternatives. For long-term impact analysis (Section 5.3.5.2 of this EIS), DOE assumed that any structure was vulnerable to degradation failure after 500 years in accordance with the Nuclear Regulatory Commission position for long-term storage facilities (NRC 1994).***

- ***Although NEPA requirements allow agencies to consider alternatives that may not be consistent with applicable laws, regulations, and enforceable agreements, DOE does not regard disposal of all the mixed transuranic waste/SBW in the tanks or calcine in the bin sets to be reasonable, primarily because it would not meet RCRA regulatory disposal requirements for mixed waste at the INEEL.***

3.3.9 OTHER TECHNOLOGIES EVALUATED

New technologies and variations of previously studied treatment options were suggested by the public, the National Academy of Sciences, and subject matter experts. These options were evaluated and eventually eliminated from further detailed analysis. Section B.8.3 of Appendix B includes a summary of these technologies and variations, and discusses why they were eliminated from detailed analysis. In addition, operating the calciner in its present interim status configuration was evaluated and eliminated from detailed analysis in the Final EIS. Based on programmatic considerations, DOE has determined that operating the calciner in its current configuration is not a reasonable alternative.

3.4 Preferred Alternatives

When the Draft EIS was published, DOE and the State of Idaho, as a cooperating agency, had not selected a preferred alternative. Subsequently, DOE and the State of Idaho have selected their Preferred Alternatives for this EIS. The process used to select the Preferred Alternatives is described in Appendix B.

3.4.1 WASTE PROCESSING

The State of Idaho's preferred waste processing alternative - The State of Idaho's Preferred Alternative for waste processing is the Direct Vitrification Alternative described in Section 3.1.6. This alternative includes vitrification of mixed transuranic waste/SBW and vitrification of the HLW calcine with or without separations.

Under the option to vitrify the mixed transuranic waste/SBW and calcine without separations, the mixed transuranic waste/SBW would be retrieved from the INTEC Tank Farm and vitrified. Calcine would be retrieved from the bin sets and vitrified. In both cases, the vitrified product would be stored at INTEC pending disposal in a geologic repository.

The option to vitrify the mixed transuranic waste/SBW and vitrify the HLW fraction after calcine separations would be selected if separations were shown to be technically and economically practical. Mixed transuranic waste/SBW would be retrieved from the INTEC Tank Farm and vitrified. Calcine would be retrieved from the bin sets and chemically separated into a HLW fraction and transuranic or low-level waste fractions, depending on the characteristics of the waste fractions. The HLW fraction would be vitrified. The vitrified product from both the SBW and HLW fraction would be stored at INTEC pending disposal in a geologic repository. The transuranic or low-level waste fractions would be disposed of at an appropriate disposal facility outside of Idaho.

In addition, under the Direct Vitrification Alternative, newly generated liquid waste could be vitrified in the same facility as the mixed transuranic waste/SBW, or DOE could construct a separate treatment facility for newly generated liquid waste.

DOE's preferred waste processing alternative - DOE's preferred waste processing alternative is to implement the proposed action by selecting from among the action alternatives, options and technologies analyzed in this EIS. Table 3-1 identifies DOE's preferred options, and also identifies options contained within the action alternatives that DOE does not prefer. Options not included in DOE's Preferred Alternative are, storage of calcine in the bin sets for an indefinite period under the Continued Current Operations Alternative, the shipment of calcine to the Hanford Site for treatment under the Minimum INEEL Processing Alternative, and disposal of mixed low-level waste on the INEEL under any alternative. The selection of any one of, or combination of, technologies or options used to implement the proposed action would be based on performance criteria that include risk, cost, time and compliance factors. The selection may also be based on the results of laboratory and demonstration scale evaluations and comparisons using actual wastes in proof of process tests. The elements of the proposed action and how they would be addressed under Preferred Alternative are identified below.

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The option to vitrify the mixed transuranic waste/SBW and vitrify the HLW fraction after calcine separations would be selected if separations were shown to be technically and economically practical. Mixed transuranic waste/SBW would be retrieved from the INTEC Tank Farm and vitrified. Calcine would be retrieved from the bin sets and chemically separated into a HLW fraction and transuranic or low-level waste fractions, depending on the characteristics of the waste fractions. The HLW fraction would be vitrified. The vitrified product from both the SBW and HLW fraction would be stored at INTEC pending disposal in a geologic repository. The transuranic or low-level waste fractions would be disposed of at an appropriate disposal facility outside of Idaho.

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- **Select appropriate technologies and construct facilities necessary to prepare INTEC mixed transuranic waste/SBW for shipment to the Waste Isolation Pilot Plant -** DOE would treat all mixed transuranic waste/SBW stored in the INTEC Tank Farm and ship the product waste to the Waste Isolation Pilot Plant for disposal. A range of potential treatment technologies representative of those that could be used is analyzed in this EIS. The Department's objective is to treat the mixed transuranic waste/SBW such that this waste would be ready for shipment to the Waste Isolation Pilot Plant by December 31, 2012.

- **Prepare the mixed HLW calcine so that it will be suitable for disposal in a repository -** DOE would place all mixed HLW calcine in a form suitable for disposal in a repository. This may include any of the treatment technologies analyzed in this EIS as well as shipment to a repository without treatment as analyzed in this EIS. The Department's objective is to place the mixed HLW calcine in a form such that this waste would be ready for shipment out of Idaho by December 2035.

- **Treat and dispose of associated radioactive wastes -** DOE would treat and dispose of all wastes associated with the treatment and management of HLW and mixed transuranic waste at INTEC. This includes the treatment and disposal of newly generated liquid waste. A range of the potential treatment technologies that could be used is analyzed in this EIS.

- **Provide safe storage of HLW destined for a repository -** DOE would continue to store mixed HLW calcine in the INTEC calcine bin sets until the calcine is retrieved for treatment or placed in containers for shipment to a repository.

3.4.2 FACILITIES DISPOSITION

Both DOE and the State of Idaho have designated performance-based closure methods as the Preferred Alternative for disposition of HLW facilities at INTEC. These methods encompass three of the six facility disposition alternatives analyzed in this EIS: Clean Closure, Performance-Based Closure, and Closure to Landfill Standards. Performance-based closure would be implemented in accordance with applicable regulations and DOE Orders. However, any of the disposition alternatives analyzed in this EIS could be implemented under performance-based closure criteria. Consistent with the objectives and requirements of DOE Order 430.1A, *Life Cycle Management*, and DOE Manual 435.1-1, *Radioactive Waste Management Manual*, all newly constructed facilities necessary to implement the waste processing alternatives would be designed and constructed consistent with measures that facilitate clean closure. Therefore, the Preferred Alternative for disposition of new facilities is Clean Closure.

Waste management activities associated with any of the facility disposition alternatives would be carried out over a long period of time. Disposition actions would be implemented incrementally as the facilities associated with the generation, treatment, and storage of high-level and associated wastes approached the completion of their mission. Disposition actions would be systematically planned, documented, executed, and evaluated to ensure public, worker, and environmental protection in accordance with applicable regulations. Performance-based closure may result in some residual wastes being retained within the dispositioned facilities. Residual wastes would be reduced to the extent technically and economically practical. Examples of wastes which may not be totally removed include residuals in the HLW Tank Farm storage tanks, wastes remaining following decontamination of systems, equipment and facility interiors, and unrecoverable calcine in the bin sets. These remaining wastes would be immobilized and the sites would be monitored in accordance with applicable requirements of RCRA, the Idaho Hazardous Waste Management Act, and/or DOE requirements.

In addition, in accordance with DOE Order 435.1, *Radioactive Waste Management*, a Composite Analysis would be developed to determine the allowable accumulated risk to be protective for all pathways resulting from the residual contamination that would be eventually disposed of in-place from all the INTEC facilities. For example, the CERCLA Record of Decision for Waste Area Group 3, INTEC, which

has been provided to the public, committed DOE to restoring the existing contaminated groundwater plume outside the INTEC security fence to meet the current drinking water standard of 4 millirem per year.

A performance assessment would be developed for each facility or group of facilities under consideration for disposition, to determine which of the three disposition alternatives would be implemented. The performance assessment results would be used to identify the impact on the limited cumulative risk in the INTEC area resulting from residual contamination from all facilities. For facilities where a performance assessment is not necessary, residual waste left in place would also be used to identify impacts on the limited cumulative risk in the INTEC area. All residual waste volumes and characteristics would be identified and the accumulation of retained risk tracked to ensure protection adequate for potential receptors. Table 3-3 identifies the facility disposition alternatives analyzed in this EIS for existing facilities. Only one disposition alternative would be selected for each facility. Table 3-1 identifies the major facilities that may be constructed to implement the waste processing alternatives. The analysis of disposition impacts of existing facilities and the new facilities for waste processing alternatives is presented in Section 5.3.

3.5 Summary Level Comparison of Impacts

This section ***provides a summary level comparison of*** the potential environmental impacts of implementing each of the alternatives described in Sections 3.1 and 3.2**.** The 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 present a reasonable projection of the upper bound for potential environmental consequences. Discussion of the level of conservatism and degree of uncertainty in these analyses is presented in Chapter 5. ***Table 3-2*** summarizes some of the key attributes of the ***alternatives and options. Figure 3-13 compares the timelines for each of the alternatives and options with the legal requirements timeline. Tables 3-4 and 3-5*** summarize the potential impacts of ***each alternative*** for the various environmental disciplines (see Appendix C.10 for more details).

The Minimum INEEL Processing Alternative includes impacts associated with the treatment of mixed HLW calcine at the Hanford Site. These impacts are denoted by the "at Hanford" entries in Table 3-4. This alternative also includes impacts associated with transportation of the calcine from INTEC to Hanford and transportation of the treated waste forms (vitrified mixed HLW and mixed LLW fractions from calcine) from Hanford to INEEL. Under the Full Separations Option and the Vitrification with Calcine Separations Option of the Direct Vitrification Alternative, DOE could elect to treat the separated mixed HLW fraction from calcine either at INTEC or at the Hanford Site. Impacts associated with transportation of the separated mixed HLW fraction to the Hanford Site under these options are provided in Appendix C.5 and Section 5.2.9. The impacts associated with treatment of the separated mixed HLW fraction at Hanford would be similar to those presented for the Minimum INEEL Processing Alternative, which includes both separating and treating the calcine at Hanford.

Key differences between the impacts for the alternatives and options include:

- 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, the Minimum INEEL Processing Alternative (which includes separations at the Hanford Site), ***and the Vitrification with Calcine Separations Option of the Direct Vitrification Alternative*** would produce the ***fewest*** HLW canisters. The Non-Separations Alternative ***and the Vitrification without Calcine Separations Option of the Direct Vitrification Alternative*** would significantly

has been provided to the public, committed DOE to restoring the existing contaminated groundwater plume outside the INTEC security fence to meet the current drinking water standard of 4 millirem per year.

A performance assessment would be developed for each facility or group of facilities under consideration for disposition, to determine which of the three disposition alternatives would be implemented. The performance assessment results would be used to identify the impact on the limited cumulative risk in the INTEC area resulting from residual contamination from all facilities. For facilities where a performance assessment is not necessary, residual waste left in place would also be used to identify impacts on the limited cumulative risk in the INTEC area. All residual waste volumes and characteristics would be identified and the accumulation of retained risk tracked to ensure protection adequate for potential receptors. Table 3-3 identifies the facility disposition alternatives analyzed in this EIS for existing facilities. Only one disposition alternative would be selected for each facility. Table 3-1 identifies the major facilities that may be constructed to implement the waste processing alternatives. The analysis of disposition impacts of existing facilities and the new facilities for waste processing alternatives is presented in Section 5.3.

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The Minimum INEEL Processing Alternative includes impacts associated with the treatment of mixed HLW calcine at the Hanford Site. These impacts are denoted by the "at Hanford" entries in Table 3-4. This alternative also includes impacts associated with transportation of the calcine from INTEC to Hanford and transportation of the treated waste forms (vitrified mixed HLW and mixed LLW fractions from calcine) from Hanford to INEEL. Under the Full Separations Option and the Vitrification with Calcine Separations Option of the Direct Vitrification Alternative, DOE could elect to treat the separated mixed HLW fraction from calcine either at INTEC or at the Hanford Site. Impacts associated with transportation of the separated mixed HLW fraction to the Hanford Site under these options are provided in Appendix C.5 and Section 5.2.9. The impacts associated with treatment of the separated mixed HLW fraction at Hanford would be similar to those presented for the Minimum INEEL Processing Alternative, which includes both separating and treating the calcine at Hanford.

Key differences between the impacts for the alternatives and options include:

- 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, the Minimum INEEL Processing Alternative (which includes separations at the Hanford Site), ***and the Vitrification with Calcine Separations Option of the Direct Vitrification Alternative*** would produce the ***fewest*** HLW canisters. The Non-Separations Alternative ***and the Vitrification without Calcine Separations Option of the Direct Vitrification Alternative*** would significantly increase the number of HLW canisters that are produced.

- Transportation related impacts would be greatest for the Non-Separations Alternative ***and the Vitrification without Calcine Separations Option of the Direct Vitrification 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 newly generated liquid waste and Tank Farm heel waste.

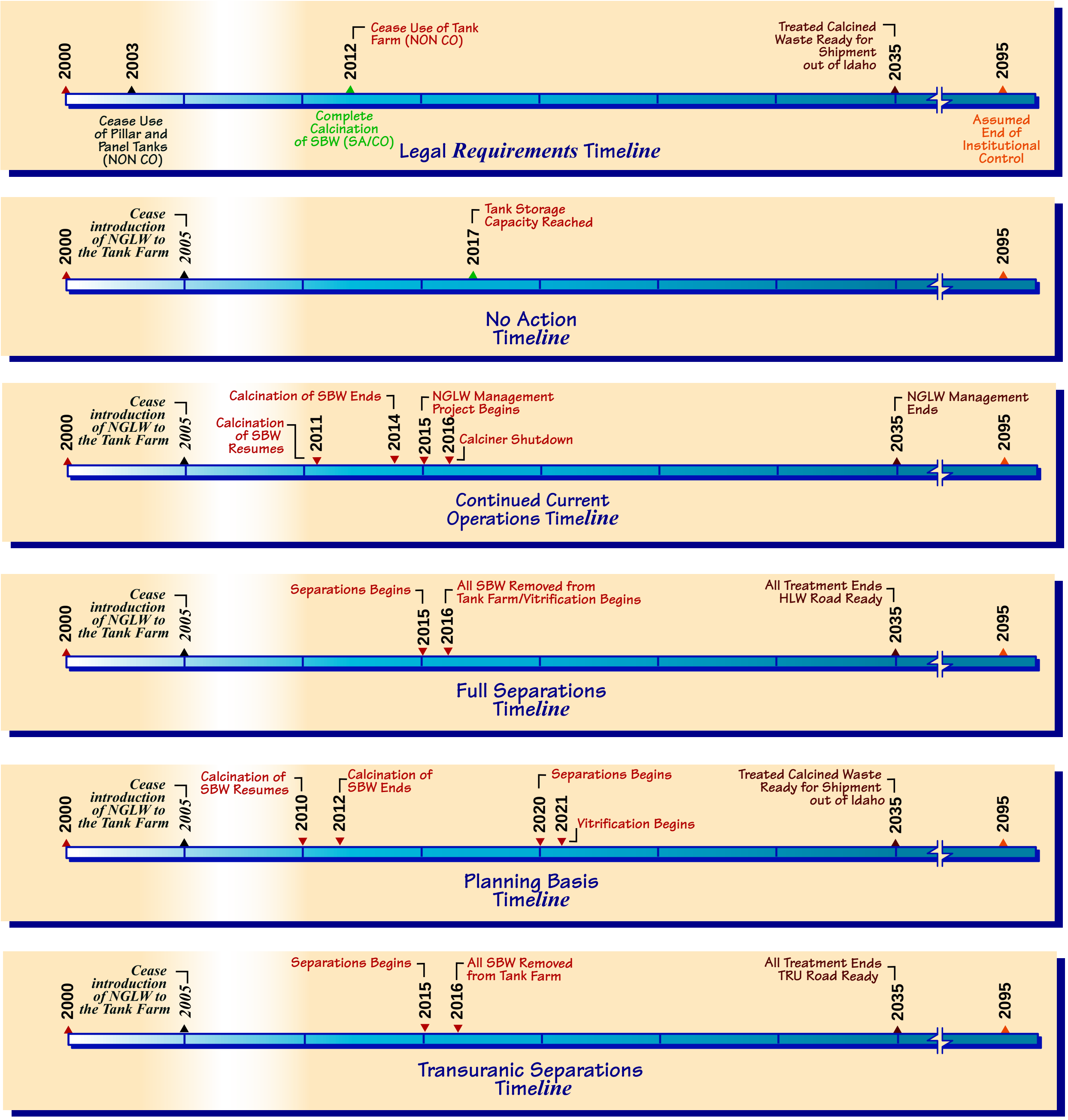
- Nonradiological air emissions would be highest for the Full Separations, Planning Basis, Hot Isostatic Pressed Waste Options ***and the Vitrification with Calcine Separations Option of the Direct Vitrification Alternative.*** These emissions would result from fossil fuel consumption to meet the energy requirements (steam) of the waste processing facilities.

- The Separations Alternative ***and the Vitrification with Calcine Separations Option of the Direct Vitrification 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), ***the Direct Vitrification Alternative (Vitrification with Calcine Separations Option),*** 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 mixed HLW calcine in the bin sets. Beyond design basis event impacts would be greatest for an accident involving the vitrification processes under the Full Separations Option, the Planning Basis Option, ***and the Vitrification with Calcine Separations Option of the Direct Vitrification Alternative.***

The compliance status of the alternatives is addressed in Section 6.3 of the EIS.

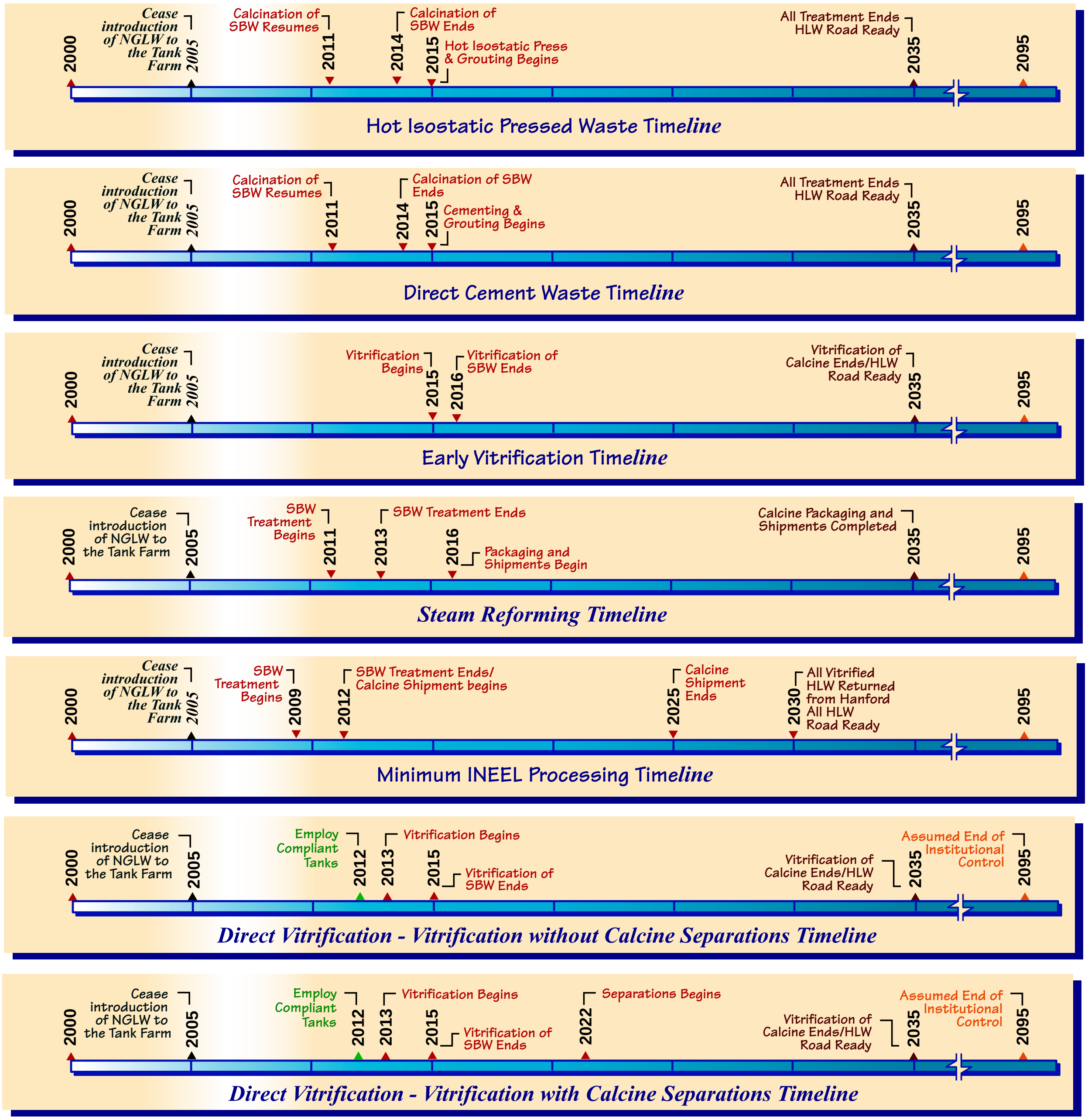


NOTE: In the event any required NEPA analysis results in the selection after October 16, 1995, of an action which conflicts with any action identified in this Agreement, DOE or the Navy may request a modification of this Agreement to confirm the action in the Agreement to that selected action. Approval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

LEGEND

SA/CO	Settlement Agreement/ Consent Order	NGLW	Newly generated liquid waste
SBW	Mixed transuranic waste/ sodium-bearing waste	NON CO	Notice of Noncompliance Consent Order
TRU	Transuranic waste		

FIGURE 3-13. (1 of 2) Timelines



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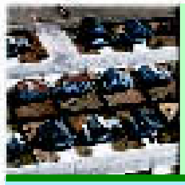
LEGEND

SA/CO	Settlement Agreement/ Consent Order	NGLW	Newly generated liquid waste
SBW	Mixed transuranic waste/ sodium-bearing waste	NON CO	Notice of Noncompliance Consent Order

FIGURE 3-13. (2 of 2)
Timelines

		DOE's Preferred Alternative			State of Idaho's Preferred Alternative
No Action Alternative	Continued Current Operations Alternative	Separations Alternative	Non-Separations Alternative	Minimum INEEL Processing Alternative	*Direct Vitrification Alternative*
 **Land Use**					
No land disturbed outside of INTEC boundary. No change in existing land use.	No land disturbed outside of INTEC boundary. No effects on local or regional land use or land use plans.	Minimal impact due to conversion of 22 acres of undeveloped land adjacent to INTEC to industrial use (new Low-Activity Waste Disposal Facility). No effects on local or regional land use or land use plans.	No land disturbed outside of INTEC boundary. No effects on local or regional land use or land use plans.	At INEEL - Minimal impact due to conversion of 22 acres of undeveloped land adjacent to INTEC to industrial use (new Low-Activity Waste Disposal Facility). No effects on local or regional land use or land use plans. At Hanford - Small impact due to conversion of 52 acres of undeveloped land within 200-East Area to industrial use (Canister Storage Buildings and Calcine Dissolution Facility).	*No land disturbed outside of INTEC boundary.* *No change in existing land use.*
 **Water Resources**					
A temporary increase in sediment loads in stormwater runoff would be expected as a result of limited construction activity. Impact to nearby surface waters would be negligible. There would be no routine discharge of hazardous or radioactive liquid effluents that would result in offsite radiation doses.	A temporary increase in sediment loads in stormwater runoff would be expected as a result of limited construction activity. Impact to nearby surface waters would be negligible. There would be no routine discharge of hazardous or radioactive liquid effluents that would result in offsite radiation doses.	A temporary increase in sediment loads in stormwater runoff would be expected as a result of limited construction activity. Impact to nearby surface waters would be negligible. There would be no routine discharge of hazardous or radioactive liquid effluents that would result in offsite radiation doses.	A temporary increase in sediment loads in stormwater runoff would be expected as a result of limited construction activity. Impact to nearby surface waters would be negligible. There would be no routine discharge of hazardous or radioactive liquid effluents that would result in offsite radiation doses.	At INEEL - A temporary increase in sediment loads in stormwater runoff would be expected as a result of construction activity. Impact to nearby surface waters would be negligible. There would be no routine discharge of hazardous or radioactive liquid effluents that would result in offsite radiation doses. At Hanford- Liquid effluent sent to Effluent Treatment Facility. No discharge to surface waters.	*A temporary increase in sediment loads in storm water runoff would be expected as a result of limited construction activity. Impact to nearby surface waters would be negligible.* *There would be no routine discharge of hazardous or radioactive liquid effluents that would result in offsite radiation doses.*

TABLE 3-4. (1 of 14)
Summary comparison of impacts on resources from waste processing alternatives.



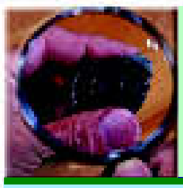
Socioeconomics

	DOE's Preferred Alternative				State of Idaho's Preferred Alternative
No Action Alternative	Continued Current Operations Alternative	Separations Alternative	Non-Separations Alternative	Minimum INEEL Processing Alternative	*Direct Vitrification Alternative*
A total of 40 construction phase (20 direct and 20 indirect) jobs would be retained in the peak year (2005). A total of *220* operations phase jobs (*73* direct and *140* indirect) would be retained in peak year (2007). No impacts on community services or public finances in the region of influence.	A total of 180 construction phase (90 direct and 90 indirect) jobs would be retained in the peak year (2008). A total of *830* operations phase jobs (280 direct and *550* indirect) would be retained in peak year (2015). No significant new job growth expected in INEEL workforce because jobs would be filled by reassigned and retrained workers. No impacts on community services or public finances in the region of influence.	FS 1,700 construction phase jobs (850 direct and *830* indirect) retained in the peak year (2013). PB *1,700* construction phase jobs (870 direct and *840* indirect) retained in the peak year (2013). TS *1,300* construction phase jobs (680 direct and *650* indirect) retained in the peak year (2012). FS Total of *1,300* operations phase jobs (440 direct and *870* indirect) retained in peak year (2018). PB Total of *1,400* operations phase jobs (480 direct and *950* indirect) retained in peak year (2020). TS Total of *950* operations phase jobs (320 direct and *630* indirect) retained in peak year (2015). No significant new job growth expected in INEEL workforce under any option because jobs would be filled by reassigned and retrained workers. No impacts on community services or public finances in the region of influence.	HIP *710* construction phase jobs (360 direct and *350* indirect) retained in the peak year (2008). DC *790* construction phase jobs (400 direct and *390* indirect) retained in the peak year (2008). EV *650* construction phase jobs (330 direct and *320* indirect) retained in the peak year (2008). *SR 1,100 construction phase jobs (550 direct and 530 indirect) retained in peak year (2010).* HIP Total of *1,400* operations phase jobs (460 direct and *910* indirect) retained in peak year (2015). DC Total of *1,600* operations phase jobs (530 direct and *1,000* indirect) retained in peak year (2015). EV Total of *980* operations phase jobs (330 direct and *650* indirect) retained in peak year (2015). *SR Total of 520 operations phase jobs (170 direct and 340 indirect) retained in peak year (2012).* No significant new job growth expected in INEEL workforce under any option because jobs would be filled by reassigned and retrained workers. No impacts on community services or public finances in the region of influence.	At INEEL - *390* construction phase jobs (200 direct and *190* indirect) retained in the peak year (2008). At Hanford - *570* construction phase jobs (290 direct and *280* indirect) retained in the peak year (2024). At INEEL - Total of *980* operations phase jobs (330 direct and *650* indirect) retained in peak year *(2018)*. No significant new job growth expected in INEEL workforce because jobs would be filled by reassigned and retrained workers. No impacts on community services or public finances in the region of influence. At Hanford - Total of *2,200* operations phase jobs (740 direct and *1,500* indirect) would be created, resulting in a 10 percent increase in Hanford Site employment and less than 1 percent increase in employment in the region of influence.	*VWOCS 690 construction phase jobs (350 direct and 340 indirect) retained in the peak year (2011).* *VWCS 1,300 construction phase jobs (670 direct and 650 indirect) retained in the peak year (2019).* *VWOCS Total of 910 operations phase jobs (310 direct and 600 indirect) retained in peak year (2015).* *VWCS Total of 1,300 operations phase jobs (440 direct and 880 indirect) retained in peak year (2023).* *No significant new job growth expected in INEEL workforce under either option because jobs would be filled by reassigned and retrained workers. No impacts on community services or public finances in the region of influence.*

LEGEND

FS	Full Separations Option
PB	Planning Basis Option
TS	Transuranic Separations Option
HIP	Hot Isostatic Pressed Waste Option
DC	Direct Cement Waste Option
EV	Early Vitrification Option
SR	Steam Reforming Option
VWOCS	Vitrification without Calcine Separations Option
VWCS	Vitrification with Calcine Separations Option

TABLE 3-4. (2 of 14)
Summary comparison of impacts on resources from waste processing alternatives.



Cultural Resources

	DOE's Preferred Alternative				State of Idaho's Preferred Alternative
No Action Alternative	Continued Current Operations Alternative	Separations Alternative	Non-Separations Alternative	Minimum INEEL Processing Alternative	Direct Vitrification Alternative
No impacts to cultural resources would be expected.	*Some minor visual degradation of the cultural setting of the INEEL and adjacent lands would occur from process air emissions through 2016.*	Some minor visual degradation of the cultural setting of the INEEL and adjacent lands would occur from process air emissions through 2035. If cultural resources or human remains are uncovered during construction phase of projects, a stop-work order would be issued and the INEEL Cultural Resources Management Office, State Historic Preservation Officer, and Native American tribes would immediately be notified. Specific mitigation measures would be determined in consultation with these groups.	Some minor visual degradation of the cultural setting of the INEEL and adjacent lands would occur from process air emissions through 2035. If cultural resources or human remains are uncovered during construction phase of projects, a stop-work order would be issued and the INEEL Cultural Resources Management Office, State Historic Preservation Officer, and Native American tribes would immediately be notified. Specific mitigation measures would be determined in consultation with these groups.	At INEEL - Some minor visual degradation of the cultural setting of the INEEL and adjacent lands would occur from process air emissions through 2035. If cultural resources or human remains are uncovered during construction phase of projects, a stop-work order would be issued and the INEEL Cultural Resources Management Office, State Historic Preservation Officer and Native American tribes would immediately be notified. Specific mitigation measures would be determined in consultation with these groups. At Hanford - Several new facilities would be built within the 200-East Area of the Hanford Site. In accordance with the Hanford Cultural Resources Management Plan, DOE would identify and evaluate cultural resources associated with the project locations and mitigate possible damage to those cultural resources.	*Some minor visual degradation of the cultural setting of the INEEL and adjacent lands would occur from process air emissions through 2035.* *If cultural resources or human remains are uncovered during construction phase of projects, a stop-work order would be issued and the INEEL Cultural Resource Management Office, State Historic Preservation Officer, and Native American tribes would immediately be notified.* *Specific mitigation measures would be determined in consultation with these groups.*

TABLE 3-4. (3 of 14)
Summary comparison of impacts on resources from waste processing alternatives.

Aesthetic/Scenic Resources

State of Idaho's Preferred Alternative

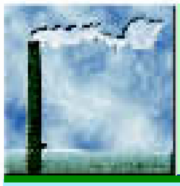
DOE's Preferred Alternative

No Action Alternative	Continued Current Operations Alternative	Separations Alternative	Non-Separations Alternative	Minimum INEEL Processing Alternative	*Direct Vitrification Alternative*
The existing INEEL visual setting would not change, nor would scenic resources be affected.	There would be negligible change in the INEEL visual setting. Scenic resources would be minimally affected.	Options under this alternative would have the highest potential for visibility degradation due to emissions of fine particulate matter and nitrogen dioxide. The Planning Basis Option presents the highest potential for impact (although its projected impacts are minimal), followed by the Full Separations and Transuranic Separations Option. Engineered air pollution control systems would likely be employed to limit impacts.	There would be negligible change in the visual setting. Scenic resources would be minimally affected.	At INEEL - There would be negligible change in the visual setting. Scenic resources would be minimally affected. At Hanford - Under certain conditions, plumes would be visible at site boundaries. Visual impacts would be minor.	*VWOCS There would be negligible change in the visual setting. Scenic resources would be minimally affected.* *VWCS Impacts would be similar to the Separations Alternative. There is potential for visibility degradation due to emissions of fine particulate matter, nitrogen dioxide, and sulfur dioxide. Engineered pollution control systems would likely be employed to limit impacts.*

Geology/Soils

No Action Alternative	Continued Current Operations Alternative	Separations Alternative	Non-Separations Alternative	Minimum INEEL Processing Alternative	*Direct Vitrification Alternative*
Minimal impacts to geologic resources and soils from limited construction.	Minimal impacts to geologic resources and soils from limited construction.	Small potential impacts on geologic resources and soils from construction activities. DOE would employ standard soil conservation measures to limit soil loss and stabilize disturbed areas.	Small potential impacts on geologic resources and soils from construction activities. DOE would employ standard soil conservation measures to limit soil loss and stabilize disturbed areas.	At INEEL - Small potential impacts from soil erosion as a result of construction activities. DOE would employ standard soil conservation measures to limit soil loss and stabilize disturbed areas. At Hanford - Small potential for erosion as a result of construction activities.	*Small potential impacts on geologic resources and soils from construction activities.* *DOE would employ standard soil conservation measures to limit soil loss and stabilize disturbed areas.*

TABLE 3-4. (4 of 14)
Summary comparison of impacts on resources from waste processing alternatives.



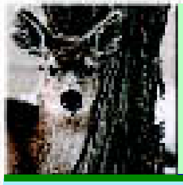
Air Resources

	DOE's Preferred Alternative				***State of Idaho's*** **Preferred Alternative**
No Action Alternative	Continued Current Operations Alternative	Separations Alternative	Non-Separations Alternative	Minimum INEEL Processing Alternative	***Direct Vitrification Alternative***
Radiation doses from emissions would be 6.0x10^{-4} millirem per year to offsite MEI; no criteria pollutant would exceed significance threshold. Maximum offsite impact of carcinogenic toxic pollutant emissions would be approximately *1.2* percent of the applicable standard.	Radiation dose from emissions would be 1.7x10^{-3} millirem per year to offsite MEI under this alternative. One criteria pollutant (SO$_2$) would exceed significance threshold. Maximum offsite impact of carcinogenic toxic pollutant emissions would be approximately *1.9* percent of the applicable standard.	FS Radiation dose from emissions would be 1.2x10^{-4} millirem per year to offsite MEI; two criteria pollutants (SO$_2$ and NO$_x$) would exceed significance thresholds. PB Radiation dose from emissions would be 1.8x10^{-3} millirem per year to offsite MEI; two criteria pollutants (SO$_2$ and NO$_x$) would exceed significance thresholds. TS Radiation dose from emissions would be 6.0x10^{-5} millirem per year to offsite MEI; *two criteria pollutants* (SO$_2$ *and* NO$_x$) *would* exceed significance thresholds. Maximum offsite impact of carcinogenic toxic pollutant emissions would be *4.5 to 10* percent of the applicable standard under the Separations Alternative.	HIP Radiation dose from emissions would be 1.8x10^{-3} millirem per year to offsite MEI, two criteria pollutants (SO$_2$ and NO$_x$) would exceed significance thresholds. DC Radiation dose from emissions would be 1.7x10^{-3} millirem per year to offsite MEI, one criteria pollutant (SO$_2$) would exceed significance threshold. EV Radiation dose from emissions would be 8.9x10^{-4} millirem per year to offsite MEI; *no criteria pollutant would exceed significance threshold.* ***SR Radiation dose from emissions would be 6.2x10^{-4} millirem per year to offsite MEI; no criteria pollutant would exceed significance threshold.*** Maximum offsite impact of carcinogenic toxic pollutant emissions would be *0.71 to 2.9* percent of the applicable standard under the Non-Separations Alternative.	At INEEL - Radiation dose from emissions would be 9.5x10^{-4} millirem per year to offsite MEI; no criteria pollutant would exceed significance threshold. Maximum offsite impact of carcinogenic toxic pollutant emissions would be *0.95* percent of applicable standard. At Hanford - Radiation dose from emissions would be low (1.7x10^{-5} millirem per year to offsite MEI); one criteria pollutant (CO) would exceed significance threshold.	***VWOCS Radiation dose from emissions would be 6.5x10^{-4} millirem per year to offsite MEI; no criteria pollutant would exceed significance threshold.*** ***VWCS Radiation dose from emissions would be 6.8x10^{-4} millirem per year to offsite MEI; two criteria pollutants (SO$_2$ and NO$_x$) would exceed significance thresholds.*** ***Maximum offsite impact of carcinogenic toxic pollutant emissions would be 1.7 to 9.5 percent of the applicable standard under the Direct Vitrification Alternative.***

LEGEND

FS	Full Separations Option
PB	Planning Basis Option
TS	Transuranic Separations Option
HIP	Hot Isostatic Pressed Waste Option
DC	Direct Cement Waste Option
EV	Early Vitrification Option
SR	Steam Reforming Option
MEI	Maximally exposed individual
VWOCS	Vitrification without Calcine Separations Option
VWCS	Vitrification with Calcine Separations Option

TABLE 3-4. (5 of 14)
Summary comparison of impacts on resources from waste processing alternatives.



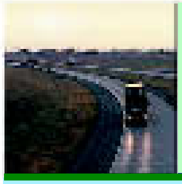
Ecological Resources

State of Idaho's **Preferred Alternative**

DOE's Preferred Alternative

No Action Alternative	Continued Current Operations Alternative	Separations Alternative	Non-Separations Alternative	Minimum INEEL Processing Alternative	*Direct Vitrification Alternative*
No impacts to state or Federally-listed species or designated critical habitats are expected. Jurisdictional wetlands would not be affected. Potential exposure of plants and animals to hazardous and radiological contaminants from emissions would be small. Biotic populations and communities would not be affected.	No impacts to state or Federally-listed species or designated critical habitats are expected. Jurisdictional wetlands would not be affected. Potential exposure of plants and animals to hazardous and radiological contaminants from emissions would be small. Biotic populations and communities would not be affected.	No impacts to state or Federally-listed species or designated critical habitats are expected. Jurisdictional wetlands would not be affected. Construction of a Low-Activity Waste Disposal Facility would disturb 22 acres of undeveloped land adjacent to INTEC, but the site provides only marginal wildlife habitat. Therefore, impacts would be minimal. Potential exposure of plants and animals to hazardous and radiological contaminants from emissions would be small. Biotic populations and communities would not be affected.	No impacts to state or Federally-listed species or designated critical habitats are expected. Jurisdictional wetlands would not be affected. Potential exposure of plants and animals to hazardous and radiological contaminants from emissions would be small. Biotic populations and communities would not be affected.	At INEEL - No impacts to state or Federally-listed species or designated critical habitats are expected. Jurisdictional wetlands would not be affected. Construction of a Low-Activity Waste Disposal Facility would disturb 22 acres of undeveloped land adjacent to INTEC, but the site provides only marginal wildlife habitat. Therefore, impacts would be minimal. Potential exposure of plants and animals to hazardous and radiological contaminants from emissions would be small. Biotic populations and communities would not be significantly affected. At Hanford - New facilities could require the conversion of 52 acres of shrub-steppe habitat to industrial use. Impacts to biodiversity would be small and local in scope. There would be no impacts to wetlands or special status species.	*No impacts to state or Federally-listed species or designated critical habitats are expected.* *Jurisdictional wetlands would not be affected.* *Potential exposure of plants and animals to hazardous and radiological contaminants from emissions would be small. Biotic populations and communities would not be affected.*

TABLE 3-4. (6 of 14)
Summary comparison of impacts on resources from waste processing alternatives.



Transportation

	DOE's Preferred Alternative				*State of Idaho's* **Preferred Alternative**
No Action Alternative	Continued Current Operations Alternative	Separations Alternative	Non-Separations Alternative	Minimum INEEL Processing Alternative	***Direct Vitrification Alternative***
No offsite transportation would occur.	Incident-free impacts to public from truck shipments[a]: 0.013 LCF. Accident LCF risk for the public from truck transport: *$5.7x10^{-4}$*.	Incident-free impacts to public from truck shipments: 0.23 LCF (Transuranic Separations Option is highest impact option). Accident LCF risk for the public from truck transport: *0.10* (Transuranic Separations Option is highest impact option).	Incident-free impacts to public from truck shipments: *1.4* LCFs (Direct Cement Waste Option is highest impact option). Accident LCF risk for the public from truck transport: *0.039* (*Steam Reforming* Option is highest impact option).	Incident-free impacts to public from truck shipments: *1.1* LCFs. Accident LCF risk for the public from truck transport: 0.018.	***VWOCS - Incident-free impacts to public from truck shipments: 0.99 LCF.*** ***Accident LCF risk for the public from truck transport: $1.5x10^{-6}$.*** ***VWCS - Incident-free impacts to public from truck shipments: 0.12 LCF.*** ***Accident LCF risk for the public from truck transport: $7.9x10^{-5}$.***

LEGEND

VWOCS	Vitrification without Calcine Separations Option
VWCS	Vitrification with Calcine Separations Option
LCF	Latent cancer fatality

[a] Latent cancer fatalities for transportation by truck selected as the representative parameter for comparison of alternatives

TABLE 3-4. (7 of 14)
Summary comparison of impacts on resources from waste processing alternatives.

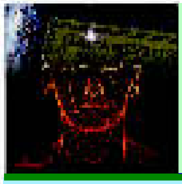
Health & Safety

	DOE's Preferred Alternative				*State of Idaho's Preferred Alternative*
No Action Alternative	Continued Current Operations Alternative	Separations Alternative	Non-Separations Alternative	Minimum INEEL Processing Alternative	*Direct Vitrification Alternative*
The estimated number of latent cancer fatalities in the population within 50 miles of INTEC related to waste processing under this alternative would be *7.0x10^{-4}*.	The estimated number of latent cancer fatalities in the population within 50 miles of INTEC related to waste processing under this alternative would be *6.0x10^{-4}*.	FS The estimated number of latent cancer fatalities in the population within 50 miles of INTEC related to waste processing under this option would be *7.0x10^{-5}*. PB The estimated number of latent cancer fatalities in the population within 50 miles of INTEC related to waste processing under this option would be *2.0x10^{-4}*. TS The estimated number of latent cancer fatalities in the population within 50 miles of INTEC related to waste processing under this option would be *3.8x10^{-5}*.	HIP The estimated number of latent cancer fatalities in the population within 50 miles of INTEC related to waste processing under this option would be *6.5x10^{-4}*. DC The estimated number of latent cancer fatalities in the population within 50 miles of INTEC related to waste processing under this option would be *6.5x10^{-4}*. EV The estimated number of latent cancer fatalities in the population within 50 miles of INTEC related to waste processing under this option would be *1.0x10^{-3}*. *SR The estimated number of latent cancer fatalities in the population within 50 miles of INTEC related to waste processing under this option would be 7.0x10^{-4}.*	At INEEL - The estimated number of latent cancer fatalities in the population within 50 miles of INTEC related to waste processing under this option would be *7.0x10^{-4}*. At Hanford - The estimated number of latent cancer fatalities in the population within 50 miles of *200-East and 200-West Areas* related to waste processing under this alternative would be 1.1x10^{-6}.	*VWOCS The estimated number of latent cancer fatalities in the population within 50 miles of INTEC related to waste processing under this option would be 7.5x10^{-4}.* *VWCS The estimated number of latent cancer fatalities in the population within 50 miles of INTEC related to waste processing under this option would be 7.5x10^{-4}.*

LEGEND

FS	Full Separations Option
PB	Planning Basis Option
TS	Transuranic Separations Option
HIP	Hot Isostatic Pressed Waste Option
DC	Direct Cement Waste Option
EV	Early Vitrification Option
SR	Steam Reforming Option
VWOCS	Vitrification without Calcine Separations Option
VWCS	Vitrification with Calcine Separations Option

TABLE 3-4. (8 of 14)
Summary comparison of impacts on resources from waste processing alternatives.



Health & Safety

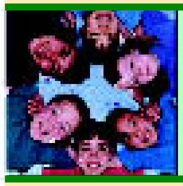
No Action Alternative	Continued Current Operations Alternative	Separations Alternative	Non-Separations Alternative	Minimum INEEL Processing Alternative	Direct Vitrification Alternative
		DOE's Preferred Alternative			State of Idaho's Preferred Alternative
The estimated number of latent cancer fatalities in involved workers related to waste processing under this alternative would be *0.14.*	The estimated number of latent cancer fatalities in involved workers related to waste processing under this alternative would be *0.16.*	FS The estimated number of latent cancer fatalities in involved workers related to waste processing under this option would be *0.31.* PB The estimated number of latent cancer fatalities in involved workers related to waste processing under this option would be *0.39.* TS The estimated number of latent cancer fatalities in involved workers related to waste processing under this option would be *0.27.*	HIP The estimated number of latent cancer fatalities in involved workers related to waste processing under this option would be *0.31.* DC The estimated number of latent cancer fatalities in involved workers related to waste processing under this option would be *0.43.* EV The estimated number of latent cancer fatalities in involved workers related to waste processing under this option would be *0.29.* *SR The estimated number of latent cancer fatalities in involved workers related to waste processing under this option would be 0.25.*	At INEEL - The estimated number of latent cancer fatalities in involved workers related to waste processing under this alternative would be *0.27.* At Hanford - The estimated number of latent cancer fatalities in involved workers related to waste processing under this alternative would be 0.14.	*VWOCS The estimated number of latent cancer fatalities in involved workers related to waste processing under this option would be 0.20.* *VWCS The estimated number of latent cancer fatalities in involved workers related to waste processing under this option would be 0.26.*
Total lost workdays during construction: *30.* Total recordable cases during construction: *3.9.*	Total lost workdays during construction: *110.* Total recordable cases during construction: 14.	FS Total lost workdays during construction: *$1.5x10^3$.* Total recordable cases during construction: *190.* PB Total lost workdays during construction: *$1.5x10^3$.* Total recordable cases during construction: *200.* TS Total lost workdays during construction: *$1.1x10^3$.* Total recordable cases during construction: *150.*	HIP Total lost workdays during construction: *520.* Total recordable cases during construction: *67.* DC Total lost workdays during construction: *620.* Total recordable cases during construction: *81.* EV Total lost workdays during construction: *530.* Total recordable cases during construction: *69.* *SR Total lost workdays during construction: 770. Total recordable cases during construction: 100.*	At INEEL - Total lost workdays during construction: *620.* Total recordable cases during construction: *81.* At Hanford - Total lost workdays during construction not reported. Total recordable cases during construction: *230.*	*VWOCS Total lost workdays during construction: 710. Total recordable cases during construction: 93.* *VWCS Total lost workdays during construction: $1.3x10^3$. Total recordable cases during construction: 170.*

LEGEND

FS	Full Separations Option
PB	Planning Basis Option
TS	Transuranic Separations Option
HIP	Hot Isostatic Pressed Waste Option
DC	Direct Cement Waste Option
EV	Early Vitrification Option
SR	Steam Reforming Option
VWOCS	Vitrification without Calcine Separations Option
VWCS	Vitrification with Calcine Separations Option

TABLE 3-4. (9 of 14)
Summary comparison of impacts on resources from waste processing alternatives.

Health & Safety



Environmental Justice

	DOE's Preferred Alternative				State of Idaho's Preferred Alternative
No Action Alternative	Continued Current Operations Alternative	Separations Alternative	Non-Separations Alternative	Minimum INEEL Processing Alternative	*Direct Vitrification Alternative*
Health & Safety					
Total lost workdays during operations: *850.* Total recordable cases during operations: *110.*	Total lost workdays during operations: *$1.1x10^3$.* Total recordable cases during operations: *150.*	FS Total lost workdays during operations: *$3.0x10^3$.* Total recordable cases during operations: *400.* PB Total lost workdays during operations: *$3.7x10^3$.* Total recordable cases during operations: *480.* TS Total lost workdays during operations: *$2.3x10^3$.* Total recordable cases during operations: *300.*	HIP Total lost workdays during operations: *$2.5x10^3$.* Total recordable cases during operations: *320.* DC Total lost workdays during operations: *$2.9x10^3$.* Total recordable cases during operations: *370.* EV Total lost workdays during operations: *$2.5x10^3$.* Total recordable cases during operations: *330.* *SR Total lost workdays during operations: $1.4x10^3$. Total recordable cases during operations: 180.*	At INEEL - Total lost workdays during operations: *$2.0x10^3$.* Total recordable cases during operations: *270.* At Hanford - Total lost workdays during operations not reported. Total recordable cases during operations: *27.*	*VWOCS Total lost workdays during operations: $1.9x10^3$. Total recordable cases during operations: 250.* *VWCS Total lost workdays during operations: $2.5x10^3$. Total recordable cases during operations: 330.*
Environmental Justice					
No significant impacts to human health were identified, thus no disproportionately high and adverse impacts to minority populations or low-income populations would be expected.	No significant impacts to human health were identified, thus no disproportionately high and adverse impacts to minority populations or low-income populations would be expected.	No significant impacts to human health were identified, thus no disproportionately high and adverse impacts to minority populations or low-income populations would be expected.	No significant impacts to human health were identified, thus no disproportionately high and adverse impacts to minority populations or low-income populations would be expected.	No significant impacts to human health were identified, thus no disproportionately high and adverse impacts to minority populations or low-income populations would be expected.	*No significant impacts to human health were identified, thus no disproportionately high and adverse impacts to minority populations or low-income populations would be expected.*

LEGEND

FS	Full Separations Option	EV	Early Vitrification Option
PB	Planning Basis Option	SR	Steam Reforming Option
TS	Transuranic Separations Option	VWOCS	Vitrification without Calcine Separations Option
HIP	Hot Isostatic Pressed Waste Option	VWCS	Vitrification with Calcine Separations Option
DC	Direct Cement Waste Option		

TABLE 3-4. (10 of 14)
Summary comparison of impacts on resources from waste processing alternatives.

Utilities/Energy

	DOE's Preferred Alternative				State of Idaho's Preferred Alternative
No Action Alternative	Continued Current Operations Alternative	Separations Alternative	Non-Separations Alternative	Minimum INEEL Processing Alternative	*Direct Vitrification Alternative*
Operational electrical usage would increase by *14* percent relative to baseline usage. Estimated increase in annual fossil fuel use would be about 0.64 million gallons. Process water use would increase by about 3.5 percent. Sewage treatment demand would increase by approximately 2.5 percent. Existing INTEC capacity would be adequate to support increased resource demand.	Operational electrical usage would increase by 20 percent relative to baseline usage. Estimated increase in annual fossil fuel use would be about 1.9 million gallons. Process water use would increase by about 16 percent. Sewage treatment demand would increase by approximately *4.9* percent. Existing INTEC capacity would be adequate to support increased resource demand.	FS Operational electrical usage would increase by 45 percent relative to baseline usage. Estimated increase in annual fossil fuel use would be about 4.5 million gallons. Process water use would increase by about *1.3* percent. Sewage treatment demand would increase by approximately *7.3* percent. PB Operational electrical usage would increase by 57 percent relative to baseline usage. Estimated annual increase in fossil fuel use would be about 6.3 million gallons. Process water use would increase by about 17 percent. Sewage treatment demand would increase by approximately 11 percent. TS Operational electrical usage would increase by 33 percent relative to baseline usage. Estimated annual increase in fossil fuel use would be about 2.2 million gallons. Process water use would increase by about 13 percent. Sewage treatment demand would increase by approximately *5.1* percent. Existing INTEC capacity would be adequate to support increased resource demand.	HIP Operational electrical usage would increase by 38 percent relative to baseline usage. Estimated increase in annual fossil fuel use would be about 2.8 million gallons. Process water use would increase by about 22 percent. Sewage treatment demand would increase by approximately *6.9* percent. DC Operational electrical usage would increase by 32 percent relative to baseline usage. Estimated increase in annual fossil fuel use would be about 2.5 million gallons. Process water use would increase by about 16 percent. Sewage treatment demand would increase by approximately *8.7* percent. EV Operational electrical increase by 44 percent relative to baseline usage. Estimated increase in annual fossil fuel use would be about 1.1 million gallons. Process water use would increase by about *1.6* percent. Sewage treatment demand would increase by approximately *5.3* percent. *SR Operational electrical increase by 27 percent relative to baseline usage. Estimated increase in annual fossil fuel use would be about 0.40 million gallons. Process water use would increase by about 1.5 percent. Sewage treatment demand would increase by approximately 3.6 percent.* Existing INTEC capacity would be adequate to support increased resource demand.	At INEEL - Operational electrical usage would increase by 28 percent relative to baseline usage. Estimated increase in annual fossil fuel use would be about 0.49 million gallons. Process water use would increase by about *1.6* percent. Sewage treatment demand would increase by approximately *5.1* percent. Existing INTEC capacity would be adequate to support increased resource demand. At Hanford - Operational electrical usage would increase substantially but would fall short of electrical usage experienced in the 1980's. Approximately 1.3 million gallons per year of fuel oil would be required during operations, which would not affect supplies locally or regionally.	*VWOCS Operational electrical usage would increase by 44 percent relative to baseline usage. Estimated increase in annual fossil fuel use would be about 1.3 million gallons. Process water use would increase by approximately 1.6 percent. Sewage treatment demand would increase by approximately 5.3 percent.* *VWCS Operational electrical usage would increase by 59 percent relative to baseline usage. Estimated increase in annual fossil fuel use would be approximately 5.0 million gallons. Process water use would increase by approximately 2.8 percent. Sewage treatment demand would increase by approximately 8.0 percent.* *Existing INTEC capacity would be adequate to support increased resource demand.*

LEGEND

FS	Full Separations Option
PB	Planning Basis Option
TS	Transuranic Separations Option
HIP	Hot Isostatic Pressed Waste Option
DC	Direct Cement Waste Option
EV	Early Vitrification Option
SR	Steam Reforming Option
VWOCS	Vitrification without Calcine Separations Option
VWCS	Vitrification with Calcine Separations Option

TABLE 3-4. (11 of 14)
Summary comparison of impacts on resources from waste processing alternatives.

Waste & Materials

	DOE's Preferred Alternative				State of Idaho's Preferred Alternative
No Action Alternative	Continued Current Operations Alternative	Separations Alternative	Non-Separations Alternative	Minimum INEEL Processing Alternative	*Direct Vitrification Alternative*
Approximately 15,000 cubic meters of industrial waste, 1,500 cubic meters of mixed LLW, and 190 cubic meters of LLW generated through year 2035. (includes construction and operations phases)	Approximately 26,000 cubic meters of industrial waste, 3,400 cubic meters of mixed LLW, and 9,500 cubic meters of LLW generated through year 2035. (includes construction and operations phases)	FS Approximately 110,000 cubic meters (maximum) of industrial waste, 7,000 cubic meters of mixed LLW, and 1,500 cubic meters of LLW generated through year 2035. PB Approximately 110,000 cubic meters (maximum) of industrial waste, 9,000 cubic meters of mixed LLW, and 10,000 cubic meters of LLW generated through year 2035. TS Approximately 82,000 cubic meters (maximum) of industrial waste, 6,400 cubic meters of mixed LLW, and 1,200 cubic meters of LLW generated through year 2035. (includes construction and operations phases)	HIP Approximately 69,000 cubic meters (maximum) of industrial waste, 7,500 cubic meters of mixed LLW, and 10,000 cubic meters of LLW generated through year 2035. DC Approximately 80,000 cubic meters (maximum) of industrial waste, 9,700 cubic meters of mixed LLW, and 10,000 cubic meters of LLW generated through year 2035. EV Approximately 65,000 cubic meters of industrial waste, 7,100 cubic meters of mixed LLW, and 1,100 cubic meters of LLW generated through year 2035. *SR Approximately 49,000 cubic meters of industrial waste, 5,200 cubic meters of mixed LLW, and 560 cubic meters of LLW generated through year 2035.* (includes construction and operations phases)	At INEEL - Approximately 61,000 cubic meters of industrial waste, 6,800 cubic meters of mixed LLW, and 810 cubic meters of LLW generated through the year 2035. At Hanford - Approximately 26,000 cubic meters of industrial waste, 0 cubic meters of mixed LLW, and 1,500 cubic meters of LLW generated through year 2030. (includes construction and operations phases)	*VWOCS Approximately 53,000 cubic meters of industrial waste, 7,100 cubic meters of mixed LLW, and 2,300 cubic meters of LLW generated through the year 2035.* *VWCS Approximately 85,000 cubic meters of industrial waste, 8,600 cubic meters of mixed LLW, and 3,000 cubic meters of LLW generated through the year 2035.* *(includes construction and operations phases)*

LEGEND

FS	Full Separations Option
LLW	Low-Level Waste
PB	Planning Basis Option
TS	Transuranic Separations Option
HIP	Hot Isostatic Pressed Waste Option
DC	Direct Cement Waste Option
EV	Early Vitrification Option
SR	Steam Reforming Option
VWOCS	Vitrification without Calcine Separations Option
VWCS	Vitrification with Calcine Separations Option

TABLE 3-4. (12 of 14)
Summary comparison of impacts on resources from waste processing alternatives.

Accident Analysis

					State of Idaho's Preferred Alternative
	DOE's Preferred Alternative				
No Action Alternative	Continued Current Operations Alternative	Separations Alternative	Non-Separations Alternative	Minimum INEEL Processing Alternative	Direct Vitrification Alternative
Bounding[b] Abnormal Event (long-term onsite storage of calcine) - Degraded bin set fails in seismic event after 500 years[c]: MEI Dose = 8.3×10^4 millirem, Noninvolved Worker Dose = 5.7×10^6 millirem, Offsite Population Impacts = 270 LCFs. Bounding Design Basis Event (onsite storage of calcine) - Flood Induced Failure of Bin Set: MEI Dose = 880 millirem, Noninvolved Worker Dose = 5.9×10^4 millirem, Offsite Population Impacts = 29 LCFs.	Bounding Abnormal Event (long-term onsite storage of calcine) - Degraded bin set fails in seismic event after 500 years[c]: MEI Dose = 8.3×10^4 millirem, Noninvolved Worker Dose = 5.7×10^6 millirem, Offsite Population Impacts = 270 LCFs. Bounding Design Basis Event (onsite storage of calcine) - Flood Induced Failure of Bin Set: MEI Dose = 880 millirem, Noninvolved Worker Dose = 5.9×10^4 millirem, Offsite Population Impacts = 29 LCFs.	Bounding Abnormal Event (calcine retrieval and onsite transport) - Equipment failure results in release during transfer operation: MEI Dose = 40 millirem, Noninvolved Worker Dose = 2.7×10^3 millirem, Offsite Population Impacts = 0.23 LCF. Bounding Design Basis Event (short-term onsite storage of calcine) - Flood Induced Failure of Bin Set: MEI Dose = 880 millirem, Noninvolved Worker Dose = 5.9×10^4 millirem, Offsite Population Impacts = 29 LCFs.	Bounding Abnormal Event (calcine retrieval and onsite transport) - Equipment failure results in release during transfer operation: MEI Dose = 40 millirem, Noninvolved Worker Dose = 2.7×10^3 millirem, Offsite Population Impacts = 0.23 LCF. Bounding Design Basis Event (short-term onsite storage of calcine) - Flood Induced Failure of Bin Set: MEI Dose = 880 millirem, Noninvolved Worker Dose = 5.9×10^4 millirem, Offsite Population Impacts = 29 LCFs.	Bounding Abnormal Event (calcine retrieval and onsite transport) - Equipment failure results in release during transfer operation: MEI Dose = 40 millirem, Noninvolved Worker Dose = 2.7×10^3 millirem, Offsite Population Impacts = 0.23 LCF. Bounding Design Basis Event (short-term onsite storage of calcine) - Flood Induced Failure of Bin Set: MEI Dose = 880 millirem, Noninvolved Worker Dose = 5.9×10^4 millirem, Offsite Population Impacts = 29 LCFs.	Bounding Abnormal Event (calcine retrieval and onsite transport) - Equipment failure results in release during transfer operation: MEI Dose = 40 millirem, Noninvolved Worker Dose = 2.7×10^3 millirem, Offsite population Impacts = 0.23 LCF. Bounding Design Basis Event (short-term onsite storage of calcine) - Flood Induced Failure of Bin Set: MEI Dose = 880 millirem, Noninvolved Worker Dose = 5.9×10^4 millirem, Offsite Population Impacts = 29 LCFs.

LEGEND

MEI	Maximally exposed individual
LCF	Latent cancer fatality

[b] The term "bounding" means the accident with highest consequence for each frequency range (Abnormal Event, Design Basis Event, and Beyond Design Basis Event).

[c] The abnormal event assumes one bin set fails. Although no failure mechanism for the simultaneous failure of two bin sets has been identified, the source terms and consequences were based on two bin sets for conservatism.

TABLE 3-4. (13 of 14)
Summary comparison of impacts on resources from waste processing alternatives.

Accident Analysis

State of Idaho's Preferred Alternative

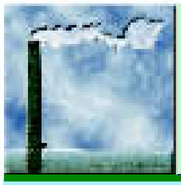
DOE's Preferred Alternative

No Action Alternative	Continued Current Operations Alternative	Separations Alternative	Non-Separations Alternative	Minimum INEEL Processing Alternative	Direct Vitrification Alternative
Bounding Beyond Design Basis Event (onsite storage of calcine) - An external event causes a failure of a bin set structure: MEI Dose = 1.4x10^{4} millirem, Noninvolved Worker Dose = 9.3x10^{5} millirem, Offsite Population Impacts = 61 LCFs.	Bounding Beyond Design Basis Event (onsite storage of calcine) - An external event causes a failure of a bin set structure: MEI Dose = 1.4x10^{4} millirem, Noninvolved Worker Dose = 9.3x10^{5} millirem, Offsite Population Impacts = 61 LCFs.	FS, PB Bounding Beyond Design Basis Event (borosilicate vitrification of separated HLW) - An external event results in a release from the vitrification facility: MEI Dose = 1.7x10^{4} millirem, Noninvolved Worker Dose = 1.2x10^{6} millirem, Offsite Population Impacts = 76 LCFs. TS Bounding Beyond Design Basis Event (short-term onsite storage of calcine) - An external event causes a failure of a bin set structure: MEI Dose = 1.4x10^{4} millirem, Noninvolved Worker Dose = 9.3x10^{5} millirem, Offsite Population Impacts = 61 LCFs.	Bounding Beyond Design Basis Event (onsite storage of calcine) - An external event causes a failure of a bin set structure: MEI Dose = 1.4x10^{4} millirem, Noninvolved Worker Dose = 9.3x10^{5} millirem, Offsite Population Impacts = 61 LCFs.	Bounding Beyond Design Basis Event (onsite storage of calcine) - An external event causes a failure of a bin set structure: MEI Dose = 1.4x10^{4} millirem, Noninvolved Worker Dose = 9.3x10^{5} millirem, Offsite Population Impacts = 61 LCFs.	VWOCS Bounding Beyond Design Basis Event (short-term onsite storage of calcine) - An external event causes a failure of a bin set structure: MEI Dose = 1.4x10^{4} millirem, Noninvolved Worker Dose = 9.3x10^{5} millirem, Offsite Population Impacts = 61 LCFs. VWCS Bounding Beyond Design Basis Event (borosilicate vitrification of separated HLW) - An external event results in a release from the vitrification facility: MEI Dose = 1.7x10^{4} millirem, Noninvolved Worker Dose = 1.2x10^{6} millirem, Offsite Population Impacts = 76 LCFs.

LEGEND

FS	Full Separations Option
PB	Planning Basis Option
TS	Transuranic Separations Option
VWOCS	Vitrification without Calcine Separations Option
VWCS	Vitrification with Calcine Separations Option
MEI	Maximally exposed individual
LCF	Latent cancer fatality

TABLE 3-4. (14 of 14)
Summary comparison of impacts on resources from waste processing alternatives.



Air Resources

					State of Idaho's Preferred Alternative
	DOE's Preferred Alternative				
No Action Alternative	Continued Current Operations Alternative	Separations Alternative	Non-Separations Alternative	Minimum INEEL Processing Alternative	Direct Vitrification Alternative
No impacts from No Action Alternative are anticipated.	RADIATION EFFECTS Radiation doses from emissions would be $1.1x10^{-10}$ millirem per year to offsite MEI and $4.0x10^{-9}$ person-rem per year to the offsite population.	RADIATION EFFECTS FS Radiation dose from emissions would be $3.3x10^{-10}$ millirem per year to offsite MEI and $1.2x10^{-8}$ person-rem per year to the offsite population. PB Radiation dose from emissions would be $3.9x10^{-10}$ millirem per year to offsite MEI and $1.4x10^{-8}$ person-rem per year to the offsite population. TS Radiation dose from emissions would be $4.7x10^{-10}$ millirem per year to offsite MEI and $1.3x10^{-8}$ person-rem per year to the offsite population.	RADIATION EFFECTS HIP Radiation dose from emissions would be $1.8x10^{-10}$ millirem per year to offsite MEI and $5.7x10^{-9}$ person-rem per year to the offsite population. DC Radiation dose from emissions would be $1.3x10^{-10}$ millirem per year to offsite MEI and $4.5x10^{-9}$ person-rem per year to the offsite population. EV Radiation dose from emissions would be $1.4x10^{-10}$ millirem per year to offsite MEI and $4.6x10^{-9}$ person-rem per year to the offsite population. SR Radiation dose from emissions would be $2.4x10^{-10}$ millirem per year to offsite MEI and $8.8x10^{-9}$ person-rem per year to the offsite population.	RADIATION EFFECTS At INEEL - radiation dose from emissions would be $5.6x10^{-10}$ millirem per year to offsite MEI and $1.6x10^{-8}$ person-rem per year to the offsite population.	RADIATION EFFECTS VWOCS Radiation dose to the offsite MEI would be $2.1x10^{-10}$ millirem per year. Collective population dose to the general public would be $7.0x10^{-9}$ person-rem per year. VWCS Radiation dose to the offsite MEI would be $3.0x10^{-10}$ millirem per year. Collective population dose to the general public would be $9.9x10^{-9}$ person-rem per year.
	HAZARDOUS/CARCINOGENIC Maximum impacts of offsite carcinogenic toxic pollutant emissions are estimated to be 0.65 percent of the applicable standard.	HAZARDOUS/CARCINOGENIC Maximum impacts of offsite carcinogenic toxic pollutant emissions are estimated to be 1.8 to 2.6 percent of the applicable standard.	HAZARDOUS/CARCINOGENIC Maximum impacts of offsite carcinogenic toxic pollutant emissions are estimated to be 0.72 to 2.1 percent of the applicable standard.	HAZARDOUS/CARCINOGENIC Maximum impacts of offsite carcinogenic toxic pollutant emissions are estimated to be 2.0 percent of the applicable standard.	HAZARDOUS/CARCINOGENIC Maximum impacts of offsite carcinogenic toxic pollutant emissions are estimated to be 1.6 to 2.2 percent of the applicable standard.

LEGEND

FS	Full Separations Option
PB	Planning Basis Option
TS	Transuranic Separations Option
HIP	Hot Isostatic Pressed Waste Option
DC	Direct Cement Waste Option
EV	Early Vitrification Option
SR	Steam Reforming Option
VWOCS	Vitrification without Calcine Separations Option
VWCS	Vitrification with Calcine Separations Option

TABLE 3-5. (1 of 4)
Summary comparison of impacts on resources from facility disposition.

Health & Safety

	DOE's Preferred Alternative				State of Idaho's Preferred Alternative
No Action Alternative	Continued Current Operations Alternative	Separations Alternative	Non-Separations Alternative	Minimum INEEL Processing Alternative	Direct Vitrification Alternative
No impacts from No Action Alternative are anticipated.	DOSE EFFECTS Estimated radiation dose to involved workers will result in 0.017 LCF and 43 person-rem.	DOSE EFFECTS Estimated radiation dose to involved workers will result in: FS 0.11 LCF and 270 person-rem. PB 0.11 LCF and 270 person-rem. TS 0.077 LCF and 190 person-rem.	DOSE EFFECTS Estimated radiation dose to involved workers will result in: HIP 0.12 LCF and 290 person-rem. DC 0.084 LCF and 210 person-rem. EV 0.068 LCF and 170 person-rem. SR 0.033 LCF and 83 person-rem.	DOSE EFFECTS At INEEL - Estimated radiation dose to involved workers will result in 0.055 LCF and 140 person-rem.	DOSE EFFECTS Estimated radiation dose to involved workers will result in: VWOCS 0.071 LCF and 180 person-rem. VWCS 0.12 LCF and 290 person-rem.
	INDUSTRIAL EFFECTS Total lost workdays: 70. Total recordable cases: 9.2.	INDUSTRIAL EFFECTS Total lost workdays and recordable cases: FS 570 and 74, respectively. PB 570 and 74, respectively. TS 420 and 54, respectively.	INDUSTRIAL EFFECTS Total lost workdays and recordable cases: HIP 610 and 79, respectively. DC 410 and 54, respectively. EV 510 and 67, respectively. SR 140 and 19, respectively.	INDUSTRIAL EFFECTS At INEEL - Total lost workdays: 350. Total recordable cases: 45.	INDUSTRIAL EFFECTS VWOCS Total lost workdays: 520. Total recordable cases: 68. VWCS Total lost workdays: 610. Total recordable cases: 79.

LEGEND

FS	Full Separations Option
PB	Planning Basis Option
TS	Transuranic Separations Option
HIP	Hot Isostatic Pressed Waste Option
DC	Direct Cement Waste Option
EV	Early Vitrification Option
SR	Steam Reforming Option
VWOCS	Vitrification without Calcine Separations Option
VWCS	Vitrification with Calcine Separations Option

TABLE 3-5. (2 of 4)
Summary comparison of impacts on resources from facility disposition.

Waste & Materials

	DOE's Preferred Alternative				State of Idaho's Preferred Alternative
No Action Alternative	Continued Current Operations Alternative	Separations Alternative	Non-Separations Alternative	Minimum INEEL Processing Alternative	Direct Vitrification Alternative
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.	FS 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. PB 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. TS 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.	HIP 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. DC 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. EV 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. SR Approximately 18,000 cubic meters of industrial water, 69 cubic meters of mixed low-level waste, and 15,000 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.	VWOCS Approximately 81,000 cubic meters of industrial waste, 530 cubic meters of mixed low-level waste, and 41,000 cubic meters of low-level waste are generated. VWCS Approximately 77,000 cubic meters of industrial waste, 900 cubic meters of mixed low-level waste, and 80,000 cubic meters of low-level waste are generated.

LEGEND

FS	Full Separations Option
PB	Planning Basis Option
TS	Transuranic Separations Option
HIP	Hot Isostatic Pressed Waste Option
DC	Direct Cement Waste Option
EV	Early Vitrification Option
SR	Steam Reforming Option
VWOCS	Vitrification without Calcine Separations Option
VWCS	Vitrification with Calcine Separations Option

TABLE 3-5. (3 of 4)
Summary comparison of impacts on resources from facility disposition.

Accident Analysis

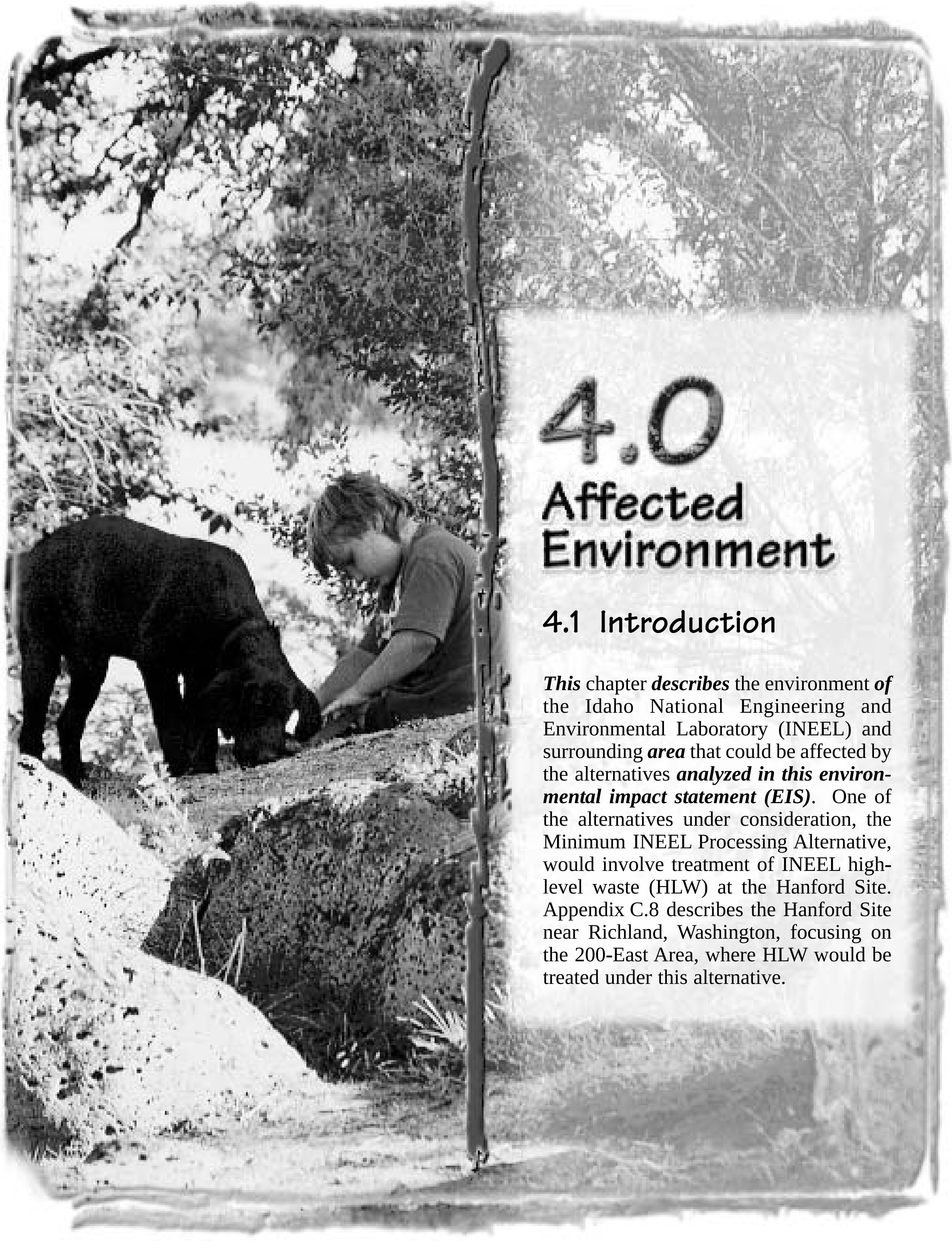
	Preferred Alternative		
No Action Alternative	Clean Closure	Performance-Based Closure	Closure to Landfill Stadards
There are no anticipated accidents.	Approximately 1,100 injuries/illnesses and 2.4 fatalities are calculated.	Approximately 280 injuries/illnesses and 0.64 fatalities are calculated.	Approximately 210 injuries/illnesses and 0.48 fatalities are calculated.

TABLE 3-5. (4 of 4)
Summary comparison of impacts on resources from facility disposition.

- New Information -

4.0

Affected Environment



4.0

Affected Environment

4.1 Introduction

This chapter ***describes*** the environment ***of*** the Idaho National Engineering and Environmental Laboratory (INEEL) and surrounding ***area*** that could be affected by the alternatives ***analyzed in this environmental impact statement (EIS)***. One of the alternatives under consideration, the Minimum INEEL Processing Alternative, would involve treatment of INEEL high-level waste (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 U.S. Department of Energy (DOE) *Spent Nuclear Fuel Management and Idaho National Engineering Laboratory Environmental Restoration and Waste Management Programs Final Environmental Impact Statement* or SNF & INEL EIS (DOE 1995). ***Information has been updated where necessary***. ***The*** section***s*** in this chapter support the analysis of potential environmental consequences in Chapter 5.

4.2 Land Use

This section contains a brief description of existing and planned land uses at INEEL and the surrounding area, focusing on the Idaho Nuclear Technology and Engineering Center (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). ***DOE is the designated federal agency with the responsibility and authority for effectively managing the INEEL lands in accordance with a series of Land Withdrawal Public Land Orders (PLO), PLO 318, PLO 545, PLO 637, and PLO 691 that include approximately 506,000 acres. In addition, approximately 21,000 acres of state land and 43,000 acres of private land were transferred to DOE ownership and management, for a total of approximately 570,000 acres (Peterson 1995). DOE will continue to ensure that the future use and management of these lands are in accordance with the PLOs.*** 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 ***surrounds*** the develop***ed*** area. 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 ***2-3*** shows ***selected*** land uses 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 ***identified*** 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 consideration. 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. ***A natural resources management plan is being developed for the reserve.***

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 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

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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/sodium bearing 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 the 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 ***specific locations***. These restricted hunts are intended to assist the Idaho Department of Fish and Game in reducing crop damage on adjacent private agricultural lands caused by wild game. INEEL is a designated 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 the INEEL is located.

4.2.2 EXISTING AND PLANNED LAND USE IN THE SURROUNDING REGION

Approximately 75 percent of the land adjacent to the INEEL is ***managed*** by the Federal government and administered by the Bureau of Land Management. This federally-***managed*** land ***provides*** wildlife ***habitat and uses such as*** mineral and energy production, grazing, and recreation. Approximately 1 percent of the adjacent land is owned by the State of Idaho ***and*** used for ***the same purposes***. 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, ***and*** the Snake River, as shown in Figure ***2-1***. 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.

On November 9, 2000, President Clinton signed a Presidential Proclamation that expanded the boundaries of Craters of the Moon National Monument (Clinton 2000). The expansion adds 661,000 acres to the existing 54,000-acre monument. The boundary enlargement (DOI 2000) is shown on Figure 2-1.

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, adjacent areas are not likely to experience residential and commercial development, and no new development is planned. 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 rangeland 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 ***2-1*** 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. This section tiers from the SNF & INEL EIS, Volume 2, Part A, Section 4.13 (DOE 1995). ***Since the publication of the Draft EIS, Census 2000 and related data have been incorporated into the socioeconomic analyses. Population figures, housing characteristics, labor information, and economic multipliers (such as employment and earnings multipliers) have been updated to reflect the most current socioeconomic environment in the region of influence.***

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 ***2000***, State population growth accelerated to ***2.9*** percent per year, and region of influence growth ***increased to 1.4*** percent (DOC 1997a***, 2000a***). 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

Table 4-1. Population of the INEEL region of influence and Idaho: selected years 1980-2025.[a]

County	1980	1990	1995	2000[b]	2005	2010	2015	2020	2025
Bannock	65,421	66,026	72,043	***75,565***	81,303	84,474	90,894	96, 802	102,710
Bingham	36,489	37,583	40,950	***41,735***	46,214	48,016	51,666	55,024	58,382
Bonneville	65,980	72,207	79,230	***82,522***	89,415	92,902	99,963	106,460	112,958
Butte	3,342	2,918	3,097	***2,899***	3,495	3,631	3,907	4,161	4,415
Clark	798	762	841	***1,022***	948	985	1,060	1,129	1,198
Jefferson	15,304	16,543	18,429	***19,155***	20,798	21,609	23,251	24,763	26,274
Madison	19,480	23,674	23,651	***27,467***	26,692	27,733	29,841	31,780	33,720
Region of influence	206,814	219,713	238,241	***250,365***	268,865	279,350	300,582	320,119	339,657
Idaho	944,127	1,006,749	1,164,887	***1,293,953***	1,277,000	1,335,000	1,395,000	1,514,000	1,725,000

a. Source: DOC (1997a,b) ; BEA (1997) ***except as noted.***

b. Source: DOC (2000a).

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a. Source: DOC (1997a,b) ; BEA (1997) ***except as noted.***

b. Source: DOC (2000a).

influence through ***2000*** and projections for 200***5*** through 2025. Based on population trends, the region of influence population will reach almost 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 ***63*** percent of the total region of influence population in ***2000***. 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), ***each*** with ***2000*** populations of approximately 51,000 (DOC ***2000***b). During ***2000,*** employees and their families accounted for ***17*** percent of Bonneville County's population and composed almost ***22*** percent of Idaho Falls' population. INEEL employees and their families represent only 2 percent of the population of Bannock and Madison counties (DOE ***2001***).

4.3.1.2 Housing

There were ***90,000*** housing units in the region of influence during ***2000***, the last year for which data are available. Approximately ***6.6*** 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 ***5.9*** percent in ***Bonneville*** County to ***14.7*** percent in Butte County, while ***owned housing*** vacancy rates ranged from ***1.6*** percent in Madison ***and Bonneville Counties*** to ***4.4*** percent in Butte County ***(DOC 2000c)***. The average rental vacancy rate in the state of Idaho was ***7.6*** percent, and the ***owned housing*** vacancy rate averaged ***2.2*** percent ***(DOC 2000d)***. About ***26*** percent of the occupied housing units in the region of influence were rental units, and ***74*** percent were homeowner units. The majority of housing units (***66*** percent) in the region of influence were located in Bonneville and Bannock counties, which include the cities of Idaho Falls and Pocatello (DOC ***2000c***). 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 ***131,352*** in ***2000***, an average annual growth rate of almost ***2.4*** percent. Total region of influence employment grew from 100,074 in 1990 to ***126,058*** in ***2000***, an average annual growth rate of approximately ***2.6*** percent (BLS 1997, ***2002***). 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 ***2000***, the labor force in the state of Idaho grew at an annual rate of ***3.4*** percent, and employment grew ***3.5*** percent annually. Historical trends in labor force, employment, and unemployment are shown in Tables 4-3, 4-4, and 4-5, respectively.

The region of influence unemployment rate was 4.0 percent in ***2000***, the lowest level in over a decade and lower than the average rate of ***4.9*** percent in Idaho. Unemployment rates within the region of influence ranged from ***2.5*** percent in Madison County to ***5.0*** percent in ***Bannock*** County (BLS 1997, ***2002***). 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

Table 4-2. Region of influence housing characteristics (*2000*).[a]

County	Total housing units	Number of owner occupied units	Owned ***housing*** vacancy rates	Number of rental units	Rental vacancy rates
Bannock	***29,102***	***19,628***	***2.1***%	***8,705***	***8.4***%
Bingham	***14,303***	***10,746***	***1.7***%	***3,038***	***9.4***%
Bonneville	***30,484***	***21,817***	***1.6***%	***7,739***	***5.9***%
Butte	***1,290***	***878***	***4.4***%	***293***	***14.7***%
Clark	***521***	***239***	***3.3***%	***127***	***14.2***%
Jefferson	***6,287***	***5,107***	***1.9***%	***960***	***7.0***%
Madison	***7,630***	***4,286***	***1.6***%	***3,133***	***7.0***%
Region of influence	***89,617***	***62,701***	NA[b]	***23,995***	NA

a. Source: DOC (***2000c***); does not include housing used for seasonal, recreational, or other uses.

b. NA = Not applicable.

Table 4-3. Historical trends in region of influence labor force.[a]

County	1980	1985	1990	1995	***2000***
Bannock	30,488	33,684	31,342	36,310	***39,502***
Bingham	15,582	16,892	18,383	20,507	***21,908***
Bonneville	26,966	35,103	38,632	43,422	***46,479***
Butte	1,862	1,579	1,447	1,542	***1,596***
Clark	325	538	549	623	***577***
Jefferson	4,865	7,131	8,078	9,158	***10,269***
Madison	9,103	7,802	7,406	9,695	***11,021***
Region of influence	89,191	102,729	105,837	121,257	***131,352***
Idaho	429,000	466,000	492,619	600,493	***657,712***

a. Source: BLS (1997, ***2002***).

Table 4-4. Historical trends in region of influence employment.[a]

County	1980	1985	1990	1995	***2000***
Bannock	28,207	31,064	29,051	34,183	***37,533***
Bingham	14,419	15,534	17,320	19,363	***20,896***
Bonneville	25,432	33,267	37,127	41,563	***44,921***
Butte	1,780	1,491	1,381	1,479	***1,537***
Clark	295	511	533	596	***549***
Jefferson	4,480	6,600	7,633	8,685	***9,873***
Madison	8,683	7,366	7,029	9,373	***10,749***
Region of influence	83,296	95,833	100,074	115,242	***126,058***
Idaho	395,000	429,000	463,484	568,138	***625,798***

a. Source: BLS (1997, ***2002***).

Table 4-5. Historical trends in region of influence unemployment rates.[a]

County	1980	1985	1990	1995	***2000***
Bannock	7.5%	7.8%	7.3%	5.9%	***5.0%***
Bingham	7.5%	8.0%	5.8%	5.6%	***4.6%***
Bonneville	5.7%	5.2%	3.9%	4.3%	***3.4%***
Butte	4.4%	5.6%	4.6%	4.1%	***3.7%***
Clark	9.2%	5.0%	2.9%	4.3%	***4.9%***
Jefferson	7.9%	7.4%	5.5%	5.2%	***3.9%***
Madison	4.6%	5.6%	5.1%	3.3%	***2.5%***
Region of influence	6.6%	6.7%	5.4%	5.0%	4.0%
Idaho	7.9%	7.9%	5.9%	5.4%	***4.9%***

a. Source: BLS (1997, ***2002***).

together account for 19 percent of employment. Figure 4-***1*** presents employment levels for the major sectors for the region of influence.

INEEL exerts a major influence on the regional economy. ***During Fiscal Year 2001***, INEEL provided an average of 8,100 jobs, ***about 6*** percent of the total jobs in the region of influence (***DOE 2001, BLS 2002***). INEEL is the largest employer in Southeast Idaho and ***ranks among the top five employers*** in Idaho (the State government ***is the largest***) (DOE ***2001***). 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 indicated a stabilization of the job force at about 8,000 ***after*** Fiscal Year 2000 (McCammon 1999). 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

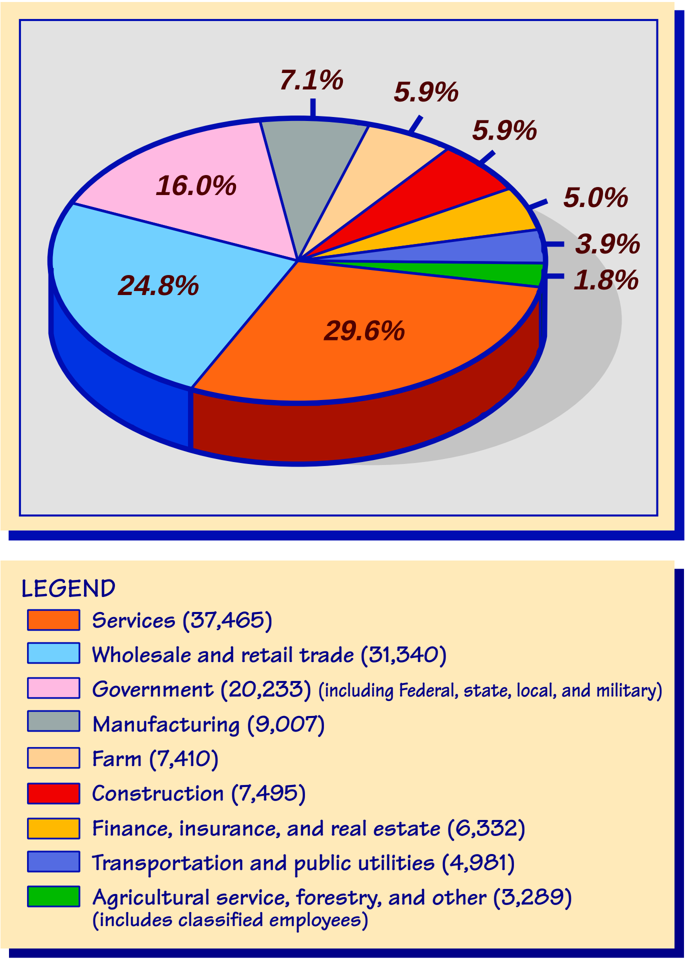


FIGURE 4-*1*.
1995 employment by sector.

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 ***24-hour*** 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 percent 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. The 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.

Table 4-6. INEEL tax support to southeastern Idaho counties (in millions of dollars).[a]

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

a. Source: DOE (1999).

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 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.

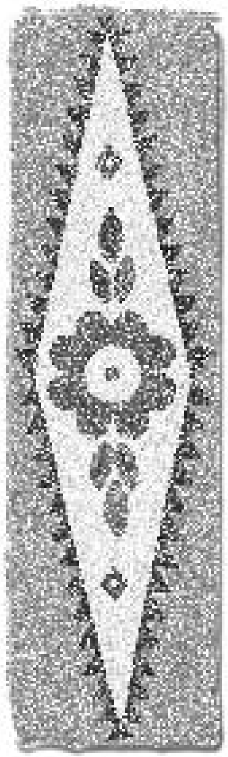
The DOE and INEEL Cultural Resources Management Office, which is staffed by contractor archaeologists and historic preservation specialists, consults regularly with representatives of the Shoshone-Bannock Tribes through meetings of the INEEL Cultural Resources Working Group. The INEEL Cultural Resources 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 the 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 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, approximately 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. ***Pending*** formal significance evaluations, including archaeological testing and historic record searches, ***these*** sites are ***treated as*** 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-*2* 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. The Cutoff and other historic trails on INEEL (Figure 4-3) 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).

CACTUS

wogwai'bi***

Opuntia polycantha is gathered for food. This common cactus grows abundantly throughout INEEL.

FIREWEED

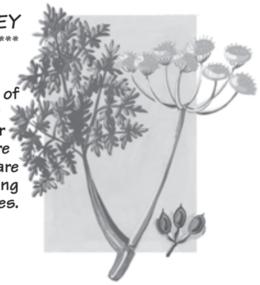
bea sa nip*
ba ba sh ea cah**

Many members of the ***Epilobium*** genus are used for food, medicine, and tools. They are common throughout INEEL.

DESERT PARSLEY

do za***

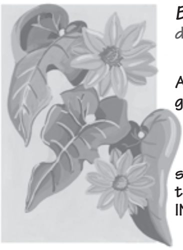
Some members of the genus ***Lomatium*** are used for food or medicine. They are uncommon but are scattered along INEEL roadsides.



BALSAM ROOT

doyatsayaha'n***

A few members of the genus ***Balsamhorriza*** are used for food and medicine. They are common and scattered about the buttes around INEEL.



TANSY MUSTARD

ah za*
a gah boe**

Several members of the genus ***Descurainia*** are used for food and medicine. They are common in disturbed areas around INEEL.

CHOKECHERRY

dongiape***

Prunus virginiana is gathered for food, medicine, tools, and fuel. It is a common tree found growing on buttes around INEEL.

WILD ONION

ge'nga***

The ***Allium*** genus is collected for food, medicine, and dye. This onion is common throughout INEEL.

SERVICEBERRY

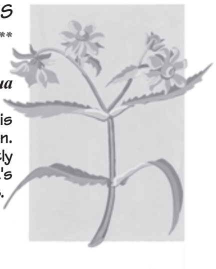
deambi, wi'yembi***

Some members of the ***Amelanchier*** genus are used for food, medicine, and tools. They are common on buttes throughout INEEL.

BEGGAR'S TICKS

sohna***

Bidens cernua is gathered for a source of food. This flower is common. It grows abundantly throughout INEEL's disturbed areas.



INDIAN RICEGRASS

wai***

Oryzopsis hymenoides is harvested for food. This grass is common and abundant throughout INEEL.

GOOSEFOOT

kah zo ne bah**
kah zo ne peh*

Many members of the genus ***Chenopodium*** are used for food. They are common and abundant throughout INEEL.

MINT

bagwana***

Some members of the ***Mentha*** genus are collected for medicine. These herbs are uncommon but are sometimes found growing along Big Lost River.

LEGEND

* = Bannock plant name
** = Shoshone plant name
*** = plant name shared by both cultures

FIGURE 4-2. (1 of 2)
Plants used by the Shoshone-Bannock located on or near INEEL.

WILD RYE

bohawehani'***

Many members of the ***Elymus*** genus are used for food and tools. These grasses are common and abundant throughout INEEL.

GUM WEED

sanaka bada'***

Grindelia squarrosa is used for medicine. This flower is common in disturbed areas throughout INEEL.

SAGEBRUSH

be ho ve**
saw wah be*

The genus ***Artemisia*** is used for tools and medicine. This genus is common and abundant throughout INEEL.

WOOD'S ROSE

tsiemb, tsiabe***

Rosa woodsii is used for multiple purposes. It is used as food, for smoking, for medicine, and in rituals. This rose is common and abundant along the Big Lost River and at Big Southern Butte.

COYOTE TOBACCO

buhibahu***

Nicotiana attenuata is used for smoking and medicine. It is uncommon but can be found along the Big Lost River.

WILLOW

seheebi***

The ***Salix*** genus is used for medicine. These small trees are common in moist areas throughout INEEL.

GOOSEBERRY

washibo go'mbi***

Many members of the ***Ribes*** genus are used for food. These shrubs are common and grow scattered throughout INEEL.

SUNFLOWER

'ake***

Some members of the genus ***Helianthus*** are used for food and medicine. These flowers are common along INEEL roadsides.

THISTLE

doyaba'ke***

Some members of the genus ***Cirisium*** are gathered for food. They are commonly found scattered throughout INEEL.

PLANTAIN

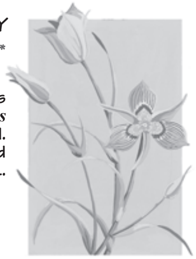
bia'sonip**
ba ba sh ea cah*

Some members of the genus ***Plantago*** are used for food and medicine. They are uncommon on INEEL.

LILY

sogo, sigobi***

Several members of the ***Calochortus*** genus are gathered for food. They are commonly found on the buttes of INEEL.



JUNIPER

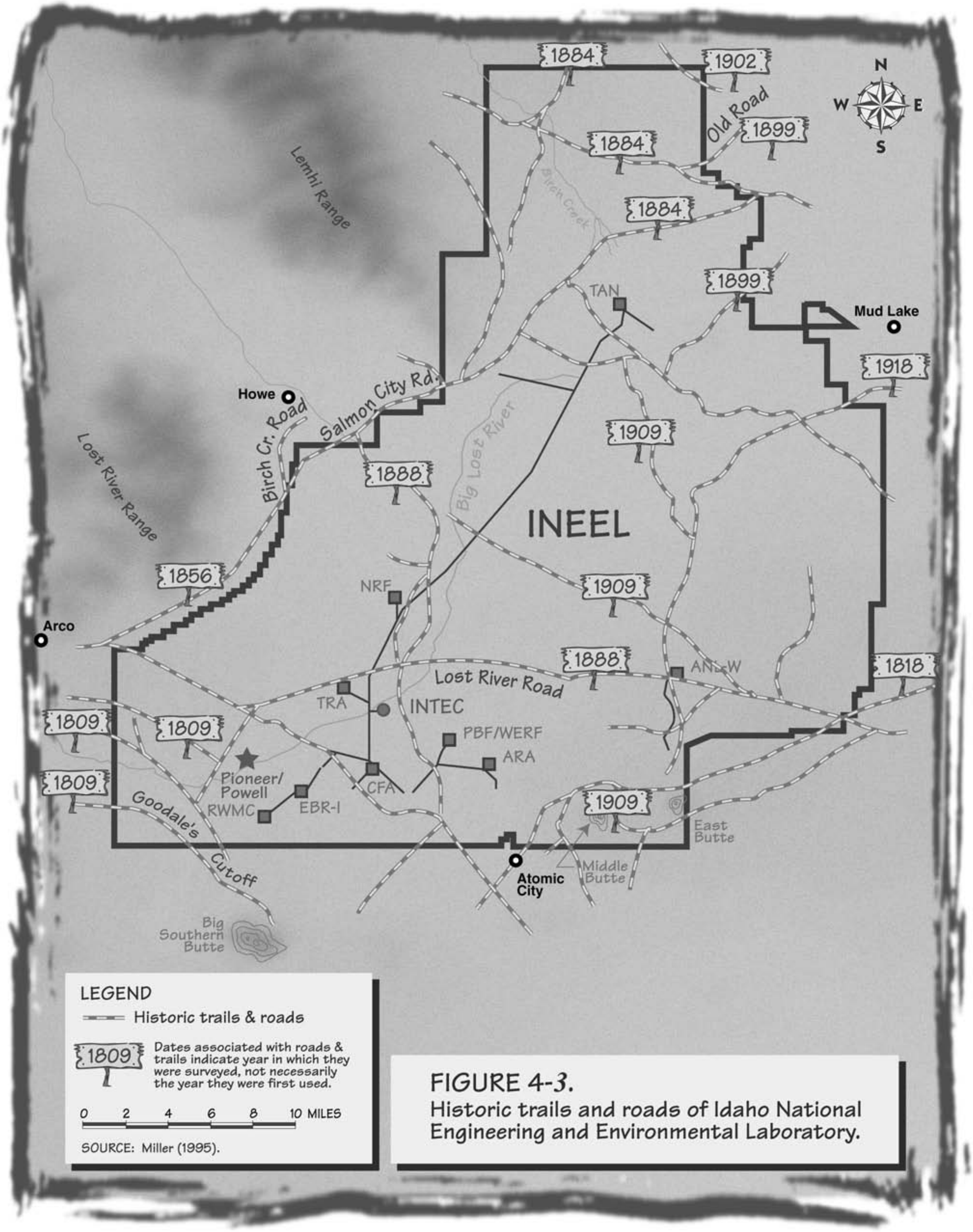
waapi***

The genus ***Juniperus*** is used for food, tools, and medicine. It is common on parts of the INEEL.

LEGEND

* = Bannock plant name
** = Shoshone plant name
*** = plant name shared by both cultures

FIGURE 4-2. (2 of 2)
Plants used by the Shoshone-Bannock located on or near INEEL.



SOURCE: Miller (1995).

FIGURE 4-3.
Historic trails and roads of Idaho National Engineering and Environmental Laboratory.

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).

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, 5th 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 ***are*** 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.

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	***Waste Storage*** Control House	1953
CPP 630	Safety and Spectrometry	1956
CPP 631	Inactive/L-Cell Off-Gas Blower Room	1957
CPP 633	Waste Calcining 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	***Waste Calcining Facility Blower Building***	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 684	Remote Analytical Laboratory[a]	1985
CPP 691	Fuel Processing Restoration Building[a]	1993

a. These buildings need to be reassessed with the State Historic Preservation Office.

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 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.


Geological drilling.

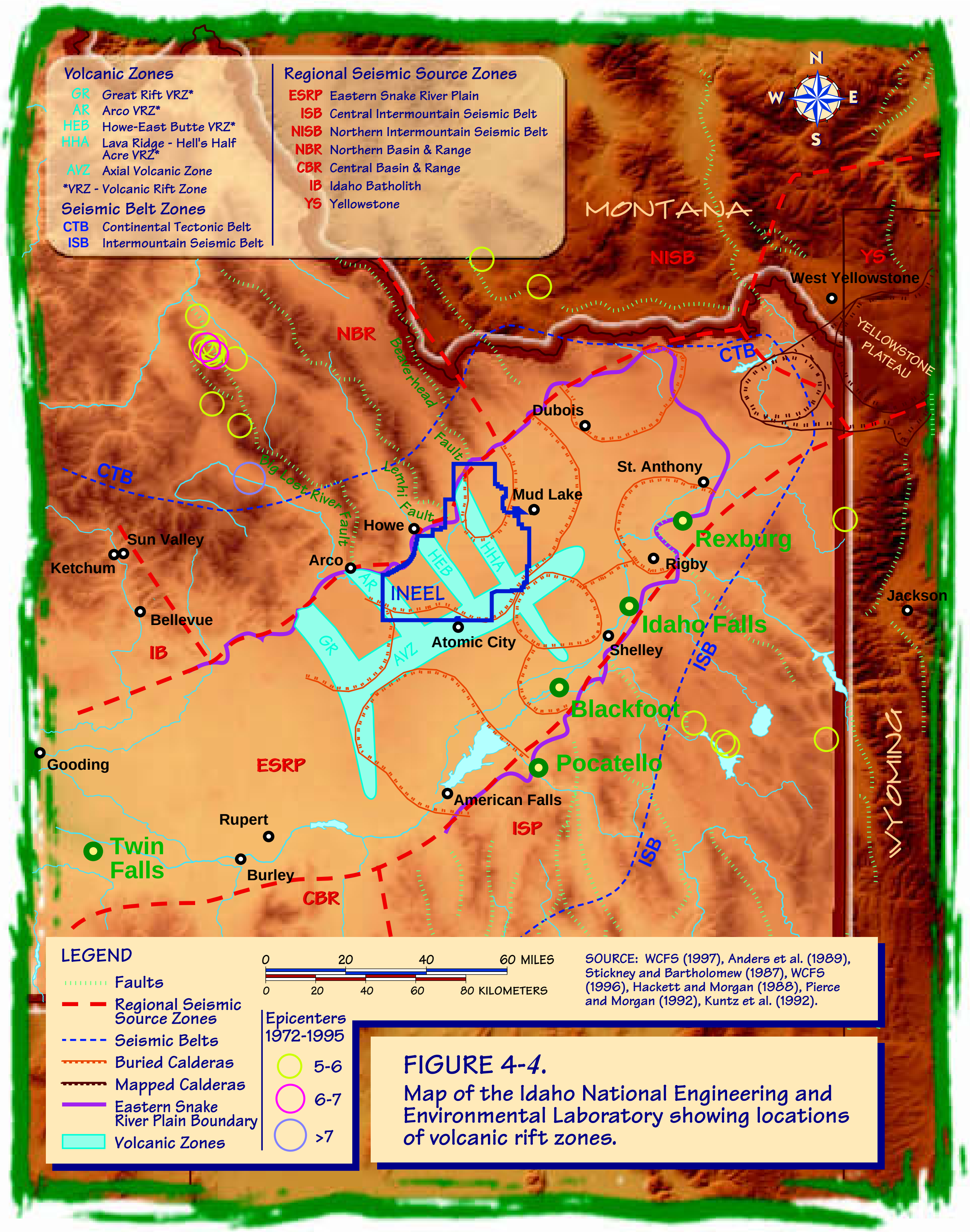
4.6 Geology and Soils

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

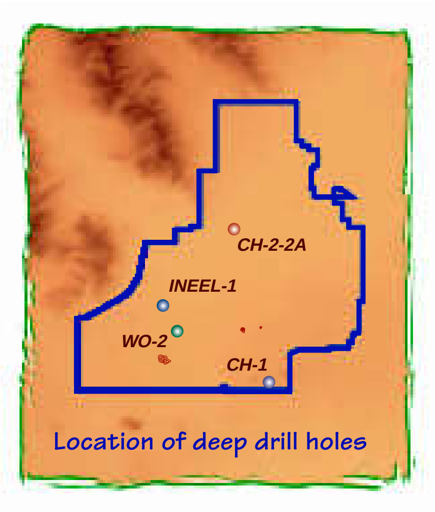
INEEL occupies a relatively flat area on the northwestern edge of the Eastern Snake River Plain. Figure 4-***4*** shows important geological features of the INEEL area. The area consists of a broad plain that has been built up from the eruptions of multiple flows of basaltic lava, which is shown on Figure 4-***5***. 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.

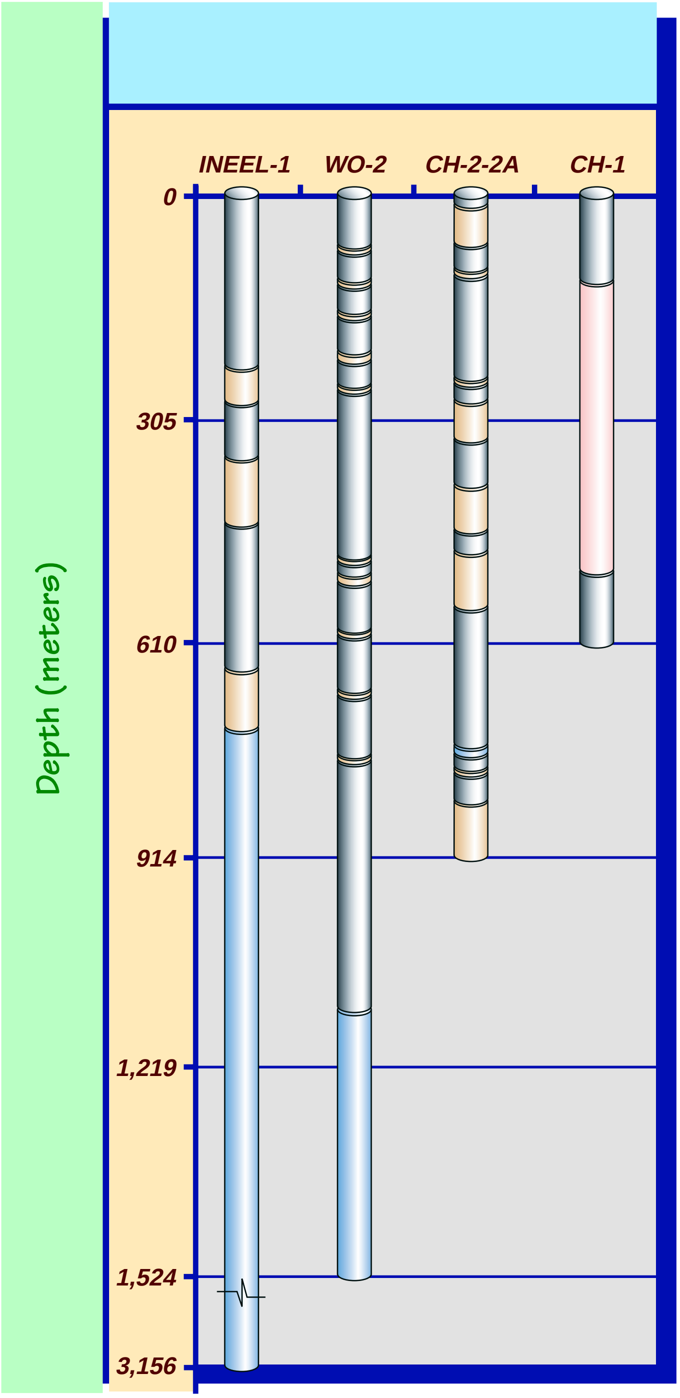
The seismic characteristics of the Plain and the adjacent Basin and Range Province are different. Earthquakes and active faulting are associated with Basin and Range tectonic activity. The Plain, however, has historically experienced infrequent small-magnitude earthquakes (King et al. 1987; Pelton et 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).



SOURCE: WCFS (1997), Anders et al. (1989), Stickney and Bartholomew (1987), WCFS (1996), Hackett and Morgan (1988), Pierce and Morgan (1992), Kuntz et al. (1992).

FIGURE 4-4.
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 4-5.
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, 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 ***up*** 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).

As a result of past practices, radioactive and hazardous materials have been released to surface soils at the INTEC. Best management practices such as monitoring and spill control programs 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 ***Eastern Snake River*** 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 ***Eastern*** 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 from earthquakes in the Basin and Range ***could affect INEEL***.

Patterns of seismicity and locations of mapped faults are used to assess potential sources of

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).

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-***4***):
  - Beaverhead Fault
  - Lost River Fault
  - Lemhi Fault
- **Volcanic Zones** – The Volcanic Zones on and around INEEL (see Figure 4-***4***):
  - 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 ***2002***). The mean peak ground acceleration, determined by the INEEL Natural Phenomena ***Hazards*** Committee, ***has been*** 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 tiers. Additional background information is presented in Appendix C.2, Air Resources. ***Newly developed information on baseline radiological dose, foreseeable increases in dose, and consumption of Prevention of Significant Deterioration (PSD) increment is presented in Sections 4.7.3 and 4.7.4.***

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-***6*** 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

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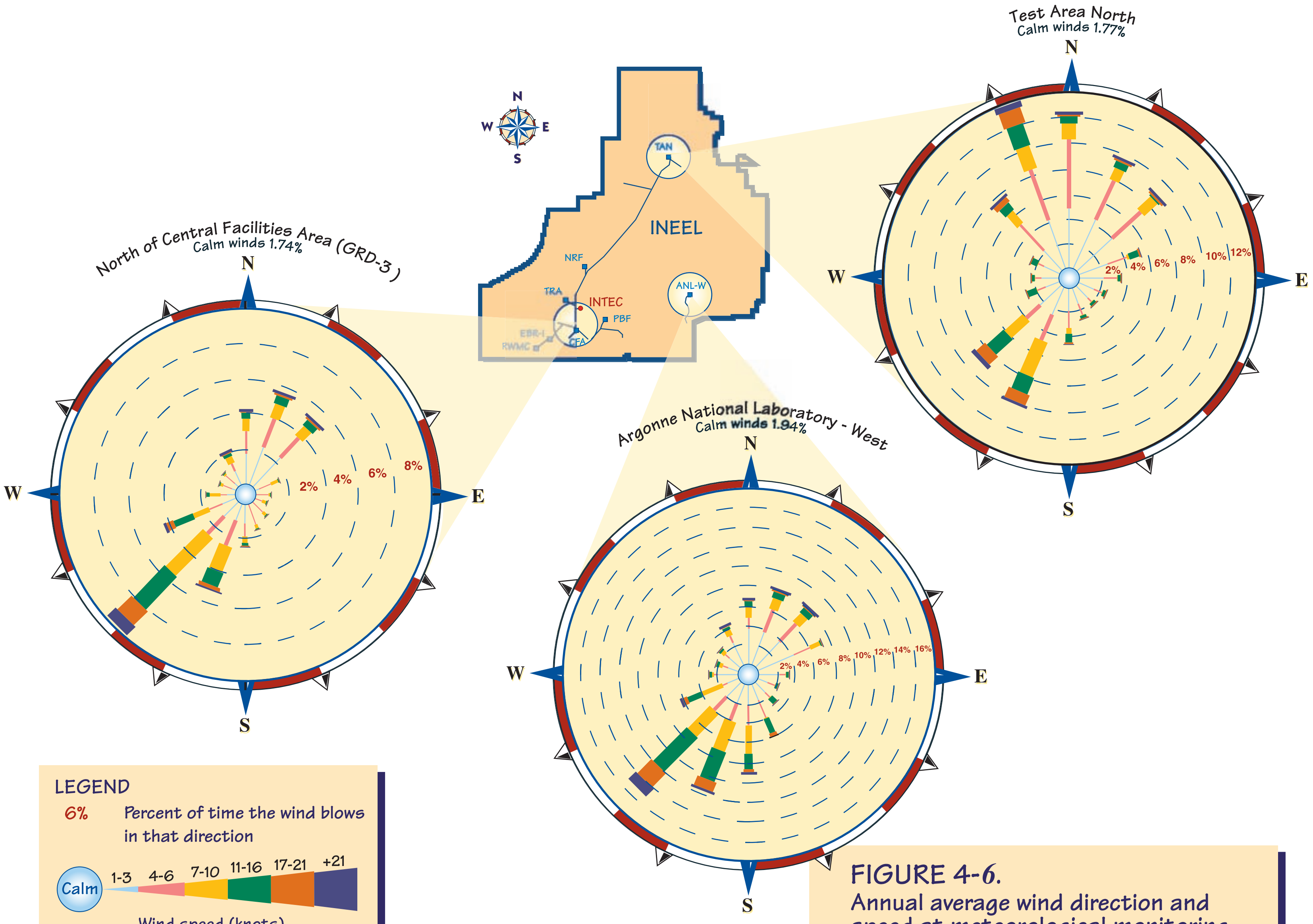


LEGEND

6% Percent of time the wind blows in that direction

Calm 1-3 4-6 7-10 11-16 17-21 +21

Wind speed (knots)

SOURCE: Clawson *et al.* (1989).

FIGURE 4-6.
Annual average wind direction and speed at meteorological monitoring stations on INEEL.

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. 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 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 ***the*** Craters of the Moon ***Wilderness Area***, 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 (EPA) and the State of Idaho Department 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 (***DEQ 2001***) ***as well as*** to internal policies and requirements of DOE.

INEEL occupies portions of ***five*** counties (Butte, Jefferson, Bingham, ***Bonneville, and Clark***) 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 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. ***Table 4-10 summarizes the airborne radioactivity emitted during 1999 and 2000, which includes calciner operations through May 2000.***

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. ***Projected*** 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-***7*** 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 (199***5*** through 199***9***), average radiation exposure levels for the boundary locations were no different than those at distant stations. The average annual dose measured by the Environmental ***Surveillance, Education and Research Program*** during 199***9*** was 12***2*** millirem for distant locations and 124 millirem for boundary community locations. 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 (***ESERP 2002***).

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 ***working*** directly with the source of the exposure (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

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 ***did*** 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.

Table 4-10. Summary of airborne radionuclide emissions (in curies) for 1999 and 2000 from facility areas at INEEL.[a]

	Tritium/ carbon-14		Iodines		Noble gases		Mixed fission and activation products[b]		U/Th/TRU[c]	
Area	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000
Monitored sources										
Argonne National Lab – West	11	2.5	–[d]	–	1.9×10^{3}	400	–	–	–	–
Central Facilities Area	–	–	–	–	–	–	–	–	–	–
INTEC	8.9	13	2.6×10^{-3}	6.1×10^{-3}	–	–	6.9×10^{-4}	7.2×10^{-4}	2.4×10^{-6}	2.8×10^{-6}
Naval Reactors Facility	–	–	–	–	–	–	–	–	–	–
Power Burst Facility	55	2.6×10^{-4}	4.2×10^{-12}	1.6×10^{-10}	–	–	–	–	2.8×10^{-9}	–
RWMC[e]	–	–	–	–	–	–	–	–	–	–
Test Area North	–	93	–	7.9×10^{-3}	–	920	2.7×10^{-6}	3.4×10^{-7}	–	–
Test Reactor Area	–	–	–	–	–	–	–	–	–	–
INEEL Total	75	110	2.6×10^{-3}	0.014	1.9×10^{3}	1.3×10^{3}	7.0×10^{-4}	7.2×10^{-4}	2.4×10^{-6}	2.8×10^{-6}
Other release points										
Argonne National Lab – West	0.014	0.010	–	–	–	–	–	–	–	–
Central Facilities Area	–	–	–	–	–	–	2.7×10^{-8}	6.6×10^{-8}	3.1×10^{-5}	1.0×10^{-9}
INTEC	1.1×10^{-5}	150	1.6×10^{-7}	6.1×10^{-11}	–	1.2×10^{3}	1.4×10^{-3}	4.4×10^{-3}	2.9×10^{-6}	8.2×10^{-4}
Naval Reactors Facility	0.67	0.69	5.0×10^{-6}	9.0×10^{-6}	0.047	0.68	1.5×10^{-4}	1.1×10^{-4}	–	6.0×10^{-6}
Power Burst Facility	7.1×10^{-5}	0.018	3.3×10^{-10}	1.6×10^{-16}	1.5×10^{-11}	2.8×10^{-13}	7.0×10^{-5}	9.8×10^{-5}	5.6×10^{-9}	4.4×10^{-7}
RWMC	0.021	0.011	–	–	–	–	4.6×10^{-8}	3.1×10^{-7}	1.0×10^{-6}	7.2×10^{-6}
Test Area North	5.3×10^{-4}	1.4×10^{-7}	–	–	–	–	2.7×10^{-7}	4.4×10^{-4}	5.7×10^{-7}	1.1×10^{-6}
Test Reactor Area	170	200	0.13	0.38	1.2×10^{3}	1.5×10^{3}	0.45	2.3	7.4×10^{-6}	1.3×10^{-5}
INEEL Total	170	350	0.13	0.38	1.2×10^{3}	2.7×10^{3}	0.45	2.3	4.3×10^{-5}	8.5×10^{-4}
Fugitive sources										
Argonne National Lab – West	–	–	–	–	–	–	–	–	–	–
Central Facilities Area	3.5	3.7	–	–	–	2.9×10^{-6}	1.9×10^{-5}	2.6×10^{-4}	1.4×10^{-10}	1.5×10^{-5}
INTEC	8.9×10^{-9}	0.092	3.8×10^{-8}	8.0×10^{-3}	–	7.1	9.2×10^{-6}	0.22	5.9×10^{-8}	1.2×10^{-3}
Naval Reactors Facility	–	–	–	–	–	–	–	3.9×10^{-5}	–	4.9×10^{-8}
Power Burst Facility	0.018	–	–	–	–	–	5.6×10^{-5}	5.6×10^{-5}	2.7×10^{-7}	2.8×10^{-7}
RWMC	55	130	–	–	–	–	3.7×10^{-7}	3.7×10^{-7}	9.5×10^{-9}	9.5×10^{-9}
Test Area North	0.060	0.15	–	–	–	–	1.1×10^{-4}	8.8×10^{-4}	9.4×10^{-8}	9.8×10^{-8}
Test Reactor Area	87	100	1.2×10^{-3}	9.3×10^{-3}	5.0×10^{-5}	2.0×10^{-4}	1.0×10^{-3}	1.6×10^{-3}	7.4×10^{-8}	9.9×10^{-6}
INEEL Total	150	230	1.2×10^{-3}	0.017	5.0×10^{-5}	7.1	1.2×10^{-3}	0.22	5.1×10^{-7}	1.2×10^{-3}
Total INEEL releases										
Argonne National Lab.-West	11	2.5	–	–	1.9×10^{3}	400	–	–	–	–
Central Facilities Area	3.5	3.7	–	–	–	2.9×10^{-6}	1.9×10^{-5}	2.6×10^{-4}	3.1×10^{-5}	1.5×10^{-5}
INTEC	8.9	160	2.6×10^{-3}	0.014	–	1.2×10^{3}	2.1×10^{-3}	0.23	5.5×10^{-6}	2.0×10^{-3}
Naval Reactors Facility	0.67	0.69	5.0×10^{-6}	9.0×10^{-6}	0.047	0.68	1.5×10^{-4}	1.5×10^{-4}	–	6.0×10^{-6}
Power Burst Facility	55	0.018	3.3×10^{-10}	1.6×10^{-10}	1.5×10^{-11}	2.8×10^{-13}	1.3×10^{-4}	1.5×10^{-4}	2.8×10^{-7}	7.2×10^{-7}
RWMC	55	130	–	–	–	–	4.2×10^{-7}	6.8×10^{-7}	1.0×10^{-6}	7.2×10^{-6}
Test Area North	0.061	93	–	7.9×10^{-3}	–	920	1.1×10^{-4}	1.3×10^{-3}	6.6×10^{-7}	1.2×10^{-6}
Test Reactor Area	260	300	0.13	0.39	1.2×10^{3}	1.5×10^{3}	0.45	2.3	7.5×10^{-6}	2.3×10^{-5}
INEEL Total	400	690	0.13	0.41	3.1×10^{3}	4.0×10^{3}	0.45	2.5	4.6×10^{-5}	2.1×10^{-3}

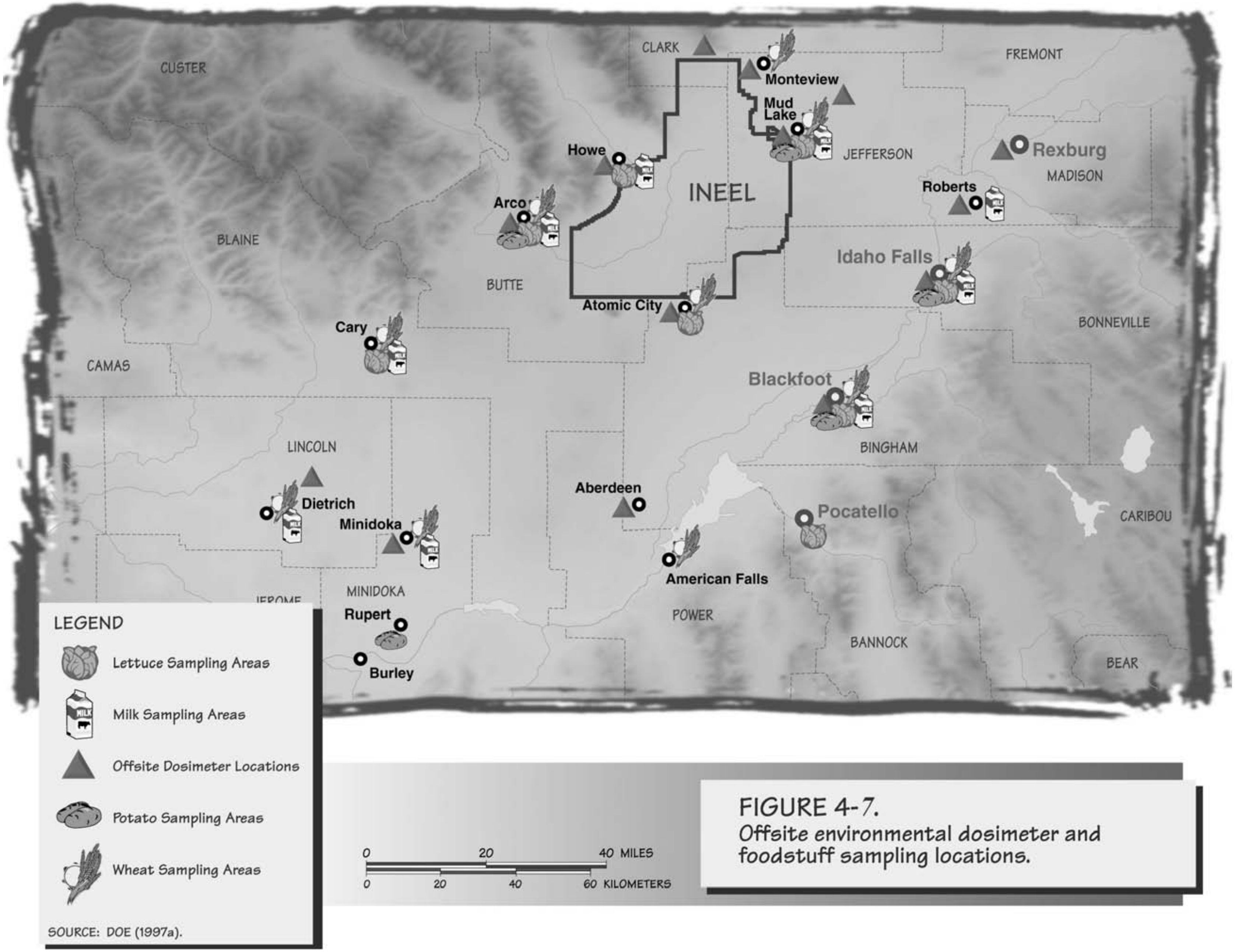
a. Source: DOE (2000, 2001).

b. Mixed fission and activation products that are primarily particulate in nature (e.g., cobalt-60, strontium-90, and cesium-137).

c. U/Th/TRU = Radioisotopes of heavy elements such as uranium, thorium, plutonium, americium, and neptunium.

d. – = Negligibly small or zero.

e. RWMC = Radioactive Waste Management Complex.



SOURCE: DOE (1997a).

FIGURE 4-7.
Offsite environmental dosimeter and foodstuff sampling locations.

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 0.2*7* millirem per year. This dose is a very small fraction of the DOE-established occupational dose limit (5,000 millirem per year) and below the National Emission 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.

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 Emission 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 EPA 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.

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. ***Based on the Census 2000 data, the population within the 50-mile INTEC radius has increased to almost 140,000 (Pruitt 2002).***

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.***35*** millirem
- Maximum ***exposed*** 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 in 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 assessed 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. Sources such as thermal treatment processes, boilers, and emergency generators emit both criteria and toxic air pollutants. Nonthermal chemical processing operations, waste management activities (other than combustion), and research laboratories ***are potential sources of*** 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 4-1***1*** 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. ***Except for lead, the current (1996 and 1997) critria pollutant 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 eight times 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. 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 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 expo-

Table 4-11. 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	***0.82***	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.

sure, 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 ***analyzed*** 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 ***(IDAPA 58.01.01)***. Unlike criteria pollutants, the toxic standards apply only to incremental increases of these pollutants, and not the sum of baseline levels and incremental increases.

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 EPA 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 ***the*** maximum ***predicted*** short-term benzene concentration, which slightly exceeded the standard within the ***INEEL's*** Central Facilities Area. Those levels result primarily from gasoline and diesel fuel storage tank emissions at the Central Facilities Area-754; however, those tanks were taken out of service in 1995, and current benzene levels are estimated to be below the occupational standard.

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 4-1*2*, indicate that all concentrations are well within the ambient air quality standards.

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 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.

Prevention of Significant Deterioration - In the SNF & INEL EIS, concentrations of criteria pollutants from existing INEEL sources were also compared to PSD 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 PSD 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. ***Federal land managers (e.g., Bureau of Land Management or National Park Service) are responsible for the protection of air quality values, including visibility, in land areas under their jurisdiction. The Clean Air Act requires the prevention of any future impairment and the remedying of any existing impairment in Class I federal areas (see Section 4.5, Aesthetic and Scenic Resources for a description of the Visual Resource Management ratings).*** Separate ***PSD*** increments are established for pristine areas, such as national parks or wilderness areas (Class I areas) and for the nation as a whole (Class II areas). Craters of the Moon Wilderness Area is the Class I area nearest INEEL, while the site boundary and public roads are the applicable Class II areas.

The amount of increment consumed by existing sources subject to PSD regulation ***described in*** this EIS ***is based on increment consumption analyses recently performed to support a permit application for installation of new oil-fired boilers in the INTEC CPP-606 boiler facility. For this application, DOE updated source inventory, emission rate, and stack parameter data based on the most recent information, and performed dispersion modeling using both the CALPUFF (Scire et al. 1999) and ISCST3 models.***

Table 4-12. Ambient air concentrations of criteria pollutants from the combined effects of maximum baseline emissions and projected increases.

		Maximum projected concentration (μg/m^3)[a]				Percent of standard		
Pollutant	Averaging time	Site boundary	Public roads	Craters of the Moon Wilderness Area	Applicable standard[b] (μg/m^3)	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.***4***.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.

The National Park Service recommends using the CALPUFF model to assess conditions at receptor locations greater than 50 kilometers from the emissions source. DOE used CALPUFF in the screening mode of operation to estimate maximum increment consumption at Class I area locations at Craters of the Moon Wilderness Area and Yellowstone and Grand Teton National Parks.

For the Class II area on and around INEEL, and for the eastern portion of the Craters of the Moon Class I area, DOE used the ISCST3 model (Version 99155) with the most current three-year set of INEEL meteorological data (1996-1998). Table 4-13 presents the CALPUFF screening results for distant Class I areas, while Tables 4-14 and 4-15 present the ISCST3 modeling results for the eastern boundary of Craters of the Moon and the Class II area on and around INEEL. These results represent the estimated amount of PSD increment consumed by the combined effects of emissions from existing INEEL sources subject to PSD regulation including the new INTEC CPP-606 boilers, assuming maximum operational capacity and unrestricted usage (8,760 hours per year). Except for nitrogen dioxide, these results are generally consistent with those presented in the Draft EIS, and the amount of increment consumed at all Class I and Class II areas remains well within allowable levels. Nitrogen dioxide results are higher because the New Waste Calcining Facility calciner (historically the largest INEEL source of this pollutant) was included in the baseline determination performed to support the INTEC CPP-606 boiler facility permit application, whereas the Draft EIS evaluated this source as part of the Continued Current Operations Alternative and the Planning Basis, Hot Isostatic Pressed Waste, and Direct Cement Waste Options. Incineration at the Advanced Mixed Waste Treatment Project was included in the Draft EIS baseline but was not included in the CPP-606 permit update; however, projected emissions from that facility are minor and would not add noticeably to increment consumption.

Building on the baseline determination for the CPP-606 permit application, DOE developed a modified baseline for evaluating cumulative impacts for the Final EIS. This modified baseline excludes the CPP-606 boiler emissions (based on maximum operational capacity), because emissions resulting from fossil fuel consumption in support of the proposed action

Table 4-13. Prevention of Significant Deterioration increment consumption at distant Class I areas by sources subject to Prevention of Significant Deterioration regulation.[a]

			Craters of the Moon National Monument[b]		Yellowstone National Park[c]		Grand Teton National Park[d]	
Pollutant	Averaging time	Allowable PSD increment[e] ($\mu g/m^3$)	Maximum predicted concentration ($\mu g/m^3$)	Percent of PSD increment consumed	Maximum predicted concentration ($\mu g/m^3$)	Percent of PSD increment consumed	Maximum predicted concentration ($\mu g/m^3$)	Percent of PSD increment consumed
Sulfur dioxide[f]	3-hour	25	11	44	2.7	11	4	16
	24-hour	5	3.4	68	0.66	13	0.99	20
	Annual	2	0.23	12	0.026	1.3	0.045	2.3
Respirable particulates	24-hour	8	0.61	7.6	0.22	2.8	0.25	3.1
	Annual	4	0.032	0.8	4.7×10^{-3}	0.12	7.4×10^{-3}	0.19
Nitrogen dioxide	Annual	2.5	0.27	11	6.6×10^{-3}	0.26	0.022	0.88

a. From Rood (2000); modeled using CALPUFF assuming maximum emission rates and full utilization (8760 hours per year) for each source.

b. The results for Craters of the Moon represent the impacts predicted at a distance of 65 kilometers from INTEC, which corresponds to the western portion of Craters of the Moon National Monument, irrespective of direction.

c. The results for Yellowstone National Park represent the impacts predicted at a distance of 160 kilometers from INTEC, which corresponds to the closest (southwestern) boundary of Yellowstone, irrespective of direction.

d. The results for Grand Teton National Park represent the impacts predicted at a distance of 161 kilometers from INTEC, which corresponds to the closest (westernmost) boundary of Grand Teton, irrespective of direction.

e. Increments specified are State of Idaho standards (IDAPA 58.01.01.579-581).

f. Based on fuel sulfur content of 0.3 percent.

PSD = Prevention of Significant Deterioration.

Table 4-14. Prevention of Significant Deterioration increment consumption at the Craters of the Moon Class I area by sources subject to Prevention of Significant Deterioration regulation.[a]

Pollutant	Averaging time	Allowable PSD increment[b] (μg/m^3)	Maximum predicted concentration (μg/m^3)	Percent of PSD increment consumed
Sulfur dioxide[c]	3-hour	25	8.1	32
	24-hour	5	1.9	37
	Annual	2	0.12	6
Respirable particulates	24-hour	8	0.57	7.2
	Annual	4	0.025	0.6
Nitrogen dioxide	Annual	2.5	0.40	16

a. From Lane et al. (2000) ; assumes maximum emission rates and full utilization (8760 hours per year) for each source.
b. Increments specified are State of Idaho standards (IDAPA 58.01.01.579-581).
c. Sulfur dioxide results have been modified from the original results by a factor of 0.6 to reflect a change in fuel sulfur content of 0.5 to 0.3 percent.
PSD = Prevention of Significant Deterioration.

Table 4-15. 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.

			Maximum predicted concentration[a]			
Pollutant	Averaging time	Allowable PSD increment[b] (μg/m^3)	INEEL boundary (μg/m^3)	Public roads (μg/m^3)	Amount of increment consumed (μg/m^3)	Percent of PSD increment consumed[c]
Sulfur dioxide[d]	3-hour	512	80	120	120	23
	24-hour	91	16	27	27	29
	Annual	20	1.1	3.6	3.6	18
Respirable particulates	24-hour	30	4.9	10	10	34
	Annual	17	0.19	0.53	0.53	3.1
Nitrogen dioxide	Annual	25	3.3	8.8	8.8	35

a. From Lane et al. (2000) ; modeled using ISC3 assuming maximum emission rates and full utilization (8760 hours per year) for each source.
b. Increments specified are State of Idaho standards (IDAPA 58.01.01.579-581).
c. The amount of increment consumed is equal to the highest value of either the site boundary or public road locations.
d. Sulfur dioxide results have been modified from the original results by a factor of 0.6 to reflect a change in fuel sulfur content of 0.5 to 0.3 percent.
PSD = Prevention of Significant Deterioration.

(including operation of the CPP-606 boilers at less than full capacity) are assessed as elements of the waste processing alternatives. In addition, the modified baseline includes contributions from the Advanced Mixed Waste Treatment Project (excluding thermal treatment) and other planned projects (See Section C.2.3.3). This modified baseline is presented in Table 4-16.

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. ***Portions of Bannock and Power counties in Idaho, near the region of influence, are in a non-attainment area for particulate matter.*** 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.

Table 4-16. 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)***		
			At or beyond site boundary	***Public roads***	***Craters of the Moon***
Carbon monoxide	***40,000***	***1-hour***	***220***	***330***	***8.5***
	10,000	***8-hour***	***44***	***68***	***3.5***
Nitrogen dioxide	***100***	***Annual***	***1.0***	***2.2***	***0.084***
Sulfur dioxide	***1,300***	***3-hour***	***30***	***140***	***6.2***
	365	***24-hour***	***6.1***	***32***	***1.7***
	80	***Annual***	***0.26***	***4.5***	***0.070***
Respirable particulates	***150***	***24-hour***	***9.0***	***20***	***0.94***
	50	***Annual***	***0.39***	***1.3***	***0.043***
Lead	***1.5***	***Quarterly***	1.8×10^{-3}	5.6×10^{-3}	3.9×10^{-4}

a. Modeled concentrations are compared to the applicable standards provided above (IDAPA 58.01.01.577) (DEQ 2001). Primary standards are designed to protect public health. Secondary standards are designed to protect public welfare. The most stringent standard is used for comparison.

b. Baseline represents the modeled pollutant concentrations based on an actual operating emissions scenario. Sources include existing INEEL facilities with actual 1997 INEEL emissions, plus reasonably foreseeable sources such as the Advanced Mixed Waste Treatment Project. The newly installed CPP-606 steam production boilers are excluded, since they are assessed as elements of the waste processing alternatives (see Section 5.2.6).

4.8 Water Resources

This section describes 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-***8*** 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 water in Birch 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 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 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. 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).

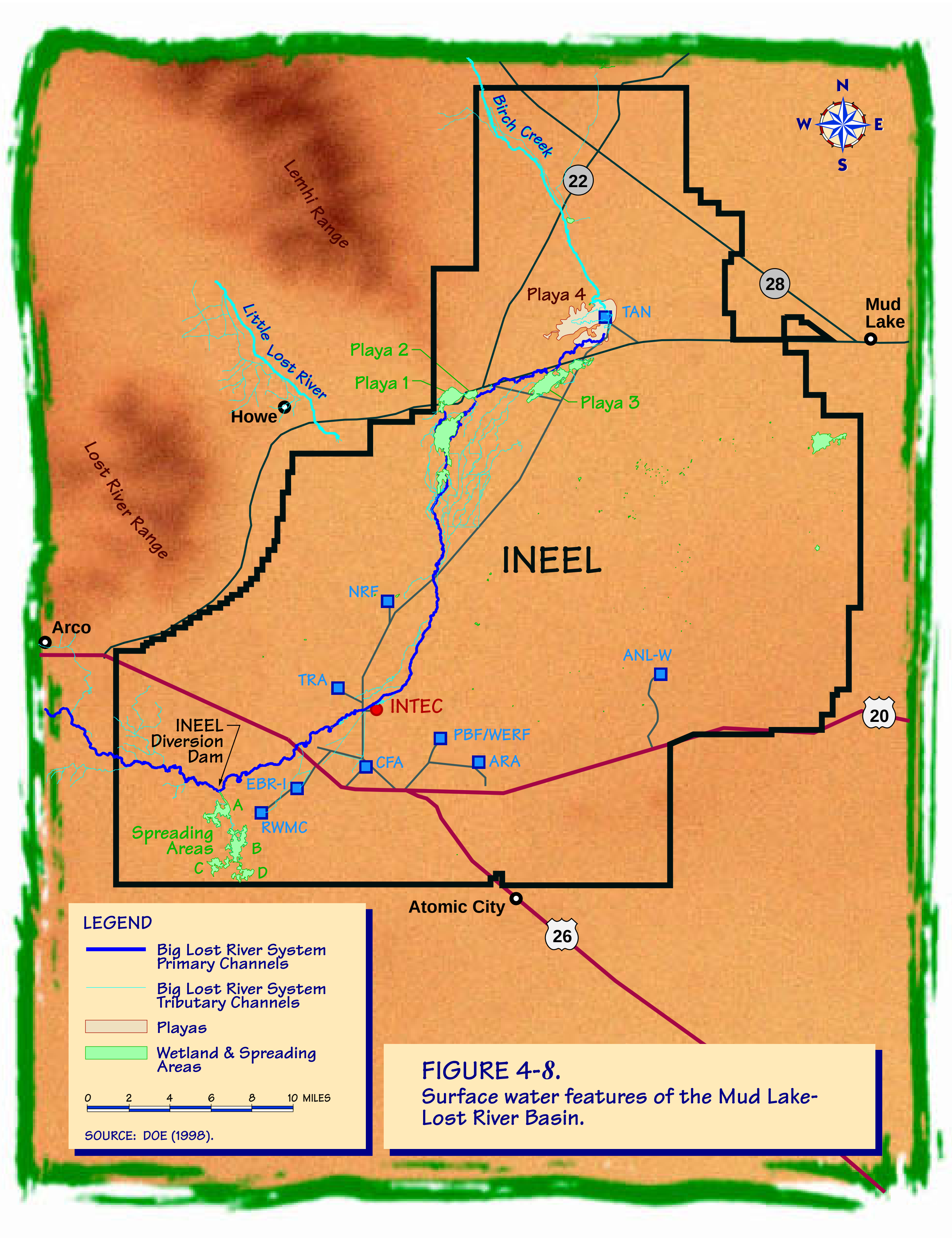


FIGURE 4-8.
Surface water features of the Mud Lake-Lost River Basin.

4.8.1.3 Flood Plains

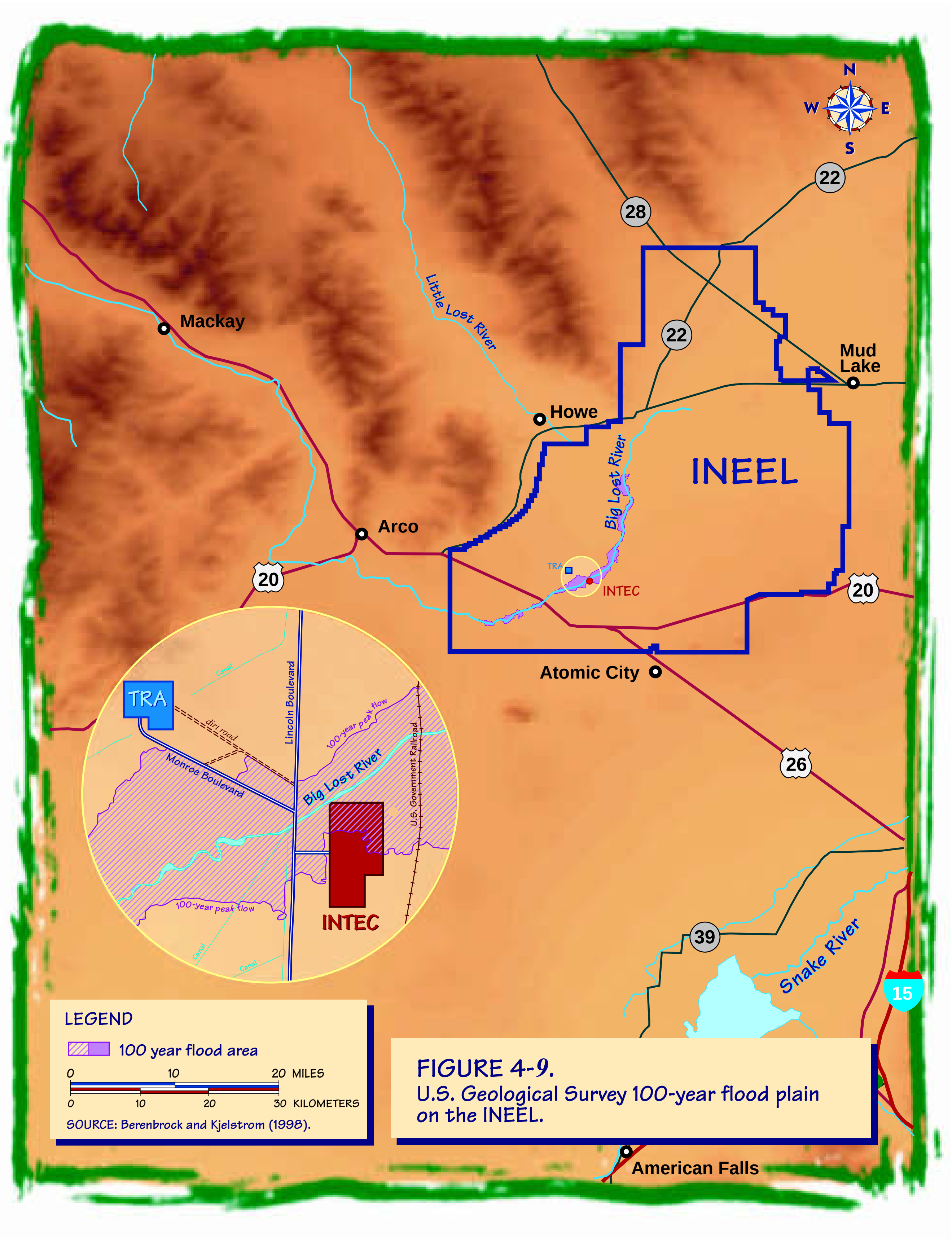
Flood studies at the INEEL include the examination of the flooding potential at INEEL facilities due to the failure of Mackay Dam, 45 miles upstream of the INEEL ***from a probable maximum flood*** (Koslow and Van Haaften 1986). The U.S. Geological Survey ***has published a preliminary map*** of the 100-year flood plain for the Big Lost River ***on the INEEL*** (Berenbrock and Kjelstrom 1998). ***As a result of this screening analysis, which indicated that INTEC may be subject to flooding from a 100-year flood,*** DOE commissioned additional studies (Ostenaa et al. 1999) ***consistent with the requirements contained in DOE standards for a comprehensive flood hazard assessment (DOE 1996).*** There is no record of any historical flooding at the INTEC ***from the Big Lost River, although evidence of flooding in geologic time exists.***

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 resulting in the overtopping and rapid failure of Mackay Dam. This flood would result 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 (ESRF 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 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, a potential effect could be the failure of bin set 1. This event is discussed in Section 5.2.7.3.

Debris bulking was not considered in the flow volumes for the probable maximum flood. Other than natural topography, the primary choke points for probable maximum flood flows are the diversion dam on the INEEL and the culverts on Lincoln Boulevard near INTEC. The probable maximum flood would quickly overtop and wash out the diversion dam so there would essentially be no effect on flows downstream of the dam. The Lincoln Boulevard culverts are capable of passing about 1,500 cubic feet per second ***(Berenbrock and Kjelstrom 1998)***. Due to the relatively flat topography in the vicinity of INTEC, debris plugging at the culverts would have little effect on the probable maximum flood elevation at INTEC.

Estimates of the 100- and 500-year flows for the Big Lost River were most recently published by the U.S. Geological Survey (Berenbrock and Kjelstrom 1996) and the U.S. Bureau of Reclamation (Ostenaa et al. 1999). The U.S. Geological Survey 100-year flow estimate is 7,260 cubic feet per second at the Arco gauging station 12 miles upstream of the INEEL Diversion Dam. This estimate is based on 60 years of stream gauge data and conservative assumptions. These assumptions attempt to address the effect of Big Lost River regulation and irrigation, which complicate the use of traditional approaches to flood frequency analysis. The U.S. Geological Survey published a preliminary one-dimensional map of the Big Lost River flood plain (Berenbrock and Kjelstrom 1998) based on the 7,260 cubic feet per second 100 year flow estimate (see Figure 4-9). In this study, it was assumed that the INEEL Diversion Dam did not exist and that 1,040 cubic feet per second would be captured by the diversion channel and flow to the spreading areas southwest of the Diversion Dam. The model then routed the remaining 6,220 cubic feet per second down the Big Lost River channel on the INEEL.

A U.S. Army Corps of Engineers analysis of existing data (Bhamidipaty 1997) and an INEEL geotechnical analysis (LMITCO 1998) both concluded that the INEEL Diversion Dam could withstand flows up to 6,000 cubic feet per second. Culverts running through the diversion dam could convey a maximum of an additional 900 cubic feet per second but their condition and capacity as a function of water elevation is unknown (Bhamidipaty 1997). Although the net capacity of the INEEL Diversion Dam may exceed U.S. Geological Survey 100-year flow estimates, it is not certi-



SOURCE: Berenbrock and Kjelstrom (1998).

FIGURE 4-9.
U.S. Geological Survey 100-year flood plain on the INEEL.

fied or used as a flood control structure for flood plain mapping purposes.

The flows and frequencies in the U.S. Bureau of Reclamation study are based on statistical analyses with inputs from stream gauge data and two-dimensional flow modeling constrained by geomorphic evidence. Radiocarbon dating indicates that the geologic evidence records Big Lost River flow history over the last 10,000 years. The mean Bureau of Reclamation estimate for the 100-year flow of the Big Lost River is 2,910 cubic feet per second. The flood plain resulting from a flow with a 97.5 percent chance of not being exceeded in 100 years (3,270 cubic feet per second) is shown on Figure 4-10. The mean Bureau of Reclamation estimate for the 500-year Big Lost River flow is 3,669 cubic feet per second. The flood plain resulting from a flow with a 97.5 percent chance of not being exceeded in 500 years (4,086 cubic feet per second) is shown on Figure 4-11.

These flood plain maps were generated assuming one-dimensional flow, no infiltration or flow loss along the Big Lost River flow path, and no diversion dam. Under these conservative assumptions, small areas of the northern portion of the INTEC could flood at the estimated 100 and 500 year flows. Additional work is under way at the INEEL by both the U.S. Geological Survey and the Bureau of Reclamation to further refine flow frequency estimates for the Big Lost River in the vicinity of INTEC.

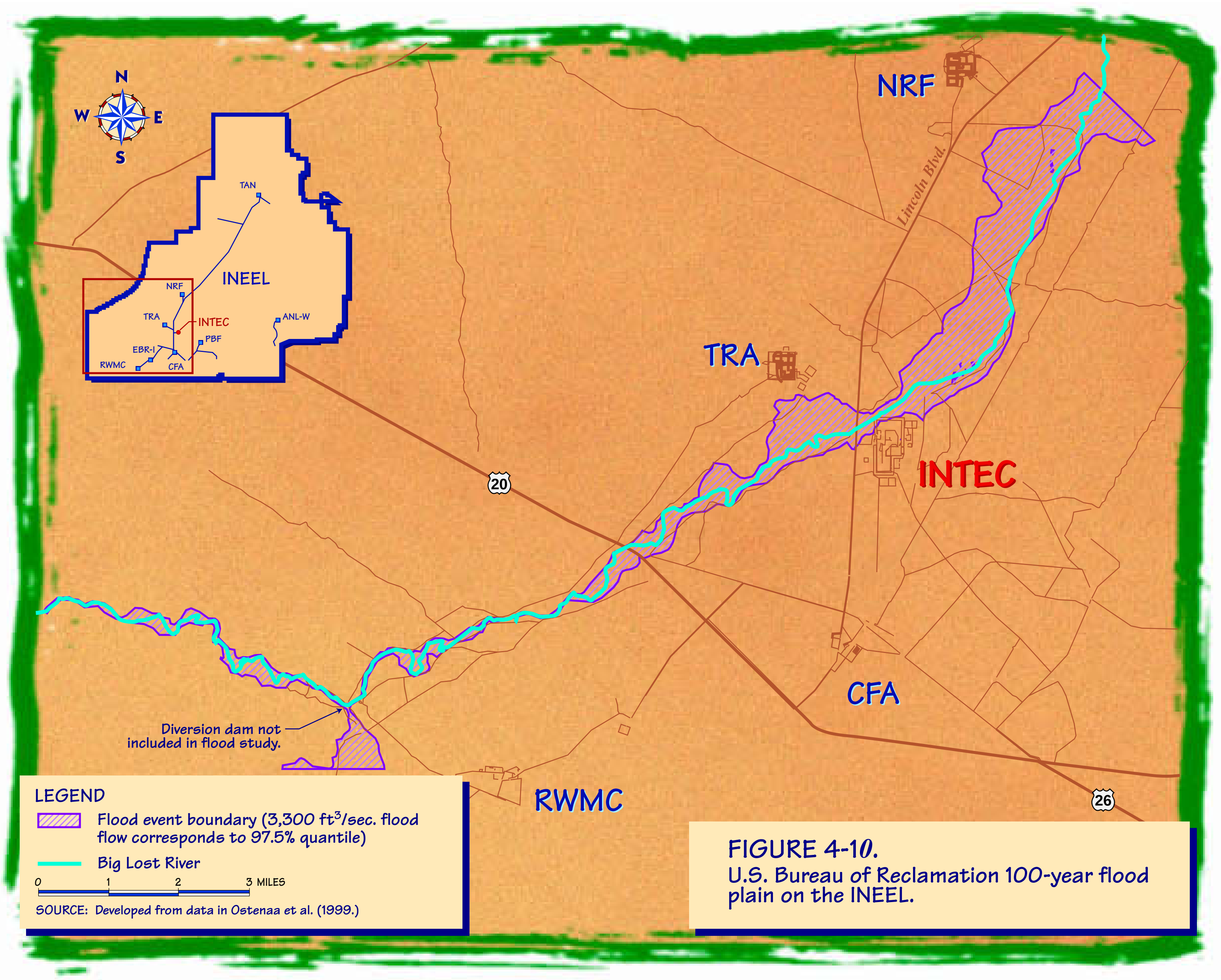
4.8.1.4 Surface Water Quality

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).

DOE measures surface water quality at INTEC at two stormwater monitoring locations, the percolation ponds and the sewage treatment lagoons. 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.

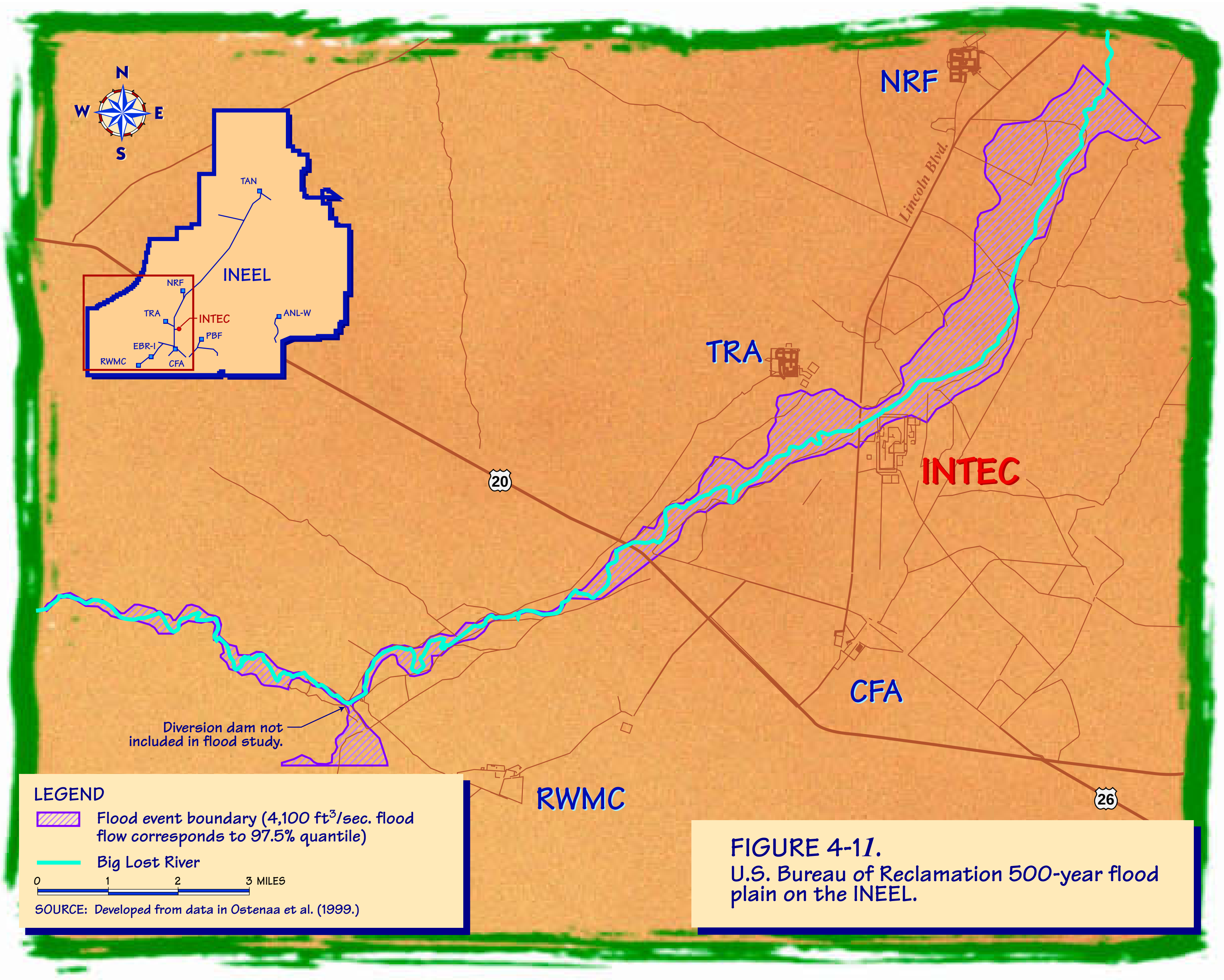
DOE monitors for metals, inorganics, radiological constituents, and volatile organic compounds in stormwater (LMITCO 1997). EPA-specified nonradiological benchmarks (60 FR 50826; September 29, 1995) and radiological benchmarks from the Derived Concentration Guides from DOE Order 5400.5 form the baseline 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 service waste system to the percolation ponds and effluent from the sewage treatment plant prior to discharge to the rapid infiltration trenches. 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). ***In 2000,*** the sewage treatment plant effluent did not exceed the 100 mg/L total suspended solids limit, or the flow limit specified in the permit. ***The 20 mg/L total nitrogen limit for the sewage treatment plant effluent was exceeded in three monthly samples during the calendar year. However, the 2000 total nitrogen average was 15.6 mg/L. As part of the ongoing nitrogen study, an in-depth inventory of nitrogen sources contributing to the INTEC sewage treatment plant was performed. The study did not identify any new sources. Additional corrective actions are planned (DOE 2001).***



SOURCE: Developed from data in Ostenaa et al. (1999.)

FIGURE 4-10.
U.S. Bureau of Reclamation 100-year flood plain on the INEEL.



SOURCE: Developed from data in Ostenaa et al. (1999.)

FIGURE 4-11.
U.S. Bureau of Reclamation 500-year flood plain on the INEEL.

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 4-12. 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).

4.8.2.2 Local Hydrogeology

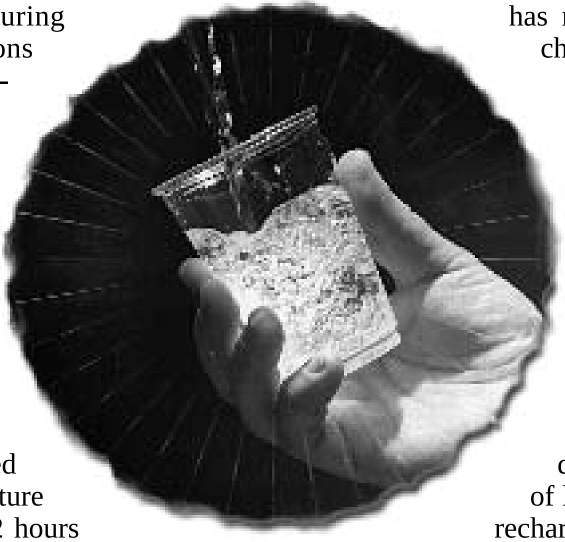
Groundwater directly beneath INTEC generally flows to the southwest and southeast, with some flow to the south. The local groundwater flow is complex and variable, and is influenced by recharge from the Big Lost River (when flow is present), the percolation ponds and sewage ponds, areas of low aquifer 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.

SOURCE: Adapted from DOE (1995).

FIGURE 4-12
Aquifers of Idaho.

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).

The upper basalt perched water zone occurs between the depths of 100 ***and*** 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 ***and*** 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 wastewater 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 ***Bechtel BWXT Idaho, LLC*** Environmental Monitoring Program. An extensive groundwater quality study at INTEC was completed in 1995

(Rodriguez et al. 1997). ***In 2001, a tracer study was conducted on INTEC perched water and monitoring of the Snake River Plan Aquifer was performed (DOE 2002a,b). Results from the groundwater monitoring activities supporting the Remedial Investigation/Feasibility Study and associated Record of Decision are summarized in reports prepared and published by the respective CERCLA Waste Area Groups.*** 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.

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 Rules for Public Drinking Water Systems (***DEQ 2001a***). In ***2000***, 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 (***DOE 2001***).

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 (***DEQ 2001b***). 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***W***-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 4-1***7*** summarizes 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, ***lead***, 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.

Table 4-17. Monitoring parameters that were exceeded for INTEC surveillance wells.[a]

Location	Exceeded parameter	Maximum concentration	Surveillance threshold[b]
PW-1[c]	***aluminum***	***0.254 mg/L***	***0.05mg/L***
	iron	***26 mg/L***	***0.3 mg/L***
	lead	***0.0036 mg/L***	***0 mg/L***
PW-2[c]	aluminum	***1.49 mg/L***	0.05mg/L
	chloride	287 mg/L	250 mg/L
	iron	***2.2 mg/L***	0.3 mg/L
	strontium-90	8.3 ± 3.4 pCi/L	8.0 pCi/L
PW-4[c]	iron	***2.2 mg/L***	0.3 mg/L
PW-5[c]	***aluminum***	***0.0562 mg/L***	***0.05 mg/L***
	iron	***2.93 mg/L***	***0.3 mg/L***
USGS-036[d]	strontium-90	***9.54 ± 1.34 pCi/L***	8.0 pCi/L
USGS-052[d]	***gross alpha***	***15 ± 3.86 pCi/L***	***15.0 pCi/L***
USGS-057[d]	strontium-90	***21.1 ± 3.43 pCi/L***	8.0 pCi/L
USGS-067[d]	strontium-90	***11.1 ± 1.47 pCi/L***	8.0 pCi/L
ICPP-MON-A-021[e,f]	total coliform	20 col/100mL	<1 col/100mL
ICPP-MON-A-022[e,g]	iron	0.487 mg/L	0.3 mg/L

a. ***Source: DOE (2002a).***

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. Source: LMITCO (1997).

f. INTEC upgradient background well (upgradient Sewage Treatment Plant well).

g. INTEC Sewage Treatment Plant surveillance well.

In 1995, 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-contamination. The source of iron is unknown. Strontium-90 concentrations are consistent with historical values (LMITCO 1997). ***In 2000, data were available for USGS-52 indicating the gross alpha concentrations were above threshold levels (DOE 2002b).***

Constituents detected above threshold levels in surveillance wells are strontium-90 and tritium. 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). ***In 2001, a tracer study was conducted on INTEC perched water and monitoring of the Snake River Plain Aquifer was performed (DOE 2002a,b).*** Tables 4-1***8*** and 4-1***9*** show the maximum concentrations of inorganics and radionuclides in the perched water and the Snake River Plain Aquifer found in ***these studies and monitoring efforts***. The percolation pond perched water body was not monitored as part of the ***1995*** 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.

In 2001, all the perched water bodies again exceeded the maximum contaminant level for nitrate/nitrite. However, only half of the 15 sample results were exceedances. The highest nitrate/nitrite concentration (60.3 mg/L) is

Table 4-18. Maximum concentrations of inorganics and radionuclides in perched water at INTEC.[a]

	Maximum concentration (mg/L or pCi/L)	Well	Perched water body
	Inorganics (mg/L)		
Alkalinity	290[b]	MW-5	Northern upper
Carbonate	5.4[b]	MW-17	Southern lower
Chloride	248	PERC Pond B	
Fluoride	0.312	Big Lost River C	Northern lower
Sulfate	12.8	USGS-50	
Total Kjeldahl Nitrogen	1.5[b]	MW-18	Northern lower
Ammonia – N	ND[b]		
NO_3/NO_2 – N	70[b]	MW-1	Northern lower
Aluminum	18.3	MW-20	Northern upper
Antimony	0.0103	MW-6	Northern upper
Arsenic	0.0167	MW-2	Northern upper
Barium	0.541	CPP 37-4	Northern upper
Beryllium	ND	–	
Cadmium	ND	–	
Calcium	114	CPP 37-4	Northern upper
Chromium	2.52	MW-2	Northern upper
Cobalt	0.0509	MW-6	Northern upper
Copper	0.0874	MW-6	Northern upper
Iron	39.5	Central Set B	Northern upper
Lead	0.0338	CPP 37-4	Northern upper
Magnesium	35.9	CPP 37-4	Northern upper
Manganese	6.55	MW-17	Northern lower
Mercury	8.58×10^{-4}	Central Set B	Northern upper
Nickel	0.276	CPP 55-06	Northern upper
Potassium	17.4	MW-17	Northern upper
Selenium	ND	–	
Silver	ND	–	
Sodium	136	Perc Pond B	Southern upper
Thallium	ND	–	
Vanadium	0.0494	MW-2	Northern upper
Zinc	1.73	MW-2	Northern upper
Zirconium	ND	–	
	Radionuclides (pCi/L)		
Gross Alpha	1,100 ± 220[b]	MW-2	Northern upper
Gross Beta	5.9×10^5 ± 2,600[b]	MW-2	Northern upper
Tritium	40,400 ± 220	MW-17	Northern upper
Strontium-90	1.36×10^5 ± 18,200	MW-2	Northern upper
Plutonium-238	0.0501± 0.0107	–	
Plutonium-239/240	ND	–	
Americium-241	0.0374 ± 0.0169	PW-5	
Neptunium-237	0.0361 ± 0.012	MW-2	Northern upper
Iodine-129	0.65 ± 0.065	USGS-50	
Technetium-99	457 ± 9.15	MW-18	Northern lower
Uranium-233/234	15.3 ± 1.99	Central Set B	Northern upper
Uranium-235/236	0.142 ± 0.042	CPP 37-4	Northern upper
Uranium-238	6.94 ± 1.21	Central Set B	Northern upper

a. Source: DOE (2002a) unless otherwise noted.

b. Source: Rodriguez et al. (1997).

ND = Not detected.

Table 4-19. Maximum concentrations of inorganics and radionuclides in the Snake River Plain Aquifer in the vicinity of INTEC.

Contaminant	Maximum concentration (mg/L or pCi/L)	Well	Maximum contaminant level[a] (mg/L or pCi/L)	Background[b] (mg/L or pCi/L)
Inorganics (mg/L)[c]				
Aluminum	ND	–	0.2[d]	
Antimony	4.6×10^{-3}	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	3.0×10^{-3}	USGS-39	0.005	<0.001
Calcium	76	CPP-2	NS	
Chromium	0.039	USGS-39	0.1	0.002 -0.003
Cobalt	1.0×10^{-3}	USGS-85	NS	
Copper	0.014	CPP-2	1.3	
Iron	0.13	USGS-123	0.3[d]	
Lead	0.018	USGS-84	0.015	<0.005
Magnesium	22	USGS-67	NS	
Manganese	0.044	USGS-122	0.05	
Mercury	3.6×10^{-4}[e]	USGS-44	0.002	<0.0001
Nickel	5.0×10^{-3}	USGS-123	0.1	
Potassium	6.80	USGS-122	NS	
Selenium	3.0×10^{-3}	USGS-47	0.05	<0.001
Silver	7.0×10^{-4}	USGS-77	0.1[d]	<0.001
Sodium	77	USGS-59	NS	
Thallium	ND	–	0.002	
Vanadium	0.010	USGS-82	NS	
Zinc	0.45	USGS-115	5[d]	
Zirconium	ND	–	NS	
Radionuclides (pCi/L)[e]				
Gross Alpha	15 ± 3.86	MW-52	15	0 - 3
Gross Beta	96.5 ± 6	MW-48	<4 mrem/yr[f]	0 - 7
Tritium	1.4×10^{4} ± 771	USGS-114	20,000	0 - 40
Strontium-90	45 ± 7.57	MW-47	8	0
Plutonium-238	ND	–	15	0
Plutonium-239/240	ND	–	15	0
Americium-241	0.742 ± 0.0336	LF2-8	15	0
Neptunium-237	ND	MW-18	15	
Iodine-129	1.06 ± 0.19	LF3-8	1	0
Technetium-99	322 ± 6.6	USGS-52	900	
Uranium-233/234	1.62 ± 0.153	USGS-123	–	
Uranium-235/236	0.146± 0.057	USGS-35	–	
Uranium-238	0.851 ± 0.126	USGS-85	–	

a. Maximum contaminant levels (MCL) from the Safe Drinking Water Act (40 CFR 140) and DOE Order 5400.5 unless otherwise noted.

b. Source: Knobel et al. (1992).

c. Source: Rodriguez et al. (1997).

d. Secondary MCL from the Safe Drinking Water Act (40 CFR 140).

e. Source: DOE (2002b).

f. Beta particle/photon radioactivity shall not produce annual dose equivalent to the total body or internal organ greater than 4 millirem per year.

ND = Not detected; NS = No standard.

slightly lower at the same location (MW-1) of the maximum concentration observed in the 1995 study. The only inorganic found to exceed its maximum contaminant level in perched water was chromium. Chromium exceedances were found in all the perched water bodies. The only organic was methylene chloride from well PW-1. The highest radioactive contaminant levels (strontium-90 and technetium-99) continue to be found in the northern upper perched water body. Tritium is the primary contaminant found in the southern upper perched water body. Gross alpha and beta were not analyzed in 2001. The maximum radiological contaminant levels for strontium-90, technetium-99 and tritium have decreased by as much as 50 percent since the 1995 study (DOE 2002a).

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.

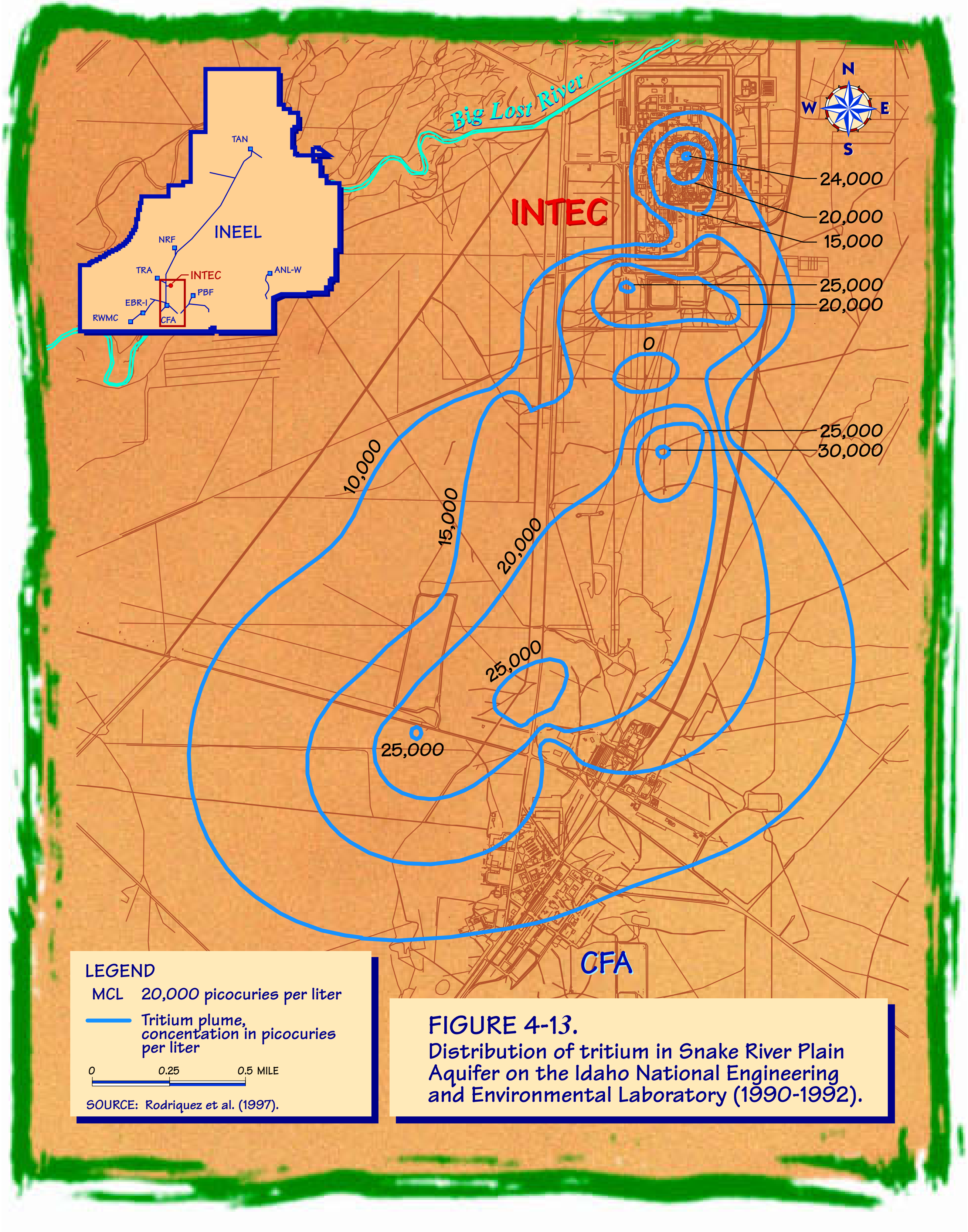
Figures 4-1***3***, 4-1***4***, and 4-1***5*** show the 1995 distribution of tritium, strontium-90, and the 1990-1992 distribution of iodine-129 in the aquifer beneath INEEL, respectively (DOE 1997). ***The figures were not updated for 2001 due to the limited data set available for contouring groundwater in 2001 (DOE 2002b).*** Additionally, Table 4-***20*** shows the general trend of decreasing concentrations of these radionuclides over time ***including the most current data from 2001***. 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 ***2001*** 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). ***In 2001, only 2 of 41 wells sampled detected iodine-129 above the maximum contaminant level. The two wells are located south of INTEC at the CFA landfill. In addition, iodine-129 was not detected in the sample analyzed from well USGS-46 as depicted in Table 4-20 (DOE 2002b).*** The Safe Drinking Water Act maximum contaminant level for iodine-129 is 1 pCi/L.

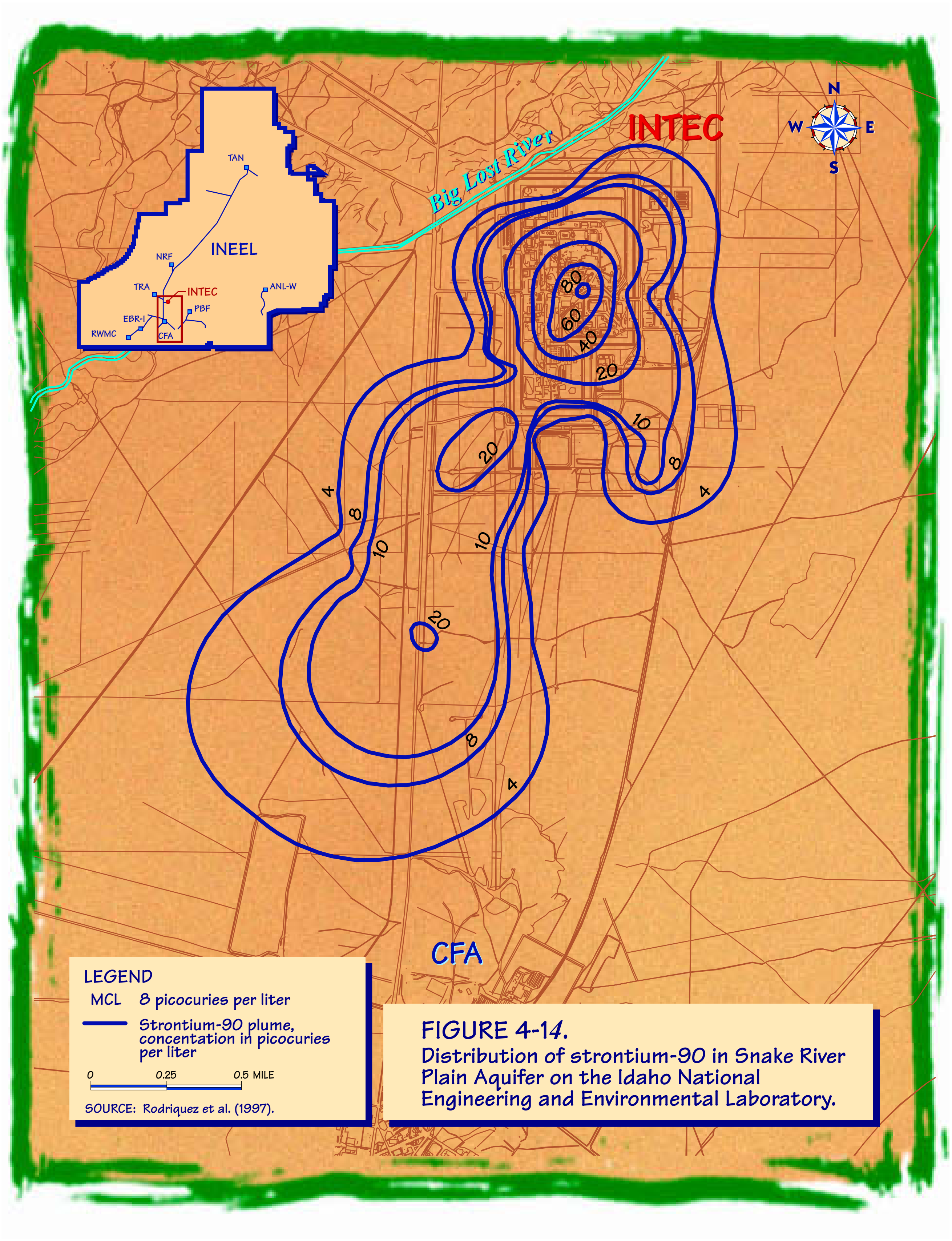
4.9 Ecological Resources

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). ***However, DOE has updated Section 4.9.1, Plant Communities and Associations, with more recent information on range fires that occurred in 1999 and 2000.***



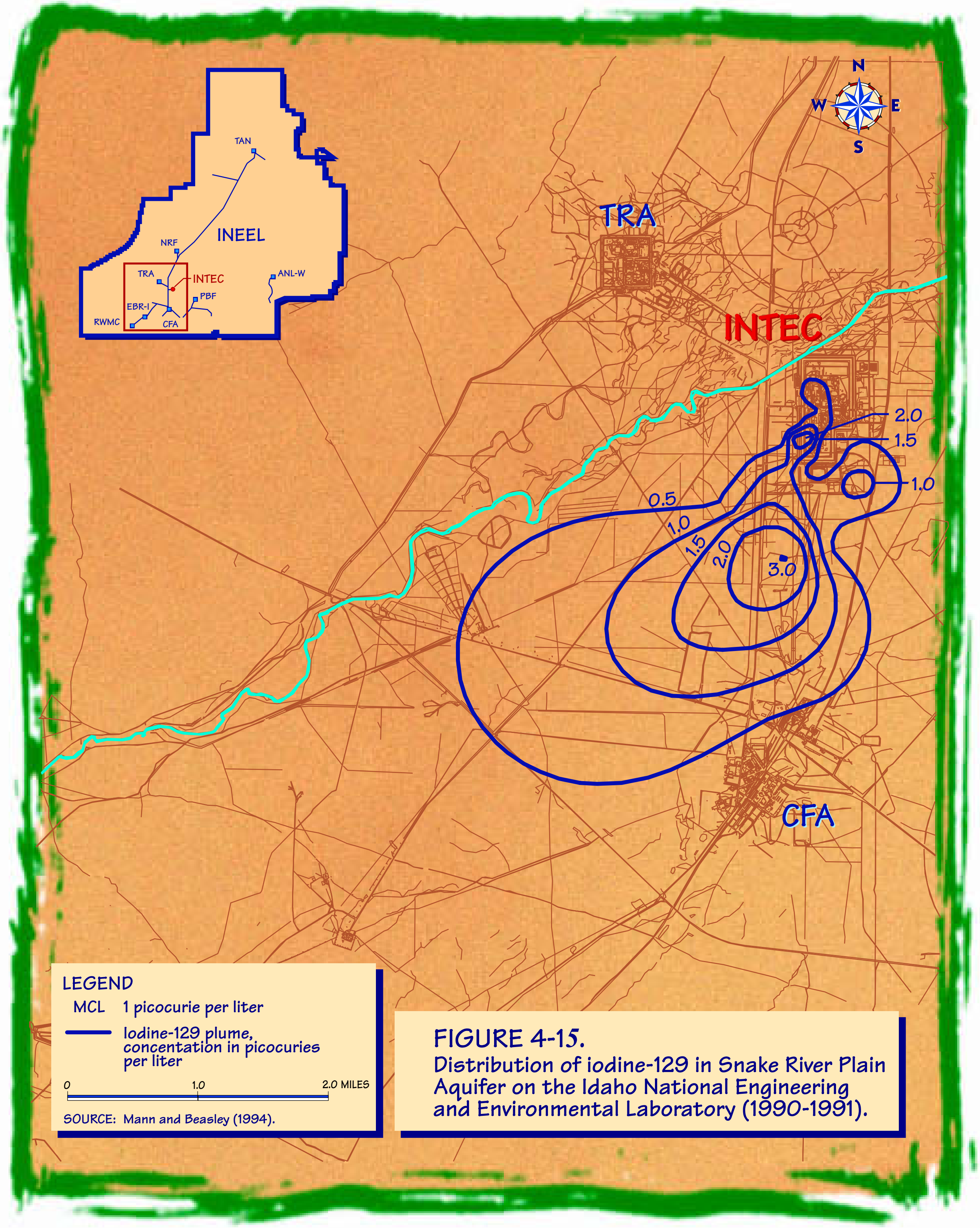
SOURCE: Rodriquez et al. (1997).

FIGURE 4-13.
Distribution of tritium in Snake River Plain Aquifer on the Idaho National Engineering and Environmental Laboratory (1990-1992).



SOURCE: Rodriquez et al. (1997).

FIGURE 4-14.
Distribution of strontium-90 in Snake River Plain Aquifer on the Idaho National Engineering and Environmental Laboratory.



SOURCE: Mann and Beasley (1994).

FIGURE 4-15.
Distribution of iodine-129 in Snake River Plain Aquifer on the Idaho National Engineering and Environmental Laboratory (1990-1991).

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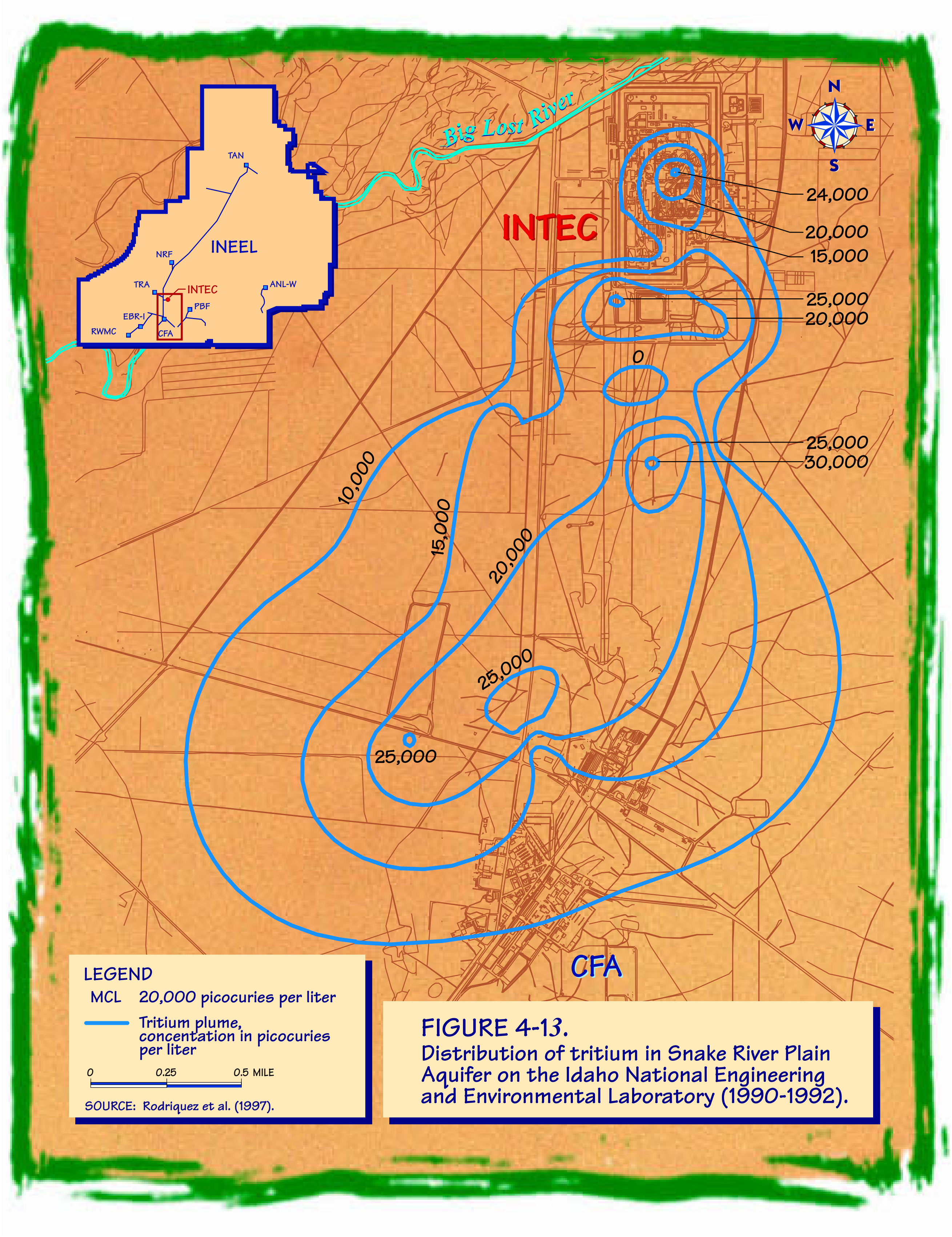
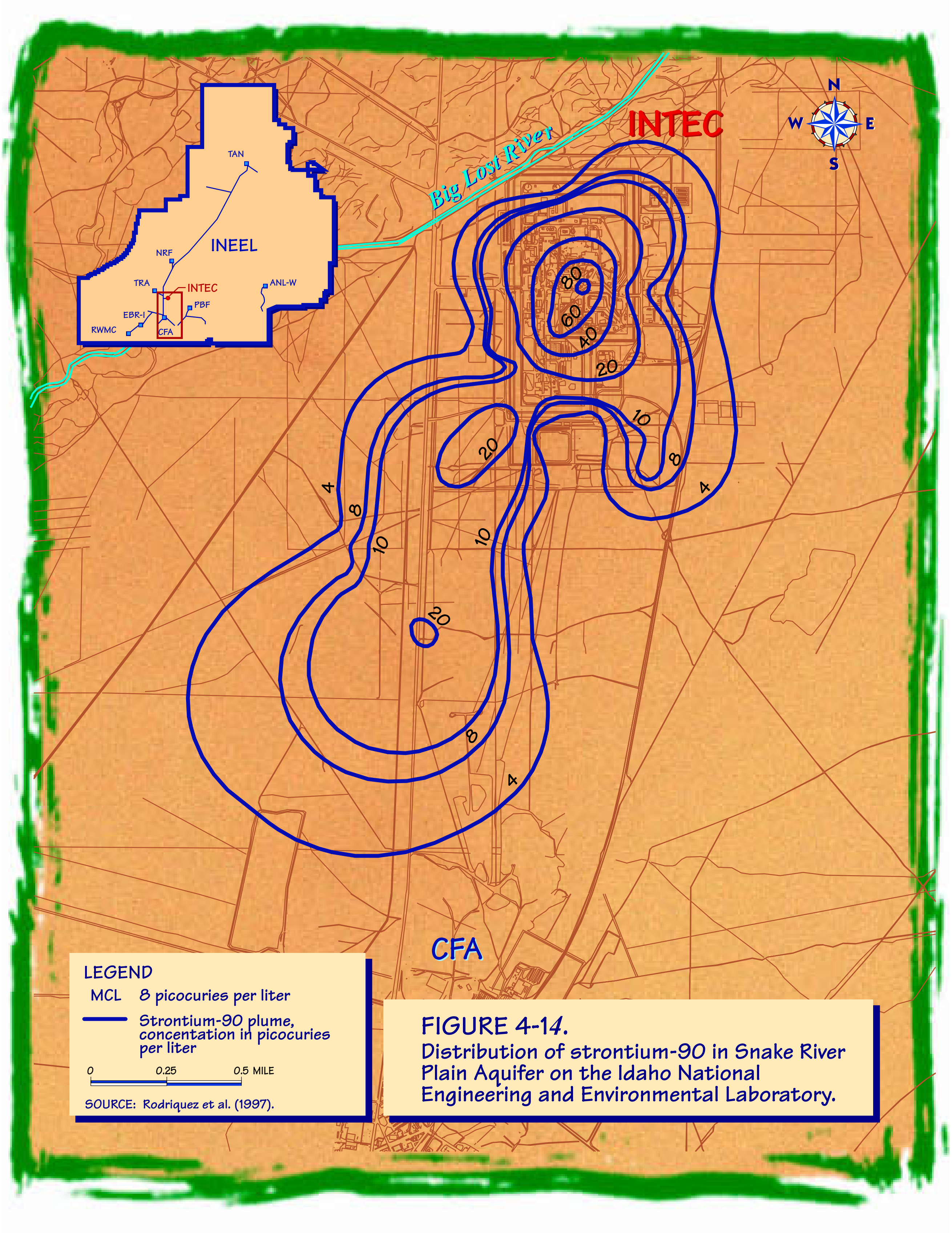


SOURCE: Rodriquez et al. (1997).

FIGURE 4-13.
Distribution of tritium in Snake River Plain Aquifer on the Idaho National Engineering and Environmental Laboratory (1990-1992).



SOURCE: Rodriquez et al. (1997).

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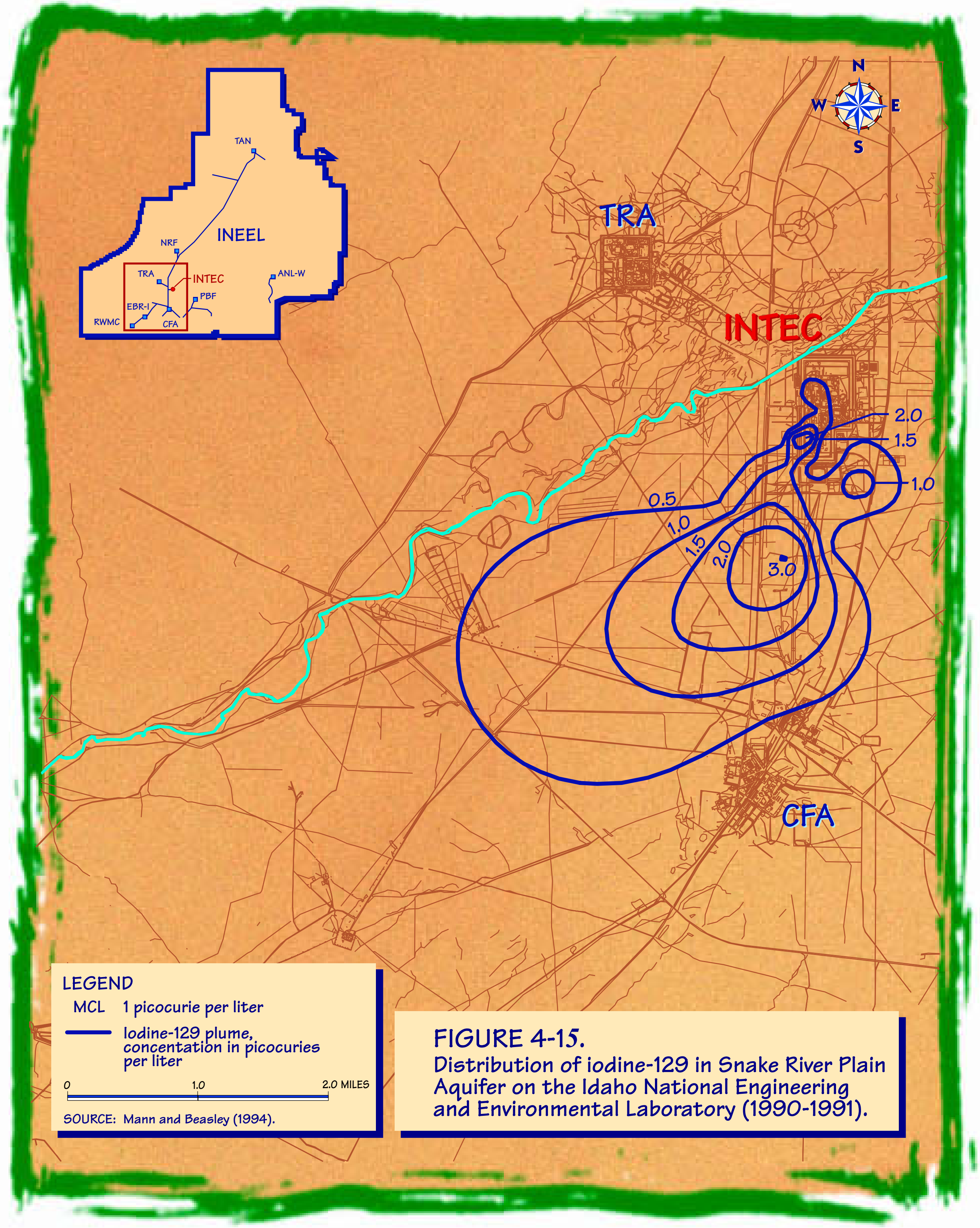
Distribution of strontium-90 in Snake River Plain Aquifer on the Idaho National Engineering and Environmental Laboratory.



SOURCE: Mann and Beasley (1994).

FIGURE 4-15.
Distribution of iodine-129 in Snake River Plain Aquifer on the Idaho National Engineering and Environmental Laboratory (1990-1991).

Table 4-*20*. 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	–
2001	***11,500 ± 613[d]***	***45 ± 7.57[d]***	***ND[d]***

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).

d. ***Source: DOE (2002b). ND = not detected***

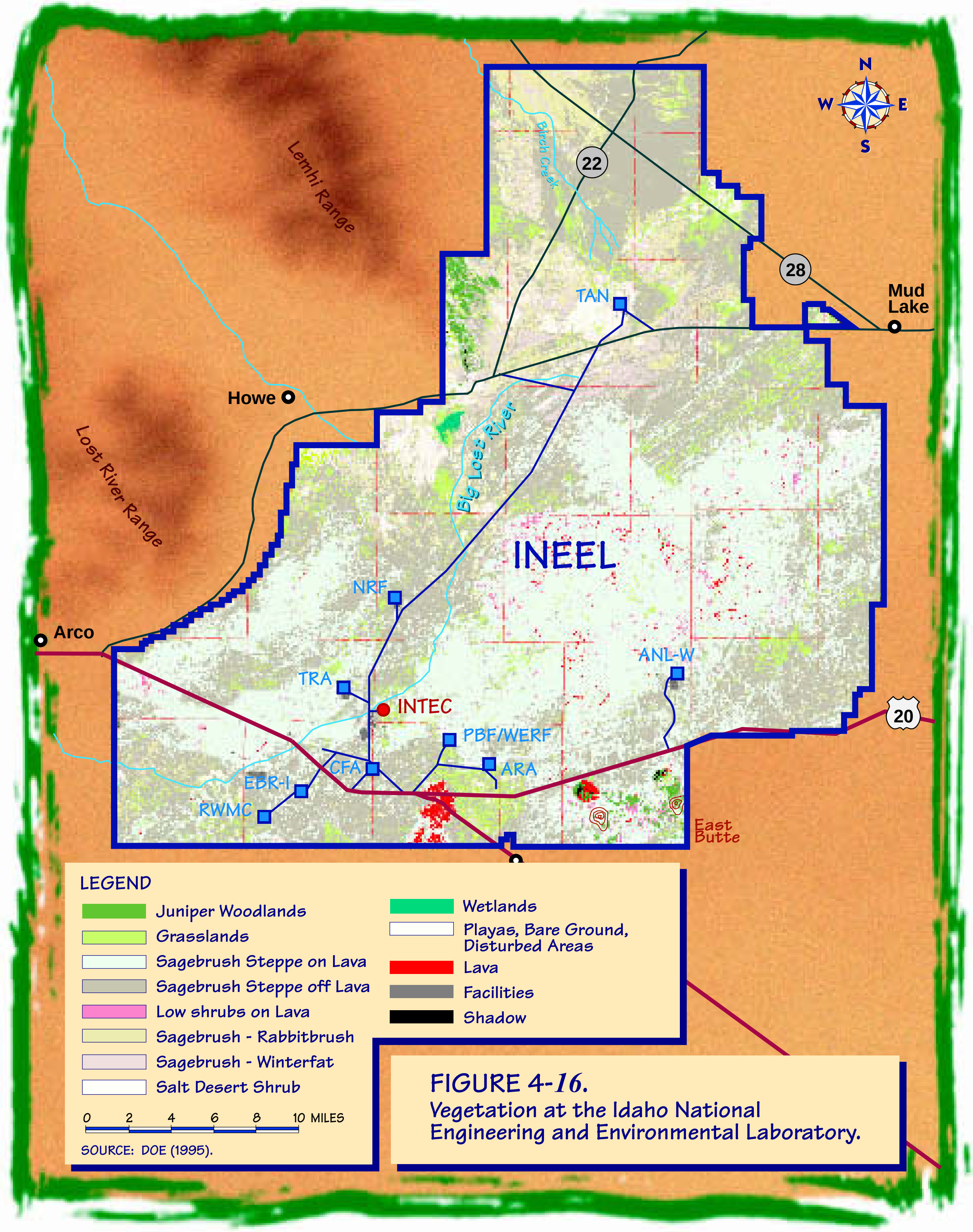
4.9.1 PLANT COMMUNITIES AND ASSOCIATIONS

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-***16*** shows these areas.

More than 90 percent of INEEL falls within the shrub-steppe vegetation type. The shrub-steppe vegetation type is dominated by sagebrush (*Artemisia spp.*), saltbush (*Atriplex spp.*), and rabbitbrush (*Chrysothamnus spp.*). Grasses found on 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.

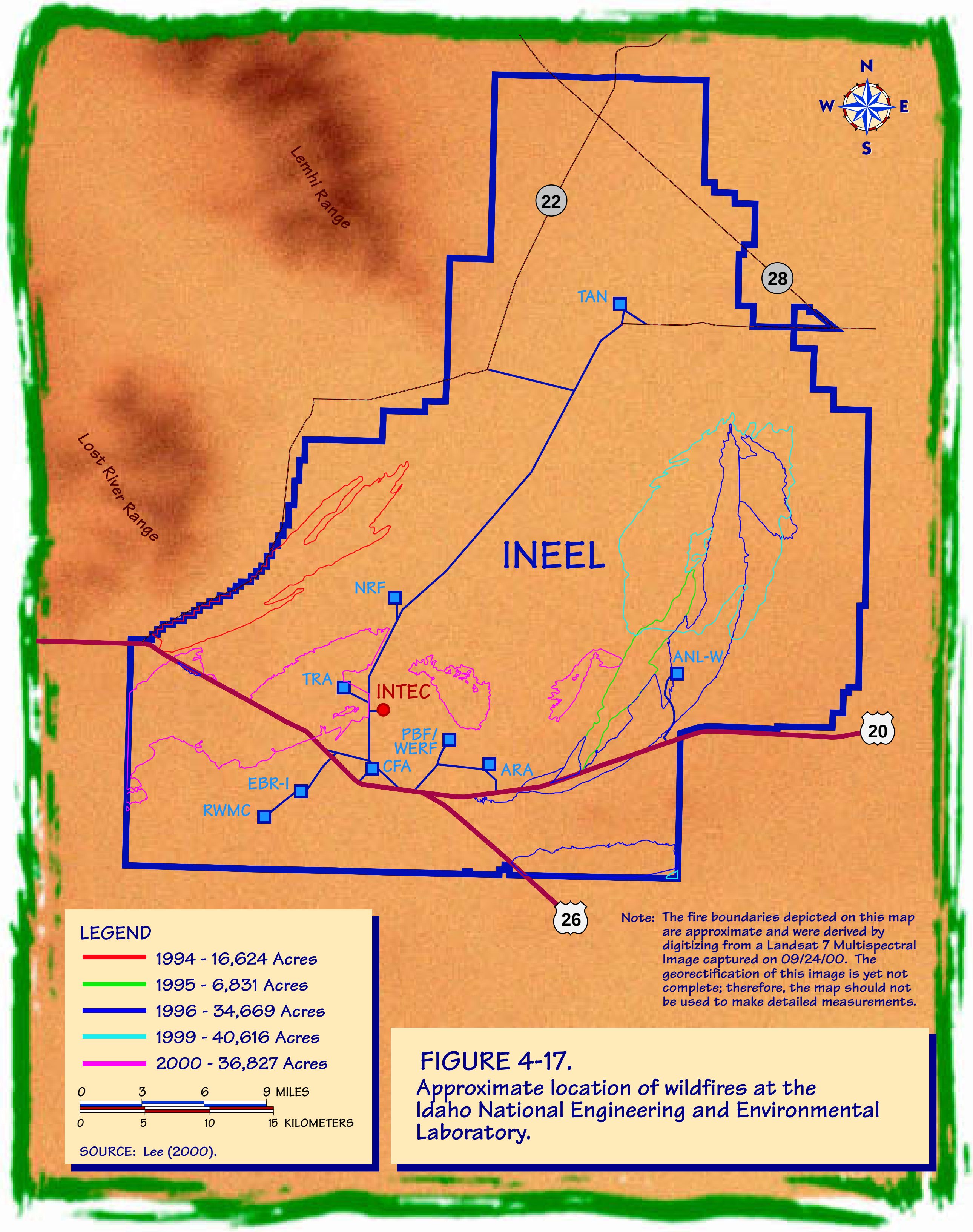
Areas cleared of natural vegetation cover about 2 percent of INEEL. Vegetation in disturbed areas such as INTEC is frequently dominated by introduced annual species, including Russian thistle and cheatgrass. Introduced annuals in disturbed areas provide lower quality food and cover for wildlife than 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, 1996, ***1999, and 2000*** played an important role in the vegetation cover at INEEL. Figure 4-***17*** 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 pro-



SOURCE: DOE (1995).

FIGURE 4-16.
Vegetation at the Idaho National Engineering and Environmental Laboratory.

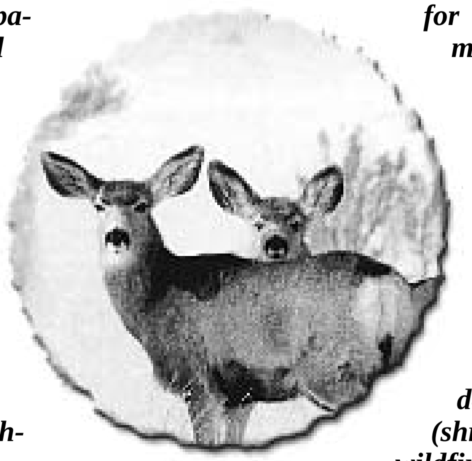


SOURCE: Lee (2000).

Note: The fire boundaries depicted on this map are approximate and were derived by digitizing from a Landsat 7 Multispectral Image captured on 09/24/00. The georectification of this image is yet not complete; therefore, the map should not be used to make detailed measurements.

FIGURE 4-17.
Approximate location of wildfires at the Idaho National Engineering and Environmental Laboratory.

duced 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). ***Wildfires in 1999 burned approximately 40,000 more acres of the INEEL and in the summer and early fall of 2000, three separate fires burned an additional 36,000 acres. The first of these fires in late July 2000 burned approximately 30,000 acres northwest of the Radioactive Waste Management Complex. A second fire in early August burned approximately 2,000 acres west of Argonne National Laboratory-West. A third fire in mid-September burned approximately 4,000 acres northwest of INTEC.***



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 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.

DOE has been conducting additional monitoring of the areas burned in 1994, 1995, and 1996 to measure the recovery of native desert vegetation and provide recommendations for a comprehensive INEEL fire management plan. Preliminary monitoring results indicate that non-native annual plants, such as cheatgrass, had not replaced native plant species in burned areas. Native shrubs, perennial grasses, and forbs recovered rapidly in areas where healthy stands existed prior to the fire (ESRF 1999). Sagebrush, the dominant shrub of these desert (shrub-steppe) areas, is killed by wildfire and is slow to recolonize areas that are completely burned. Most native shrubs, perennial grasses, and forbs regenerate from underground root systems, while most sagebrush species must regenerate from seed.

Although the lush growth of grasses and forbs that typically follows wildfires in sagebrush-steppe areas of the INEEL provides nutritious food for foraging mule deer, pronghorn, and elk (ESRF 1999), those plants do not provide suitable winter habitat and food for sage grouse. Sage grouse are dependent on sagebrush, particularly for important winter habitat (ideal winter habitat consists of healthy, mature stands of big sagebrush).

The INEEL contains one of the largest contiguous areas of protected sagebrush-steppe habitat in the world, and is one of the most important wintering areas for sage grouse in Idaho (ESRF 2000). The wildfires that have burned more than 135,000 acres of sagebrush-steppe on the INEEL since 1994 are certainly cause for concern, particularly in light of sage grouse population declines across the region. DOE is continuing to study the impacts of wildfires on the ecological resources of the site and the region in attempts to better understand the dynamics of that ecosystem and to identify ways of preserving the biodiversity on the INEEL.

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 the INEEL include waterfowl and raptors. Predators, such as bobcats ***and*** mountain lions have been observed in the area ***and coyotes are common***.

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-***21*** 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 the INEEL 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.

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-***8***) 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

Table 4-21. 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, 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

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 ***Area*** 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 ecolog*y of the area*.

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-*22* 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 is currently 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-*18*. 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 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.

Table 4-22. 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.

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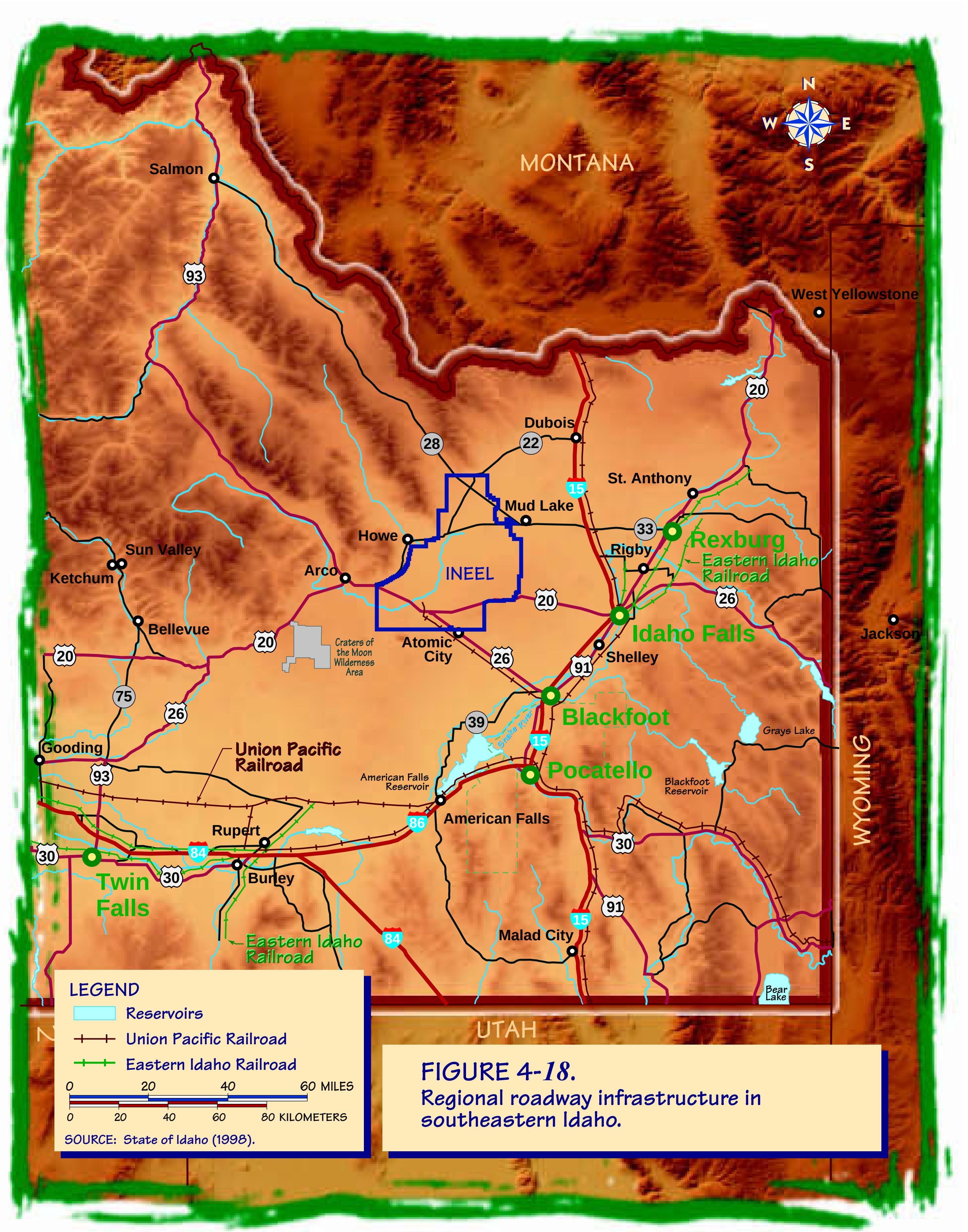


SOURCE: State of Idaho (1998).

FIGURE 4-18.
Regional roadway infrastructure in southeastern Idaho.

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 4-2***3*** 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-***18***. 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 non-hazardous bulk commodities were sent to the 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 AIR TRAFFIC

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

Table 4-2*3*. 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.

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 4-2***4***. For railroads in Idaho, the mainline accident rate is 6.4 accidents per 100 million railcar miles (Saricks and Tompkins 1999).

For ***2001***, the average motor vehicle accident rate was ***1.3*** accidents per million vehicle miles for INEEL vehicles (***Pruitt 2002a***), 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 4-2***5*** summarizes shipments associated with INEEL for the period 199***8*** through ***2001*** based on data from the ***Enterprise Transportation Analysis*** System. These shipments range from express mail packages to radioactive waste shipments to

Table 4-24. 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). ***Multiply by 1.6 for rates per mile.***
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 4-25. Annual average shipments to and from the Idaho National Engineering and Environmental Laboratory (*1998-2001*).[a]

	Commodity			
Mode	Hazardous	Nonhazardous	Radioactive	Total
Air	***221***	***18,549***	***177***	***18,947***
Motor[b]	***294***	***4,439***	***109***	***4,842***
Other[c]	***273***	***229***	***5***	***507***
Rail	***0***	3	***1***	***4***
Total	***788***	***23,220***	***292***	***24,300***

a. ***Source: Enterprise Transportation Analysis System (Pruitt 2002a).***
b. Commercial motor carriers.
c. Freight forwarder, private motor carrier, government vehicles, or parcel carriers.

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.***2*** percent of the shipments, respectively. Nonhazardous air shipments were the largest single category of shipments, 7***6*** percent, largely due to low-cost General Services Administration negotiated rates for letters and parcels. Commercial motor carrier shipments accounted for 2***0*** percent of the INEEL shipments. The remaining category of shipments, denoted "Other" in Table 4-2***5***, 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 4-2***6*** in terms of estimated annual collective doses and latent cancer fatalities.

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.

Table 4-26. 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.

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 ***72*** routes. Approximately 1,***2***00 private vehicles also travel to and from INEEL daily (***Pruitt 2002b***).

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.

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 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, ***but are part of the*** normal levels of traffic 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).

Noise Measurement

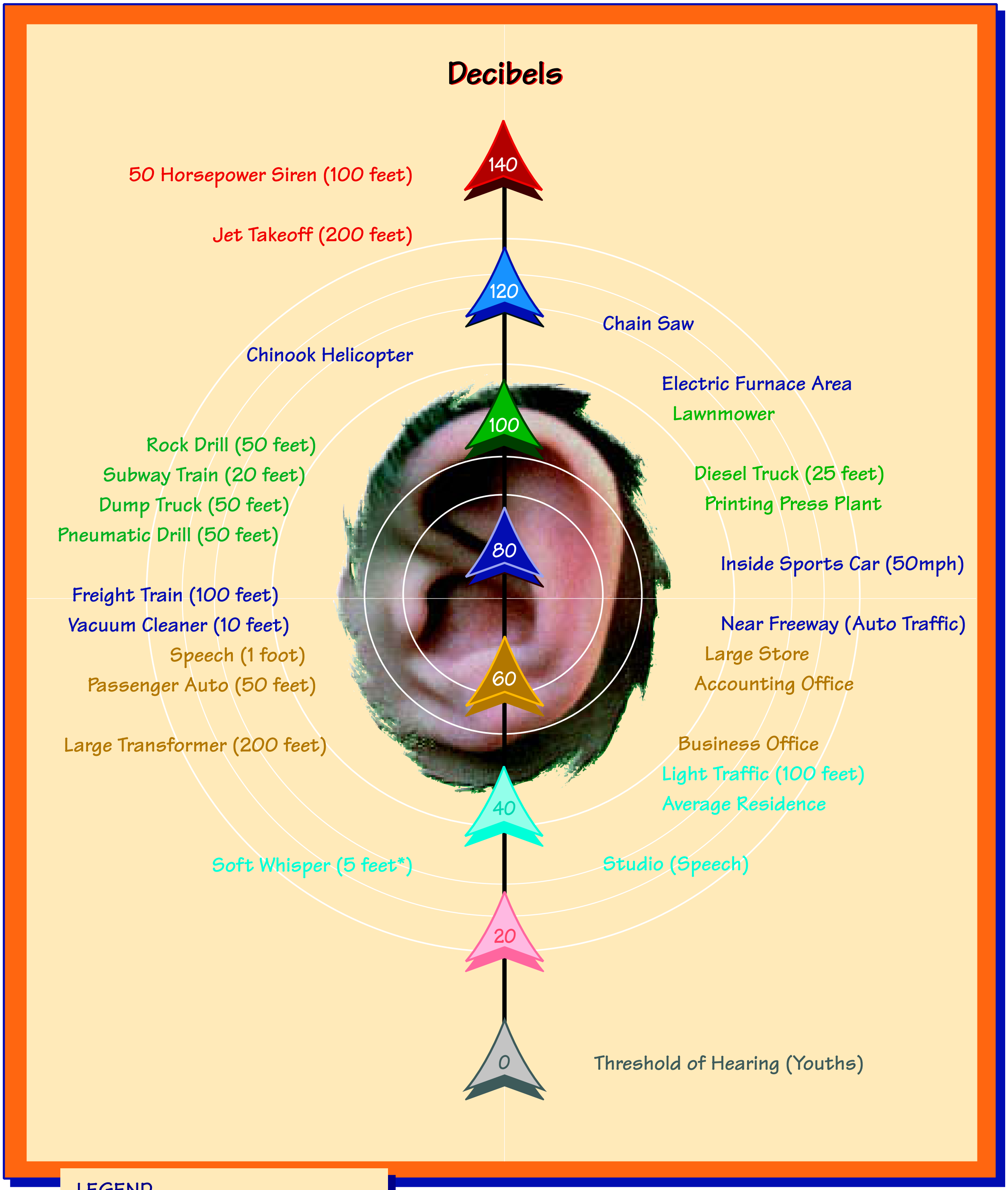
What are sound and noise?

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-**19** provides common references to sound on the A-weighted sound level scale.*



LEGEND

* Operator's Position

SOURCE: Adapted from Glorig (1965) and Golden *et al.* (1980).

FIGURE 4-*19*.
Typical A-Weighted Sound Levels.

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 1995) 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. ***The baseline radiation dose from air emissions (see Section 4.7) is presented in Section 4.11.1.1, Radiological Health Risk.***

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 as noted in Section 4.8. Nevertheless, any contamination of soil or groundwater at the INEEL would not be expected to significantly affect the offsite public because of the ***long*** distances between the INTEC area and the offsite public.

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 EPA, 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. For effects on individuals, DOE reports dose in millirem and latent cancer fatality probability.

Table 4-2*7* provides doses and latent cancer fatality probabilities from annual exposure due to routine airborne releases for the noninvolved worker ***for 1998*** and maximally exposed individual near the site boundary for years 1995, 1996, ***and 1999***. 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 4-2*8* provides summaries of the dose ***to the surrounding population*** and number of latent cancer fatalities based on annual exposure for 1995, 1996, ***and 1999***. ***Based on 1990 U.S. Census Bureau data***, the surrounding population ***consisted*** of approximately 120,000 people within a 50-mile radius of INEEL (ESRF 1997). ***(Using 2000 U.S. Census Bureau data, this population has increased to almost 140,000 (Pruitt 2002).)*** The total collective population dose for 1996 of 0.24 person-rem corresponds to much less than one latent cancer fatality within the entire population over the next 70 years

Table 4-27. Annual dose to individuals from exposure to routine airborne releases at the Idaho National Engineering and Environmental Laboratory.

Maximally exposed individual	Annual dose (millirem)	LCF Probability
Onsite worker ***(1998)***[a]	***0.27***	***1.1×10^{-7}***
Offsite individual (public) (1995) [b]	***0.018***	***9.0×10^{-9}***
Offsite individual (public) (1996) [c]	0.031	1.5×10^{-8}
Offsite individual (public) (1999) [d]	***0.008***	***4.0×10^{-9}***

a. Maximum dose at any onsite area from permanent facility emissions for onsite worker ***(see Section 4.7).***
b. ESRF (1996) for offsite individual, 1995.
c. ESRF (1997) for offsite individual, 1996.
d. ESERP (2002) for offsite individual, 1999.
LCF = latent cancer fatality.

Table 4-28. Estimated increased health effects due to routine airborne releases at the Idaho National Engineering and Environmental Laboratory.

Year	Population dose (person- rem)	Number of latent cancer fatalities
1995	0.08[a]	4.0×10^{-5}
1996	0.24[b]	1.2×10^{-4}
1999	***0.037***[c]	***1.8×10^{-5}***

a. ESRF (1996) for year 1995.
b. ESRF (1997) for year 1996.
c. ESERP (2002) for year 1999.

(ESRF 1997). The conversion from collective dose to number of latent cancer fatalities 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. ***During 1999, 51 of 60 samples contained gross alpha activities above the minimum detectable concentration. The highest concentration observed was 33 percent of the EPA maximum contaminant level for gross alpha activity in drinking water. Six samples had gross beta activities above the minimum detectable concentration. All samples were within the range for naturally occurring beta activity in the Snake River Plain Aquifer. Five onsite production wells and three drinking water distribution systems showed detectable concentrations of tritium in one or more samples. The highest concentration observed was 66 percent of the EPA maximum contaminant level for tritium in drinking water. There is a*** localized plume of strontium-90 in the groundwater near INTEC, ***which is*** routinely sampled. While samples have historically contained detectable levels of strontium-90, none of the 199***9*** samples indicated detectable concentrations of strontium-90 (***ESERP 2002***).

Potential ***lifetime*** health effects to the offsite population from the groundwater pathway are reported in the SNF & INEL EIS and were calculated as an estimated latent cancer fatality risk of 1 occurrence in 170 million.

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 (1995) 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 EPA (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 1995). The recent actual site-wide emissions for criteria pollutants presented in Table 4-***11*** of this EIS would result in similar impacts. For each criteria pollutant except lead, the current (199***6*** and 199***7***) emission rates are less than the levels assessed in the SNF & INEL EIS. Table 4-1***2*** 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 (***ESERP 2002***). For ***1999***, the EPA maximum contaminant levels and the State of Idaho drinking water limits were not exceeded. For chemical carcinogens, ***this means there would be*** an excess incidence of cancer risk of less than 1 occurrence in 1 million. No adverse health effects are expected as a result of ***noncarcinogenic chemical*** contaminants. Potable water at INEEL was monitored for coliform bacteria. ***Three of 76*** samples showed positive results for coliform at INTEC. ***All systems that tested positive were chlorinated and retested. This process is repeated until two consecutive samples show negative results for coliform bacteria (ESERP 2002).***

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 ***1997*** to ***2000*** to individuals with measurable doses was ***84*** millirem, which results in an average annual collective dose of about ***77*** person-rem (DOE ***2000, 2001***). This collective dose corresponds to ***0.031*** LCFs resulting from each year of exposure to INEEL personnel, including INTEC personnel. The average occupational dose DOE-wide from ***1997*** to ***2000*** to individuals with measurable doses was ***76*** millirem, which results in an average annual collective dose of about ***1,310*** person-rem (DOE ***2000, 2001***); this corresponds to ***0.52*** LCFs resulting from each year of exposure to all DOE workers. For airborne emissions (as shown in Table 4-2***7***), the maximum dose to an onsite worker from permanent facility emissions is 0.***27*** 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 1997). 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 1997). 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

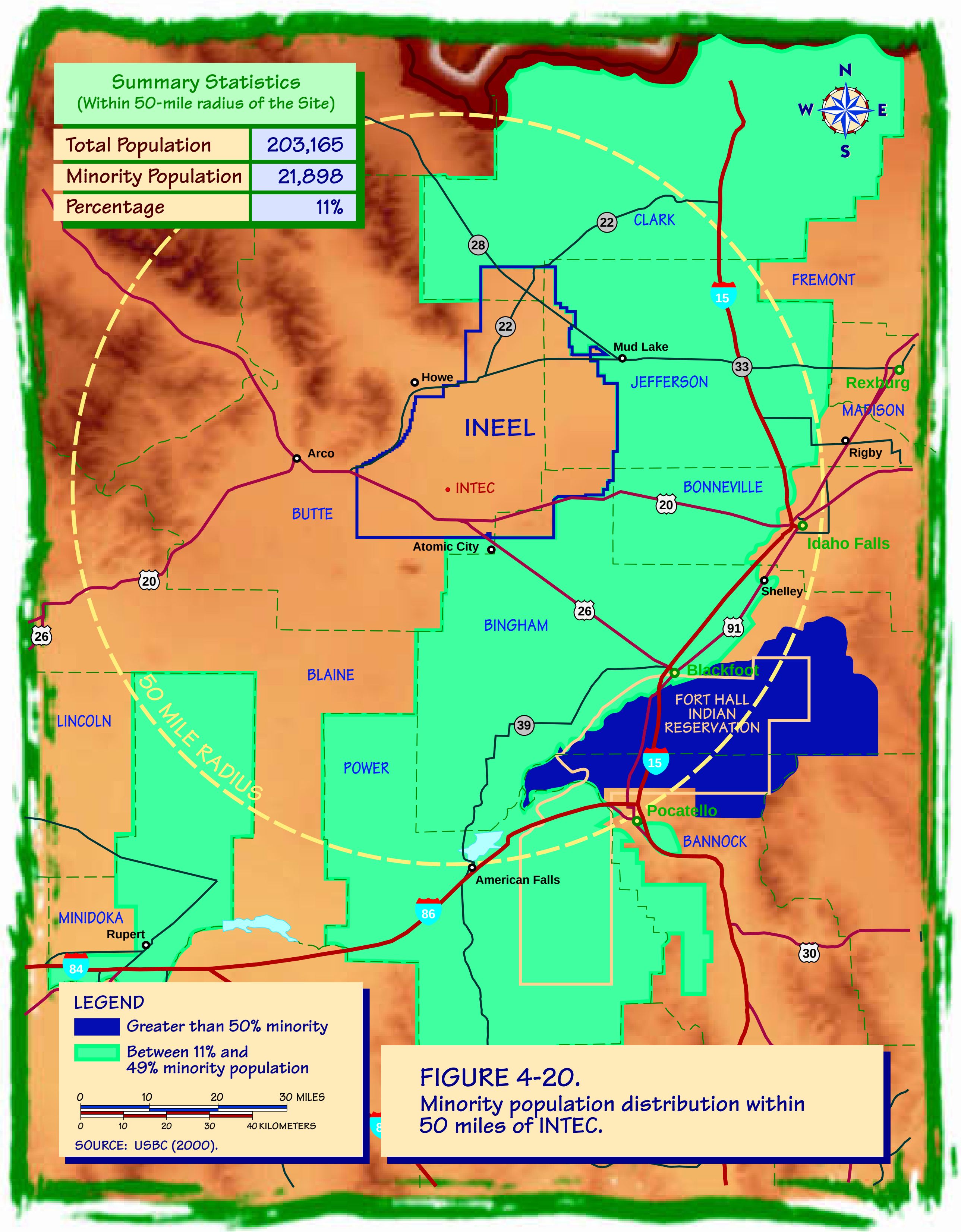
Executive Order 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations,* directs Federal agencies to make the achievement of environmental justice part of their mission. ***Federal agencies do this*** by identifying and addressing, as appropriate, 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 National Environmental Policy Act 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***, 2000***) was used to identify minority populations and low-income populations within a 50-mile radius of INTEC. ***Census 2000 data was used to identify minority populations. Low-income populations are based on the 1990 census data. The low-income population data from the 2000 Census has not been released.*** This 50-mile ***radius*** 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 ***and 2000*** 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 4-2***0*** and 4-2***1*** illustrate census tract distributions for minority populations and low-income populations. 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 4-2***9*** presents the U.S. Census poverty thresholds (USBC 1992).

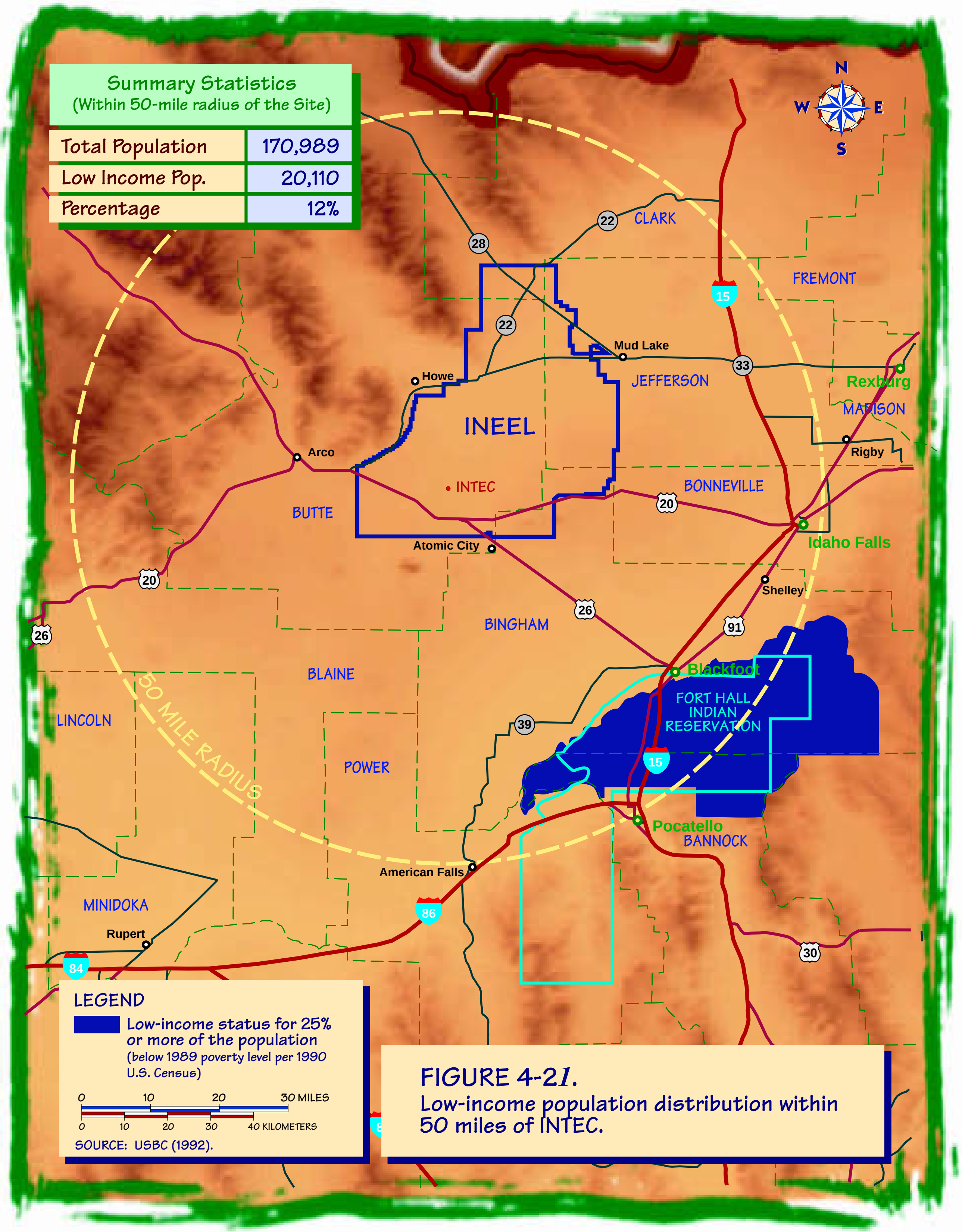


Summary Statistics
(Within 50-mile radius of the Site)

Total Population	203,165
Minority Population	21,898
Percentage	11%

SOURCE: USBC (2000).

FIGURE 4-20.
Minority population distribution within 50 miles of INTEC.



Summary Statistics
(Within 50-mile radius of the Site)

Total Population	170,989
Low Income Pop.	20,110
Percentage	12%

LEGEND

🟦 Low-income status for 25% or more of the population (below 1989 poverty level per 1990 U.S. Census)

SOURCE: USBC (1992).

FIGURE 4-21.
Low-income population distribution within 50 miles of INTEC.

Table 4-29. U.S. Census poverty thresholds in 1989 by size of family and number of related children under 18 years.[a]

		Children under 18 years								
Size of Family Unit	Weighted average threshold ($)	None ($)	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)

4.12.2 DISTRIBUTION OF MINORITY AND LOW-INCOME POPULATIONS

Accordingly to the ***2000*** census data, ***203,165*** people resided within the 50-mile INTEC region of influence. Of that population, approximately ***21,898*** individuals (***11*** 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 4-2***0***. 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.

According to the 1990 census data, 170,989 people resided within the 50-mile INTEC region of influence. Of ***that*** total population, approximately 20,110 individuals (12 percent) fall within the definition of low-income for the purpose of this analysis. ***Note that the U.S. Census Bureau has not released low-income population data for the 2000 census.*** Figure 4-2***1*** 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).

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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.***1*** billion gallons of water was pumped from the aquifer by the INEEL during ***fiscal year (FY) 2000***; of that, 0.***36*** billion gallons was pumped by INTEC (***Fossum 2002***). 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 $0.04***9*** 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 FY ***2001*** was ***36*** megawatts, compared to ***34*** megawatts for FY ***2000***. The monthly average consumption on this system for ***FY 2001*** was ***16,387*** megawatt-hours. Past years were ***16,713*** megawatt-hours for FY ***2000***, ***16,984*** megawatt-hours for FY ***1999***, ***18,067*** megawatt-hours ***for*** FY ***1998***, and ***18,328*** megawatt-hours for FY ***1997***. Yearly average consumption was ***208,000*** megawatt-hours for FYs ***1997*** to ***2001*** ***(Fossum 2002)***. Monthly average consumption of purchased power increased substantially after 1994 because 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, diesel fuel, gasoline, ***and*** propane (liquid petroleum gas). All fuels are provided and transported by various distributors to each facility.

Fossil fuels consumed at INTEC include fuel oil. In ***FY 2001***, INTEC facilities used ***1.1 million*** gallons of fuel oil (***Fossum 2002***).

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 Management

This section summarizes the management of 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).

Waste minimization technologies expected to be used to ***reduce the liquid waste going into the Tank Farm*** 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 ***among*** 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-***30*** 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. ***The average annual volume of waste disposed of from 1998 through 2001 was approximately 43,000 cubic meters (Pruitt 2002a).***

Table 4-*30*. 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]	***43,000***
Hazardous waste[e]	None[f]	120
MLLW	***2,100***[g]	***160***[g]
LLW	***980***[h]	***2,900***[h]
Transuranic waste[i,j]	65,000	–
HLW (calcine)	***4,400***	–
Mixed transuranic waste/ SBW	***1,000,000 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: ***Pruitt (2002a).***

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 (***2002***).

h. Source: ***Pruitt (2002b)***.

i. Source: DOE (1995).

j. 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.

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 ***2,100*** cubic meters of mixed low-level waste in inventory at INEEL (DOE ***2002***). In addition to the current volume of mixed low-level waste in inventory at the site, approximately ***160*** cubic meters of mixed low-level waste is generated annually (DOE ***2002***). Several mixed waste treatment facilities exist at the INEEL.

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 ***980*** cubic meters of low-level waste are in inventory at INEEL (***Pruitt 2002b***). All on-site-generated low-level waste is stored temporarily at generator facilities until it can be shipped directly to the Radioactive Waste Management Complex for disposal. DOE expects ***to stop accepting contact-handled low-level waste and remote-handled low-level waste at*** the Radioactive Waste Management Complex in ***2020 (Seitz 2002)***.

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 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 1998***b***) 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.

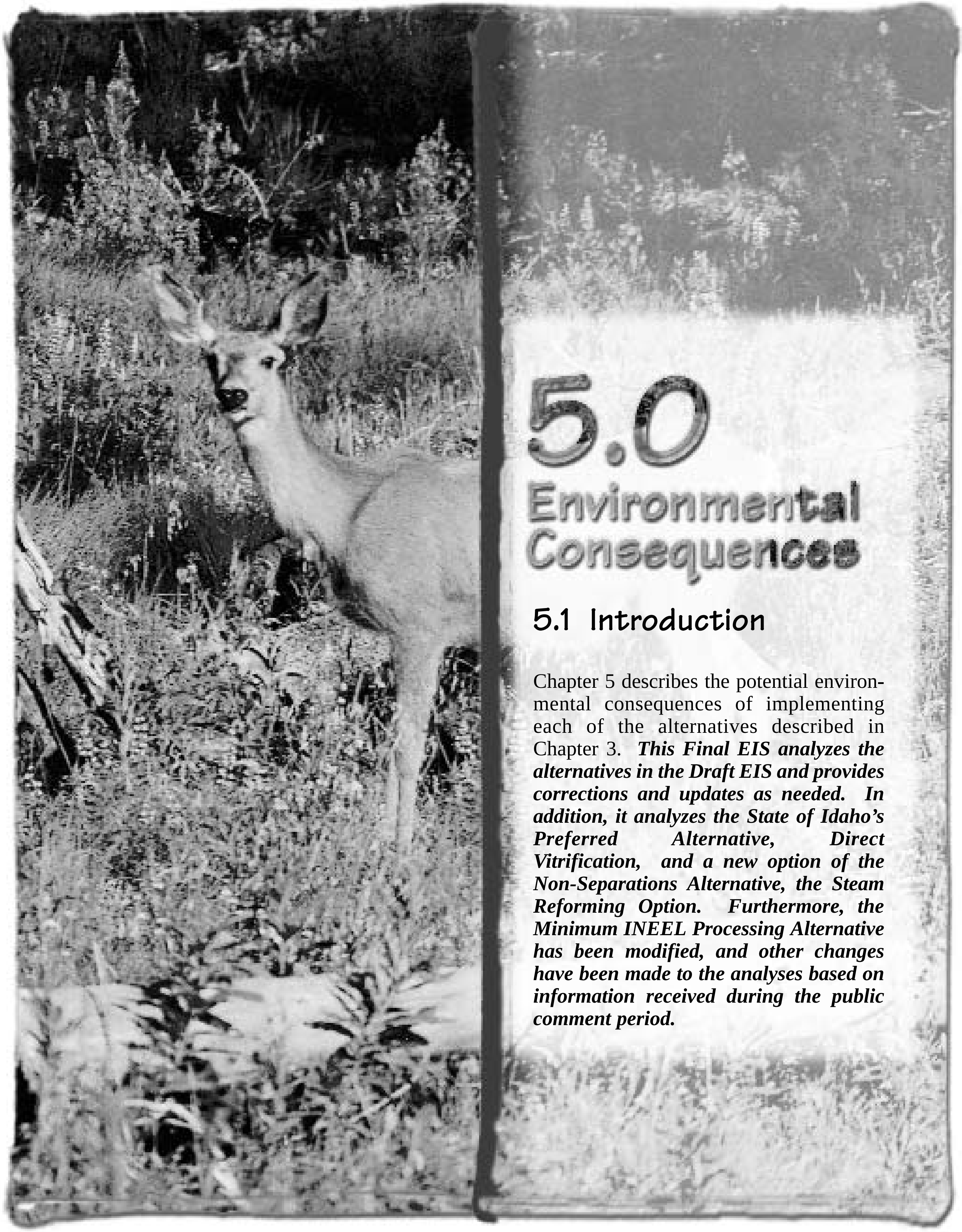
4.14.6 HIGH-LEVEL WASTE

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 ***4,400*** 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. Mixed transuranic waste/SBW is generated from incidental activities associated with operations at INTEC (DOE 1996). Currently, there are approximately ***1*** 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).

5.0

Environmental Consequences



5.0 Environmental Consequences

5.1 Introduction

Chapter 5 describes the potential environmental consequences of implementing each of the alternatives described in Chapter 3. ***This Final EIS analyzes the alternatives in the Draft EIS and provides corrections and updates as needed. In addition, it analyzes the State of Idaho's Preferred Alternative, Direct Vitrification, and a new option of the Non-Separations Alternative, the Steam Reforming Option. Furthermore, the Minimum INEEL Processing Alternative has been modified, and other changes have been made to the analyses based on information received during the public comment period.***

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., ***reducing the risk of contamination to the Snake River Plain Aquifer by removing and treating hazardous and radioactive waste from underground tanks***).

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 ***are*** 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.

In general, conservative assumptions were used in this EIS to prepare impact assessments for normal operations and facility accidents. Consequently, the identified impacts tend to exceed in magnitude and intensity those that can realistically be expected to occur. For routine operations, estimates from actual operations provide a reasonable basis for predictions of impacts. ***Estimates based on scientific literature or engineering scoping studies provide a reasonable basis for predicting impacts for new facilities.*** 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 ***six*** waste processing alternatives are discussed in Section 5.2. Potential impacts from the ***six*** facility disposition alternatives are discussed in Section 5.3. ***Section 5.3 also presents long-term impacts associated with the waste processing alternatives such as storage of untreated waste under the No Action Alternative.***

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.

When DOE calculates numbers in this EIS, two significant digits are used to report the results. 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.

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 ***so that it can be shipped to a storage or disposal facility outside of Idaho.*** After 2035, ***if a storage or disposal facility outside of Idaho is not available,*** storage of road-ready waste forms ***at the INEEL*** would ***generate*** impacts ***which are presented*** on an ***annualized*** basis. ***Altogether there are six*** waste processing alternatives, ***which are*** described in detail in Section 3.1 ***and*** evaluated ***for impacts in this section:*** the No Action Alternative, the Continued Current Operations Alternative, the Separations Alternative, the Non-Separations Alternative, the Minimum INEEL Processing Alternative***, and the State of Idaho's Preferred Alternative, Direct Vitrification. As described in Section 3.1.6, the Direct Vitrification Alternative includes two options: Vitrification without Calcine Separations and Vitrification with Calcine Separations.***

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.

Section 5.2 presents impacts of treating newly generated liquid waste as mixed transuranic waste/SBW under all waste processing alternatives. However, DOE may decide to treat this waste separately from the mixed transuranic waste/SBW after 2005. The EIS also presents the impacts for a remote-handled grout facility (see Project P2001 in Appendix C.6) that could be used to treat the liquid waste generated after 2005. This project could be included as part of any of the waste processing alternatives. The treated waste would be packaged and disposed of on- or off-site as low-level waste or disposed of at the Waste Isolation Pilot Plant as transuranic waste, depending on its characteristics. For purposes of assessing transportation and waste management impacts, DOE assumed that the grouted waste would be characterized as remote-handled transuranic waste and transported to the Waste Isolation Pilot Plant for disposal. These transportation and waste management impacts are presented in Sections 5.2.9 and 5.2.13.

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 ***potential "at Hanford"*** 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 ***resource area*** 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 service waste water. DOE currently discharges this service waste water to existing percolation ponds, but has made a decision to move the discharge of the existing service waste water to replacement ponds by December 31, 2003, as identified in the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Record of Decision for Waste Area Group 3 (the Idaho Nuclear Technology and Engineering Center (INTEC)). The service waste water discharges will need to meet the requirements established by the Waste Water Land Application Permit issued by the State of Idaho as well as DOE Order 5400.5, "Radiation Protection of the Public and the Environment."

If the waste processing alternatives generate a significant quantity of additional service waste water, DOE may have to modify its service waste water system such as by adding pretreatment to reduce the volume or by further recycling. Since DOE has not made a selection of a waste processing alternative, the waste water 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, the waste water system options will be considered, and the impacts will be assessed against the impacts analyzed in the CERCLA Waste Area Group 3 Remedial Investigation/Baseline Risk Assessment/Feasibility Study. Depending on the results, an additional assessment may be performed 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 ***resource areas*** more details on methodology are provided in Appendix C. These ***resource areas*** 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 ***six*** 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 the 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 ***twelve*** options under

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
Steam Reforming Option	***New Storage Tanks, Calcine Retrieval and Transport System, Calcine and Steam-Reformed Product Packaging Facility, Newly Generated Liquid Waste Treatment Facility, Steam Reforming Facility***	***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
Direct Vitrification Alternative			
Vitrification without Calcine Separations Option	***Calcine Retrieval and Transport System, Vitrification Facility, Interim Storage Facility, Waste Treatment Pilot Plant, New Analytical Laboratory, New Storage Tanks***	***None***	***None***
Vitrification with Calcine Separations Option	***Calcine Retrieval and Transport System, Waste Separations Facility, Vitrification Facility, Grout Plant, Interim Storage Facility, Waste Treatment Pilot Plant, New Analytical Laboratory, New Storage Tanks***	***None***	***None***

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.

the ***six*** 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 ***remain*** in standby ***(standby began May 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, ***under*** this alternative the New Waste Calcining Facility calciner ***would remain*** in standby ***(standby began May 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, 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. 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, ***which is discussed in detail earlier in this section.*** Implementing this option would not affect overall INEEL land use or land use on surrounding areas.

5.2.1.4 Non-Separations Alternative

If DOE selects one of the ***four*** options under the Non-Separations Alternative, a number of new facilities would be built within the developed portion of INTEC including an immobilization ***facility*** (Hot Isostatic Press, ***Direct*** Cement, Early Vitrification, or ***Steam Reforming***), and a Newly Generated Liquid Waste ***Treatment*** Facility. 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 ***waste*** fractions and vitrified (see ***Section 3.1.5***). 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.

5.2.1.6 Direct Vitrification Alternative

Vitrification without Calcine 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 Calcine Retrieval and Transport System, Vitrification Facility, Interim Storage Facility, Waste Treatment Pilot Plant, New Storage Tanks, and New Analytical Laboratory. No new construction would occur outside the INTEC security perimeter fence, so there would be no overall change in land use on the INEEL. This option would be consistent with current and planned uses of INTEC outlined in the INEEL Comprehensive Facility and Land Use Plan (DOE 1997).***

Vitrification with Calcine 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 Calcine Retrieval and Transport System, Waste Separations Facility, Vitrification Facility, Grout Plant (mixed low-level waste fraction), Interim Storage Facility, Waste Treatment Pilot Plant, New Storage Tanks, and New Analytical Laboratory. This option is con-***

sistent 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.

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 ± 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 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.

Since the publication of the Draft EIS, Census 2000 and related data have been incorporated into the socioeconomic analyses. Population

sistent 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.

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 ± 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 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.

Since the publication of the Draft EIS, Census 2000 and related data have been incorporated into the socioeconomic analyses. Population

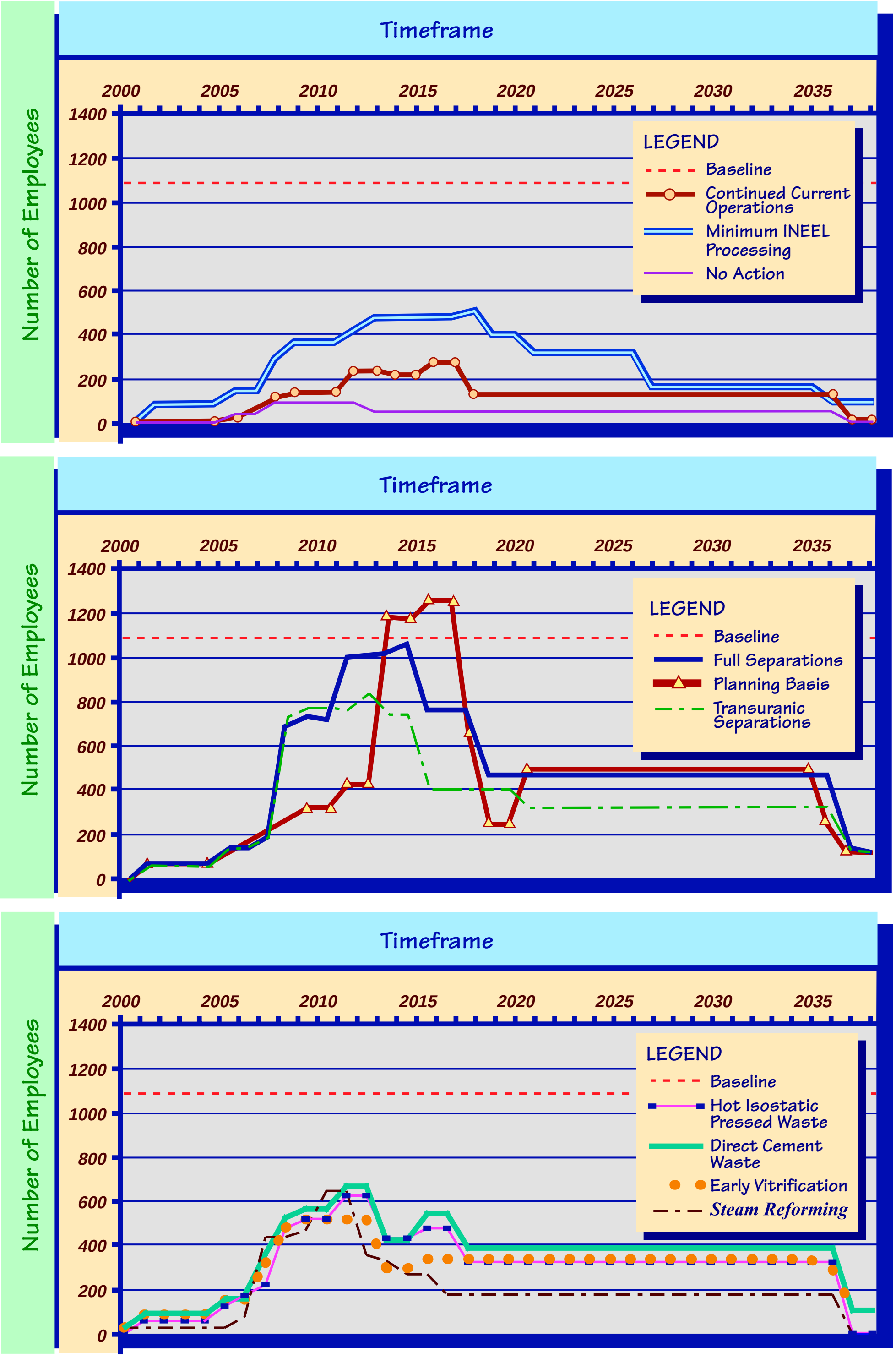


FIGURE 5.2-1. (1 of 2)
Total projected direct employment by alternative compared to projected baseline employment at INTEC.

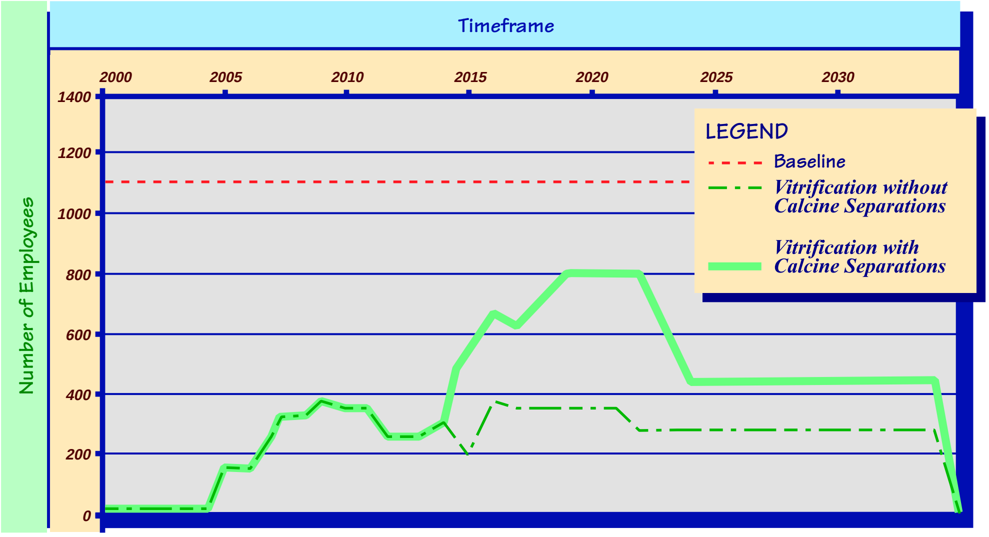


FIGURE 5.2-1. (2 of 2)
Total projected direct employment by alternative compared to projected baseline employment at INTEC.

figures, housing characteristics, labor information, and economic multipliers (such as employment and earnings multipliers) have been updated to reflect the most current socioeconomic environment in the region of influence.

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 ***approximately*** $1 million ***(2000 dollars)*** to the economy. For the construction phase, the Planning Basis Option under the Separations Alternative represents the largest potential impact. A total of ***1,700*** jobs (870 direct and ***840*** 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, ***the labor force*** in the region of influence is projected to be ***154,000*** (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 (***2000*** dollars) in earnings to the local economy, while the Continued Current Operations Alternative would add $***4.4*** million (***2000*** dollars). 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 the 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 the 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

Table 5.2-2. Construction phase employment and income by alternative during respective peak year.

		Employment			Total earnings
Alternatives	Peak[a]	Direct[b]	Indirect	Total	(Dollars)[c]
No Action Alternative	2005	***21***	20	***41***	1,000,000
Continued Current Operations Alternative	2008	***89***	***86***	180	4,400,000
Separations Alternative					
Full Separations Option	2013	850	***830***	***1,700***	***42,000,000***
Planning Basis Option	2013	870	***840***	***1,700***	***43,000,000***
Transuranic Separations Option	2012	680	***650***	***1,300***	***34,000,000***
Non-Separations Alternative					
Hot Isostatic Pressed Waste Option	2008	360	***350***	***710***	***18,000,000***
Direct Cement Waste Option	2008	400	***390***	***790***	***20,000,000***
Early Vitrification Option	2008	330	***320***	***650***	***16,000,000***
Steam Reforming Option	***2010***	***550***	***530***	***1,100***	***27,000,000***
Minimum INEEL Processing Alternative					
At INEEL	2008	200	***190***	***390***	***9,800,000***
At Hanford[d, e]	2024	290	***280***	***570***	***14,000,000***
Direct Vitrification Alternative					
Vitrification without Calcine Separations Option	***2011***	***350***	***340***	***690***	***17,000,000***
Vitrification with Calcine Separations Option	***2019***	***670***	***650***	***1,300***	***33,000,000***

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 (***2002***) presented in ***2000*** dollars.

d. Source: Data from project data sheets in Appendix C.8.

e. Based on same wage structure and employment multiplier as INEEL.

indicate that about 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 the 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 4-1 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 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 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 ***13*** percent.

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

Table 5.2-3. Population and labor projections.[a]

Year	Region of influence population	Labor force	Unemployment	Employment
2000	***250,365***	***131,352***	***5,294***	***126,058***
2001	***254,065***	***133,667***	***6,099***	***127,568***
2002	***257,765***	***135,614***	***6,188***	***129,426***
2003	***261,465***	***137,560***	***6,277***	***131,284***
2004	***265,165***	***139,507***	***6,365***	***133,142***
2005	***268,865***	***141,454***	***6,454***	***134,999***
2006	***270,962***	***142,557***	***6,504***	***136,052***
2007	***273,059***	***143,660***	***6,555***	***137,105***
2008	***275,156***	***144,763***	***6,605***	***138,158***
2009	***277,253***	***145,867***	***6,655***	***139,211***
2010	***279,350***	***146,970***	***6,706***	***140,264***
2011	***283,596***	***149,204***	***6,808***	***142,396***
2012	***287,843***	***151,438***	***6,910***	***144,528***
2013	***292,089***	***153,672***	***7,012***	***146,661***
2014	***296,336***	***155,906***	***7,114***	***148,793***
2015	***300,582***	***158,140***	***7,216***	***150,925***
2016	***304,489***	***160,196***	***7,309***	***152,887***
2017	***308,397***	***162,252***	***7,403***	***154,849***
2018	***312,304***	***164,308***	***7,497***	***156,811***
2019	***316,212***	***166,363***	***7,591***	***158,773***
2020	***320,119***	***168,419***	***7,685***	***160,735***
2021	***324,027***	***170,475***	***7,778***	***162,697***
2022	***327,934***	***172,531***	***7,872***	***164,659***
2023	***331,842***	***174,587***	***7,966***	***166,621***
2024	***335,749***	***176,642***	***8,060***	***168,583***
2025	***339,657***	***178,698***	***8,154***	***170,545***

a. Source: BEA (***1998, 2000***).

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 ***1,600*** jobs (530 direct and ***1,000*** indirect) are expected to be retained during the peak year (2015) and would contribute about $***42*** million to the economy. Projected Idaho ***labor force*** levels for the region are expected to be about ***158,000*** (RIMS II). Again, the INEEL workforce maintained by the waste processing alternatives would be small when compared to the regional workforce. The No Action

Table 5.2-4. Operations phase employment and income by alternative during respective peak year.

		Employment			
Alternatives	Peak[a]	Direct[b]	Indirect	Total	Income (dollars)[c]
No Action Alternative	2007	***73***	***140***	***220***	***5,800,000***
Continued Current Operations Alternative	2015	280	***550***	***830***	***22,000,000***
Separations Alternative					
Full Separations Option	2018	440	***870***	***1,300***	***35,000,000***
Planning Basis Option	2020	480	***950***	***1,400***	***38,000,000***
Transuranic Separations Option	2015	320	***630***	***950***	***25,000,000***
Non-Separations Alternative					
Hot Isostatic Pressed Waste Option	2015	460	***910***	***1,400***	***37,000,000***
Direct Cement Waste Option	2015	530	***1,000***	***1,600***	***42,000,000***
Early Vitrification Option	2015	330	***650***	***980***	***26,000,000***
Steam Reforming Option	***2012***	***170***	***340***	***520***	***14,000,000***
Minimum INEEL Processing Alternative					
At INEEL	2018	330	***650***	***980***	***26,000,000***
At Hanford[d,e]	2029	740	***1,500***	***2,200***	***59,000,000***
Direct Vitrification Alternative					
Vitrification without Calcine Separations Option	***2015***	***310***	***600***	***910***	***24,000,000***
Vitrification with Calcine Separations Option	***2023***	***440***	***880***	***1,300***	***35,000,000***

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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 (***2002***) presented in ***2000*** dollars.

d. Source: Data from project data sheets in Appendix C.8.

e. Based on same wage and employment multipliers as INEEL.

Alternative would have the smallest number of jobs and would contribute about $***5.8*** million to the economy. The ***Steam Reforming Option*** would have the next smallest workforce representing ***520*** jobs (***170*** direct and ***340*** indirect) with an economic contribution of about $***14*** 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 ***4*** and 6 percent in the 1990s ***and 2000*** (BLS 1997***, 2002***). As was the case for construction, sufficient labor resources appear available at the 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 ***six*** 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 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. 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 ***in*** standby ***by*** June 2000 ***(completed May 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 (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. 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.

Direct Vitrification Alternative – This alternative would require a number of new waste management and support facilities within the developed portion of INTEC (see Table 5.2-1). The greatest number of new facilities would be associated with the Vitrification with Calcine Separations Option. Some temporary visual degradation of the cultural setting of the INEEL and adjacent lands would occur from process air emissions under the Direct Vitrification Alternative. Stack emissions from all waste processing operations would cease upon completion in 2035. Section 5.2.6, Air Resources, discusses emission levels and air impacts 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). This would result in the Direct Vitrification Alternative having the highest increase in traffic. This increase, however, would be small relative to existing levels. Therefore, DOE does not expect impacts to cultural resources from the Direct Vitrification 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 ***twelve*** proposed options that define the ***six*** alternatives to determine if (1) project activities would be likely to produce aesthetic and scenic resource changes and (2) those changes would likely 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 ***twelve*** individual options within the ***six*** 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 incompatible 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 ***27*** miles ***west***-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. ***Additional modeling using the Park Service-recommended CALPUFF model, indicates that numerical visibility criteria (namely, a 5% change in 24-hour light extinction) could be exceeded on 8 days out of a 5-year simulation period. This would occur at Craters of the Moon under the Planning Basis Option; all other options would have less impact, and there would be no impacts on visibility at Yellowstone or Grand Teton National Parks.***

Visual resources include the natural and man-made physical features that give a particular

Direct Vitrification Alternative – This alternative would require a number of new waste management and support facilities within the developed portion of INTEC (see Table 5.2-1). The greatest number of new facilities would be associated with the Vitrification with Calcine Separations Option. Some temporary visual degradation of the cultural setting of the INEEL and adjacent lands would occur from process air emissions under the Direct Vitrification Alternative. Stack emissions from all waste processing operations would cease upon completion in 2035. Section 5.2.6, Air Resources, discusses emission levels and air impacts 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). This would result in the Direct Vitrification Alternative having the highest increase in traffic. This increase, however, would be small relative to existing levels. Therefore, DOE does not expect impacts to cultural resources from the Direct Vitrification 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 ***twelve*** proposed options that define the ***six*** alternatives to determine if (1) project activities would be likely to produce aesthetic and scenic resource changes and (2) those changes would likely 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 ***twelve*** individual options within the ***six*** 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 incompatible 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 ***27*** miles ***west***-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. ***Additional modeling using the Park Service-recommended CALPUFF model, indicates that numerical visibility criteria (namely, a 5% change in 24-hour light extinction) could be exceeded on 8 days out of a 5-year simulation period. This would occur at Craters of the Moon under the Planning Basis Option; all other options would have less impact, and there would be no impacts on visibility at Yellowstone or Grand Teton National Parks.***

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 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 ***could*** choose to dispose of the low-level waste fraction onsite in a new Low-Activity Waste Disposal Facility. ***This facility is described in Section 5.2.1.3.*** 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.

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).

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 ***by*** June 2000 ***(completed May 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.

Direct Vitrification Alternative – ***The Vitrification with Calcine Separations Option would have a number of new facilities similar to the Separations Alternative (see Table 5.2-1). The dimensions of the new facilities would be of the same relative size and scale as the existing facilities. New emission stacks, if any, are not expected to exceed the height of the existing INTEC main stack.***

Under this alternative, stack emissions would result from operations associated with the vitrification facility. These emissions would be limited to the requirements set by their respective permits. Section 5.2.6, Air Resources, discusses emission levels and air impacts 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 visual resource objectives of adjacent lands.

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 ***twelve*** 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 the Minimum INEEL Processing ***Alternative*** 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.***3***. 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 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.

Direct Vitrification Alternative – ***The Vitrification with Calcine Separations Option would have a number of new facilities similar to the Separations Alternative (see Table 5.2-1). The dimensions of the new facilities would be of the same relative size and scale as the existing facilities. New emission stacks, if any, are not expected to exceed the height of the existing INTEC main stack.***

Under this alternative, stack emissions would result from operations associated with the vitrification facility. These emissions would be limited to the requirements set by their respective permits. Section 5.2.6, Air Resources, discusses emission levels and air impacts 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 visual resource objectives of adjacent lands.

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 ***twelve*** 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 the Minimum INEEL Processing ***Alternative*** 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.***3***. 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 ***as described in Section 5.2.1.3.*** 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

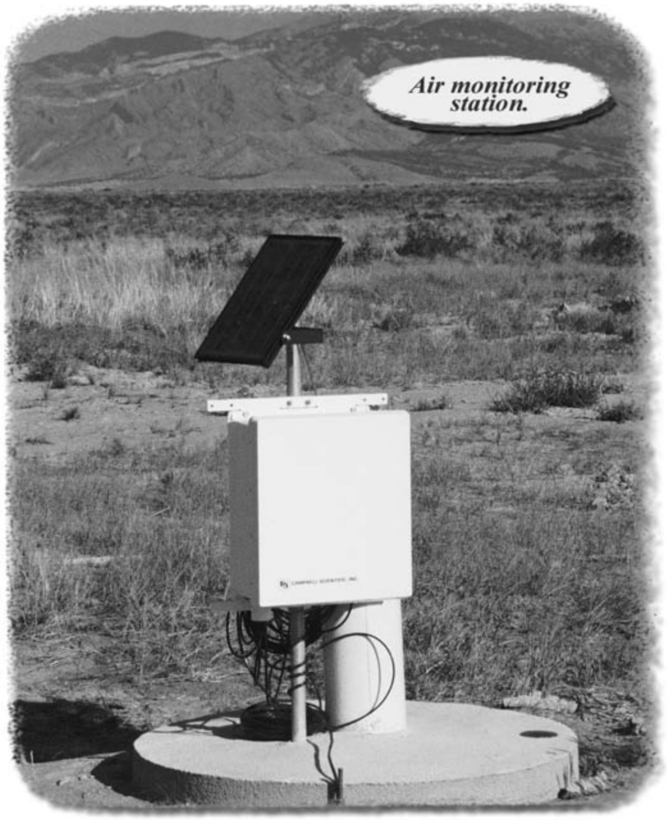
None of the ***four*** options comprising this alternative would require new construction outside of INTEC. Table 5.2-1 of Section 5.2.1 lists new facilities that would be built inside the developed portion of the INTEC under each of the ***four*** Non-Separations Alternative options. There would be some soil excavation for these new facilities, but as noted in ***Section 5.2.5.3***, 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 ***at*** 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 ***as described in Section 5.2.1.3.*** 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.

5.2.5.6 Direct Vitrification Alternative

Under this alternative, a number of new waste management and support facilities would be built within the developed portion of INTEC (see Table 5.2-1). There would be some soil excavation for these new facilities, but the potential for erosion is small in the area of INTEC. No impacts to geologic resources during construction or operation are expected under the Direct Vitrification Alternative.



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 the 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).

For the nonradiological assessments, DOE used two primary atmospheric dispersion models: Industrial Source Complex - Short Term (ISCST-3) (EPA 1995) and CALPUFF (Scire et al. 1999). DOE used the ISCST-3 model (Version 99155) to predict concentrations of criteria and toxic air pollutants at locations extending to 50 kilometers from INTEC. These assessments used hourly meteorological data collected at the INEEL during the period 1996-1998. In response to recommendations made by the U.S. National Park Service, DOE assessed impacts at Class I areas (Craters of the Moon National Wilderness Area, and Yellowstone and Grand Teton National Parks) using the CALPUFF model, which is better suited for simulating dispersion over greater distances (e.g., beyond 50 kilometers from the release point). As recommended by the National Park Service, the CALPUFF simulations used meteorological data measured at the Pocatello Airport for the years 1986 to 1991, coupled with upper air data taken at Salt Lake City Airport over the same period. Additional information on 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 (***IDEQ 2001***), 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 the 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 ***as described above***, 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 ***(PM-10)*** 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

Table 5.2-6. Total and annualized construction-related criteria air pollutant emissions and fugitive dust generation for waste processing alternatives.

				Separations Alternative			Non-Separations Alternative				Minimum INEEL Processing Alternative		***Direct Vitrification Alternative***	
Pollutant	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	***Steam Reforming Option***	At INEEL	At Hanford	***Vitrification without Calcine Separations Option***	***Vitrification with Calcine Separations Option***
Fossil fuel combustion														
Carbon monoxide	tons	7.8	27	350	330	360	280	330	260	***150***	210	120	***270***	***340***
	tons/year	1.6	8.1	110	110	110	82	91	72	***47***	54	20	***69***	***97***
Sulfur dioxide	tons	1.2	4.3	55	53	58	44	52	41	***25***	34	0.16	***43***	***54***
	tons/year	0.2	1.3	18	17	17	13	14	11	***7.5***	8.6	0.027	***11***	***16***
Particulate matter	tons	0.4	1.5	20	19	20	16	19	15	***8.7***	12	110	***15***	***19***
(PM-10)	tons/year	0.1	0.5	6.4	6.1	5.9	4.6	5.1	4.0	***2.7***	3.0	19	***3.9***	***5.5***
Nitrogen dioxide	tons	6.7	23	300	290	310	240	280	220	***130***	180	120	***230***	***290***
	tons/year	1.3	6.9	97	93	90	70	78	61	***40***	46	20	***59***	***84***
Volatile organic compounds	tons	1.4	4.9	62	60	65	50	59	47	***28***	38	NA[a]	***48***	***61***
	tons/year	0.3	1.4	20	19	19	15	16	13	***8.5***	9.7	NA	***12***	***17***
Fugitive dust generation														
Particulate matter (dust)	tons	110	210	2,800	680	2,600	670	910	550	***240***	2,600	1,300	***630***	***850***
	tons/year	22	46	490	200	430	190	240	150	***83***	420	220	***160***	***210***

a. NA = Not analyzed in the Tank Waste Remediation System EIS.

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 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 ***processing*** 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 ***0.11*** 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 1.0×10^{-4} 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.

Table 5.2-7. Radionuclide emission rates (curies per year) for waste processing alternatives.[a]

			Separations Alternative			Non-Separations Alternative				Minimum INEEL Processing Alternative		***Direct Vitrification 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	***Steam Reforming Option***	At INEEL	At Hanford[b]	***Vitrification without Calcine Separations Option***	***Vitrification with Calcine Separations Option***
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}	***1.3×10^{-6}***	8.2×10^{-9}	1.2×10^{-6}	1.2×10^{-6}	1.3×10^{-7}	***1.3×10^{-7}***	9.9×10^{-6}	–	***1.3×10^{-7}***	***1.6×10^{-7}***
Cesium-134	8.2×10^{-8}	6.3×10^{-6}	3.7×10^{-9}	***6.3×10^{-6}***	4.8×10^{-8}	6.3×10^{-6}	6.3×10^{-6}	9.3×10^{-8}	***1.5×10^{-7}***	1.0×10^{-7}	–	***9.3×10^{-8}***	***9.3×10^{-8}***
Cesium-137	2.4×10^{-4}	2.7×10^{-3}	2.3×10^{-3}	***4.9×10^{-3}***	2.3×10^{-3}	***0.096***	4.9×10^{-3}	2.5×10^{-3}	***2.5×10^{-3}***	2.5×10^{-3}	1.2×10^{-4}	***2.5×10^{-3}***	***2.5×10^{-3}***
Europium-154	2.0×10^{-7}	1.1×10^{-6}	1.1×10^{-9}	***1.2×10^{-6}***	1.0×10^{-9}	1.1×10^{-6}	1.1×10^{-6}	2.0×10^{-7}	***2.1×10^{-7}***	1.0×10^{-5}	–	***2.0×10^{-7}***	***2.0×10^{-7}***
Europium-155	–	–	4.9×10^{-10}	4.9×10^{-10}	4.9×10^{-10}	–	–	–	–	1.8×10^{-9}	–	–	–
Hydrogen-3 (tritium)	9.0	23	45	68	45	23	23	54	***54***	32	–	***54***	***54***
Iodine-129	0.031	0.089	1.5×10^{-3}	***0.090***	4.2×10^{-4}	0.089	0.089	0.032	***0.031***	0.031	9.1×10^{-11}	***0.032***	***0.033***
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}	***4.4×10^{-5}***	3.2×10^{-5}	4.3×10^{-5}	4.3×10^{-5}	3.8×10^{-5}	***3.9×10^{-5}***	9.1×10^{-5}	1.8×10^{-7}	***3.8×10^{-5}***	***3.8×10^{-5}***
Plutonium-239	1.0×10^{-7}	6.7×10^{-7}	2.4×10^{-10}	***6.7×10^{-7}***	2.2×10^{-10}	6.7×10^{-7}	6.7×10^{-7}	1.1×10^{-7}	***1.1×10^{-7}***	3.2×10^{-6}	2.6×10^{-8}	***1.1×10^{-7}***	***1.1×10^{-7}***
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}	***6.7×10^{-5}***	4.6×10^{-7}	7.7×10^{-5}	6.6×10^{-5}	2.5×10^{-6}	***2.4×10^{-6}***	2.4×10^{-6}	–	***2.5×10^{-6}***	***4.1×10^{-6}***
Antimony-125	1.5×10^{-6}	1.2×10^{-5}	7.4×10^{-7}	***1.3×10^{-5}***	5.5×10^{-7}	1.2×10^{-5}	1.2×10^{-5}	1.5×10^{-6}	***1.5×10^{-6}***	5.3×10^{-6}	–	***1.5×10^{-6}***	***2.3×10^{-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}	***6.2×10^{-3}***	5.8×10^{-3}	6.2×10^{-3}	6.2×10^{-3}	5.8×10^{-3}	***5.9×10^{-3}***	7.5×10^{-3}	8.0×10^{-5}	***5.8×10^{-3}***	***5.8×10^{-3}***
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}	–	***1.8×10^{-5}***

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).

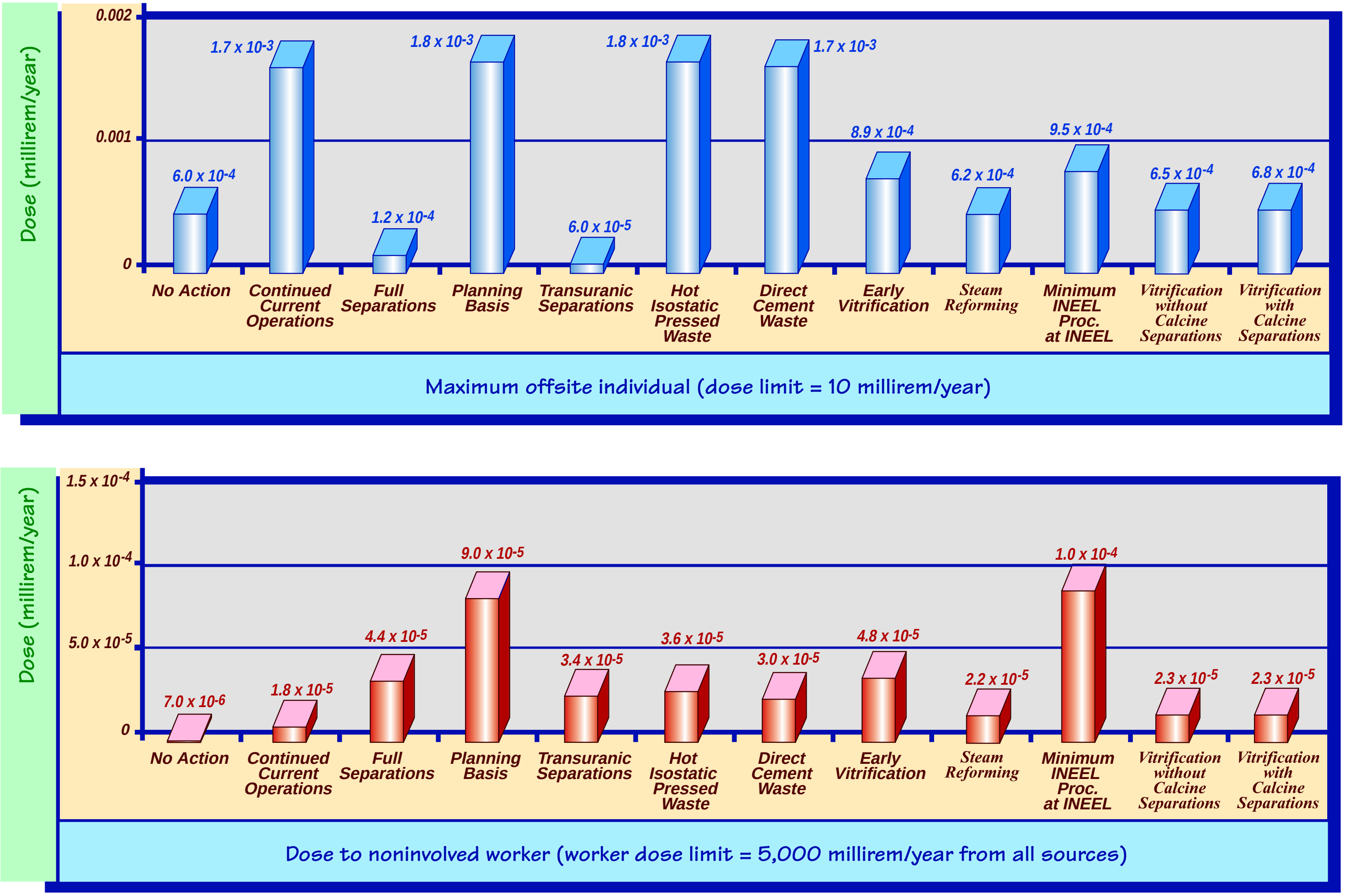


FIGURE 5.2-2. (1 of 2)
Comparison of air pathway doses by alternative.

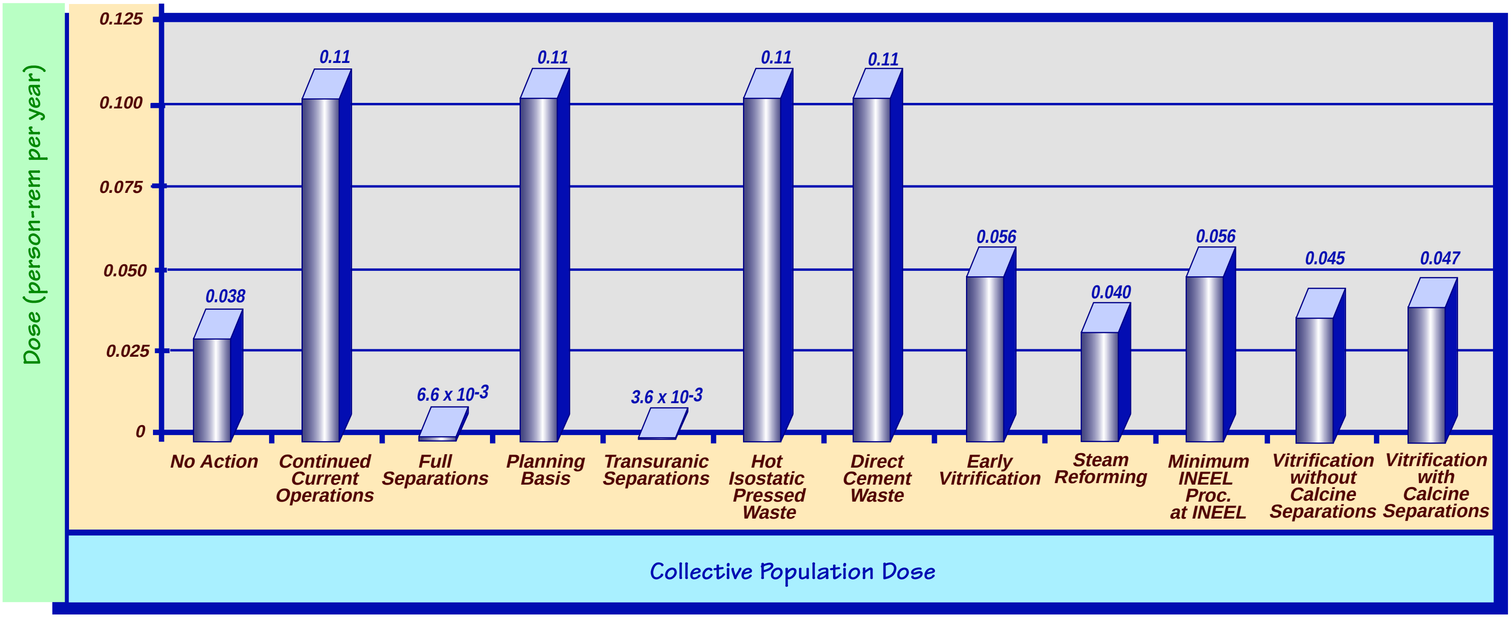


FIGURE 5.2-2. (2 of 2)
Comparison of air pathway doses by alternative.

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 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. 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. ***In the past, a notable exception was the emission of substantial amounts of nitrogen dioxide as a byproduct of the waste calcining process; however, the waste calciner has been removed from service and would not, under the alternatives analyzed in this EIS, resume operation without upgraded emission controls.*** 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 ***CPP-606*** Service Building Power House. ***This facility, which was recently upgraded by replacing the older boilers with newer, more efficient ones with enhanced emission control, would also provide the steam required by the waste processing 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

Table 5.2-8. Projected nonradiological pollutant emission rates (tons per year) for the proposed waste processing alternatives.

				Separations Alternative			Non-Separations Alternative				Minimum INEEL Processing Alternative		***Direct Vitrification Alternative***	
Pollutant	Significance Threshold[a] (tons/yr)	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	***Steam Reforming Option***	At INEEL	At Hanford	***Vitrification without Calcine Separations Option***	***Vitrification with Calcine Separations Option***
Carbon monoxide	100	1.7	8.1	21	***27***	13	10	***9.4***	***3.4***	***2.3***	***3.5***	300	***2.8***	***20***
Sulfur dioxide[b]	40	***14***	***65***	***130***	***190***	***84***	***81***	***75***	***38***	***8.7***	11	27	***28***	***150***
Particulate matter (PM-10)	25	***0.64***	1.3	4.7	***6.0***	***2.6***	***2.0***	***1.7***	***0.82***	***0.47***	***0.61***	NA[c]	***0.82***	***5.3***
Oxides of nitrogen	40	6.4	31	62	***94***	***41***	***91***	36	12	***5.1***	***6.8***	18	***9.9***	***68***
Volatile organic compounds	40	***0.093***	1.0	2.4	***3.0***	1.6	1.1	1.1	***0.15***	***0.28***	***0.48***	NA	***0.14***	***1.9***
Lead	0.6	***4.8×10^{-4}***	***7.7×10^{-4}***	***3.1×10^{-3}***	4.0×10^{-3}	***1.7×10^{-3}***	***1.3×10^{-3}***	***1.1×10^{-3}***	***6.1×10^{-4}***	***3.1×10^{-4}***	***3.7×10^{-4}***	NA	***6.1×10^{-4}***	***3.7×10^{-3}***
Total toxic air pollutants	–	***0.19***	***0.67***	***1.3***	***2.0***	***0.68***	0.90	***0.81***	***0.68***	***0.29***	***0.20***	NA	***0.48***	***1.7***

a. Significance level specified by State of Idaho ***(IDAPA 58.01.01.006.92) (IDEQ 2001)*** and the EPA ***(40 CFR 52.21(b)(23))***; net emissions increases above this level are considered “major” and are subject to additional analyses and air pollution control requirements.

b. The Draft EIS assumed 0.5 percent sulfur content of diesel boiler fuel. The Final EIS assumes 0.3 percent sulfur (as required by permit).

c. NA = Not analyzed in the TWRS EIS.

- 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 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 ***5.4.3.3.***

The analysis of waste processing alternatives assumes ***that new oil-fired boilers in the CPP-606 Power House would provide all the steam required by the waste processing alternatives. It is also assumed that the maximum sulfur content of the fuel would be 0.3% (as required by the CPP-606 permit), and that the Coal-Fired Steam Generating Facility, which is currently shut down. It should be noted that the ambient concentrations that result from criteria pollutant emissions are bounded in all cases by the maximum baseline conditions described in Section 4.7.4.2. The maximum baseline case (performed for the SNF & INEL EIS) assumes that all INEEL sources are operating, including the Coal-Fired Steam Generating Facility, the New Waste Calcining Facility and the CPP-606 Power House, emit pollutants at maximum operating capacity or at limits allowed by permits. Since the maximum steam demand projected for any of the alternatives is below the operational capacity of CPP-606, and since other major sources included in the baseline would not operate under the waste processing alternatives, the criteria pollutant emission rates and ambient concentrations are expected to be well below the maximum baseline levels described in Section 4.7.4.2. The New Waste Calcining Facility, as analyzed in this EIS, would be upgraded*** to comply with the 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 ***1998***; 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 1997 and projected emission rates for facilities required to support the waste processing alternatives (Table 5.2-8)***, except that emissions from the Coal-Fired Steam Generating Facility and the New Waste Calcining Facility (without upgrades) are not included in the inventory of existing facilities.*** The projected criteria pollutant impacts are presented graphically in Figure 5.2-***3***. 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-***4*** 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 ***as well as the Vitrification with Calcine Separations Option.***

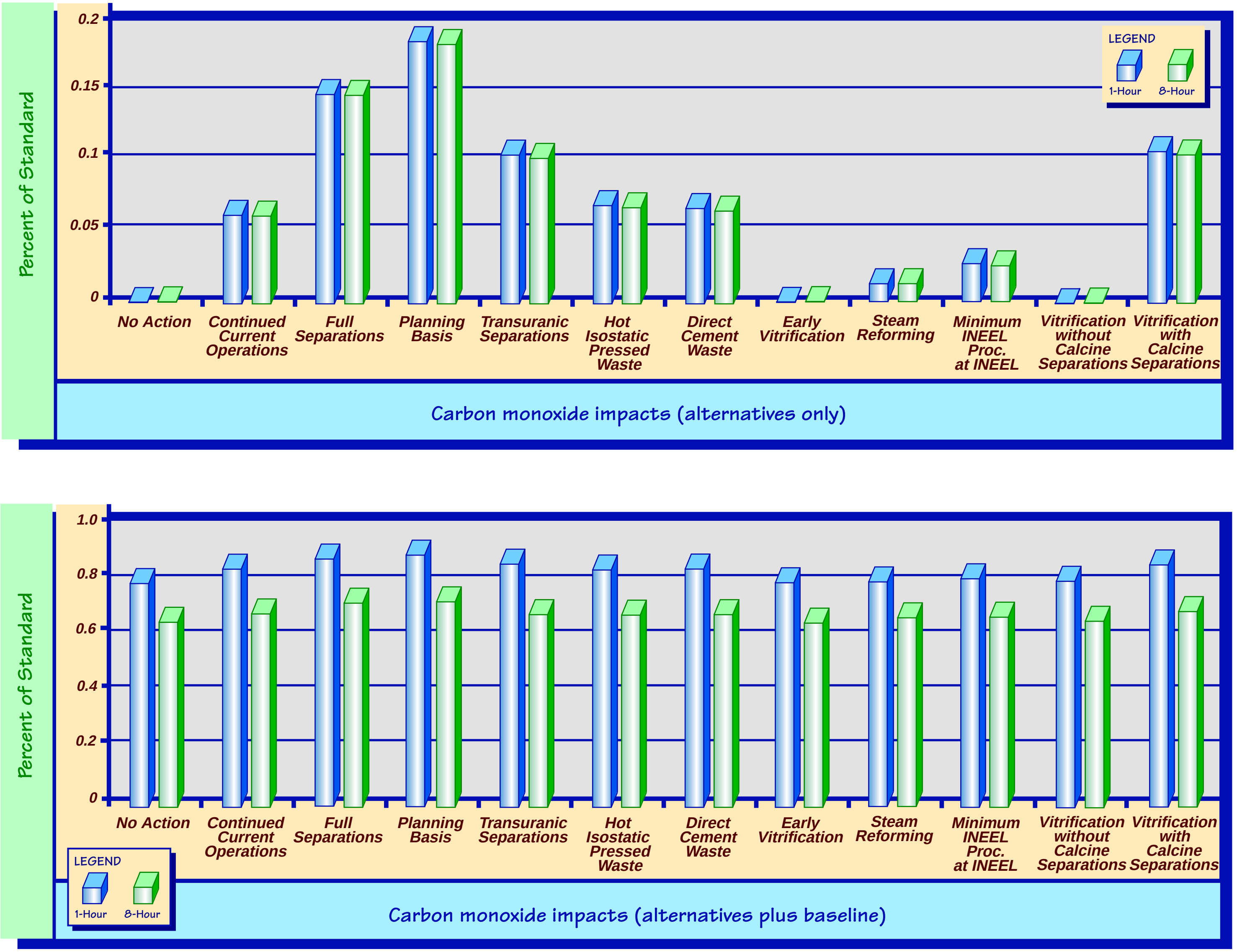
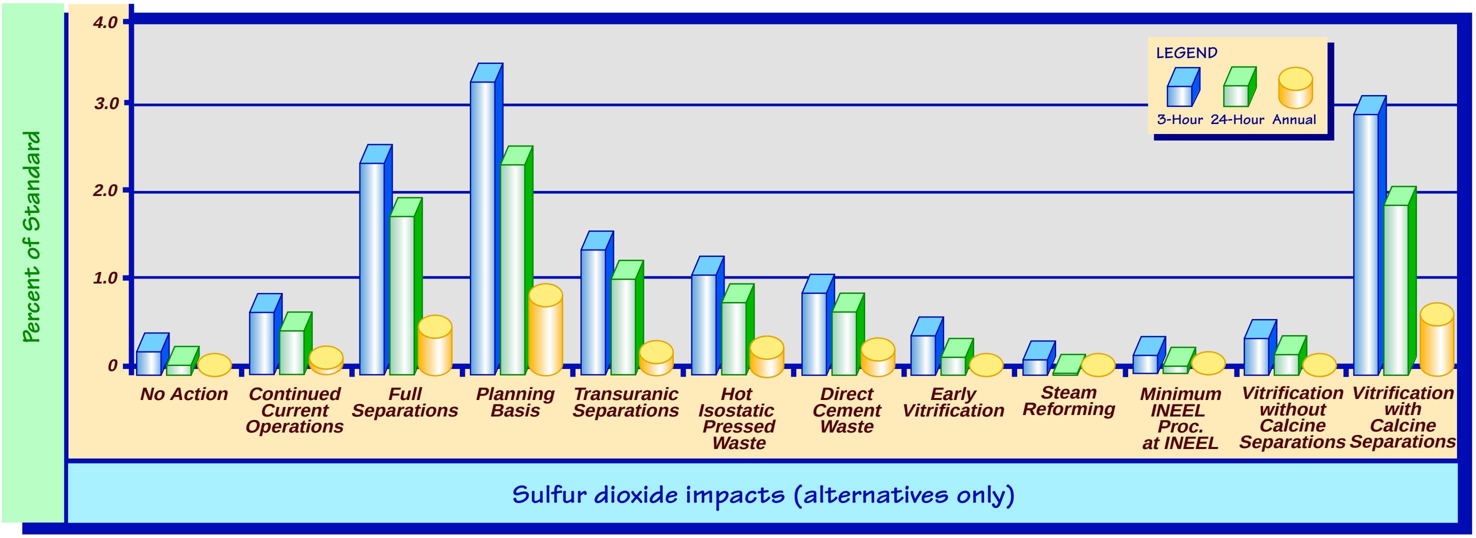
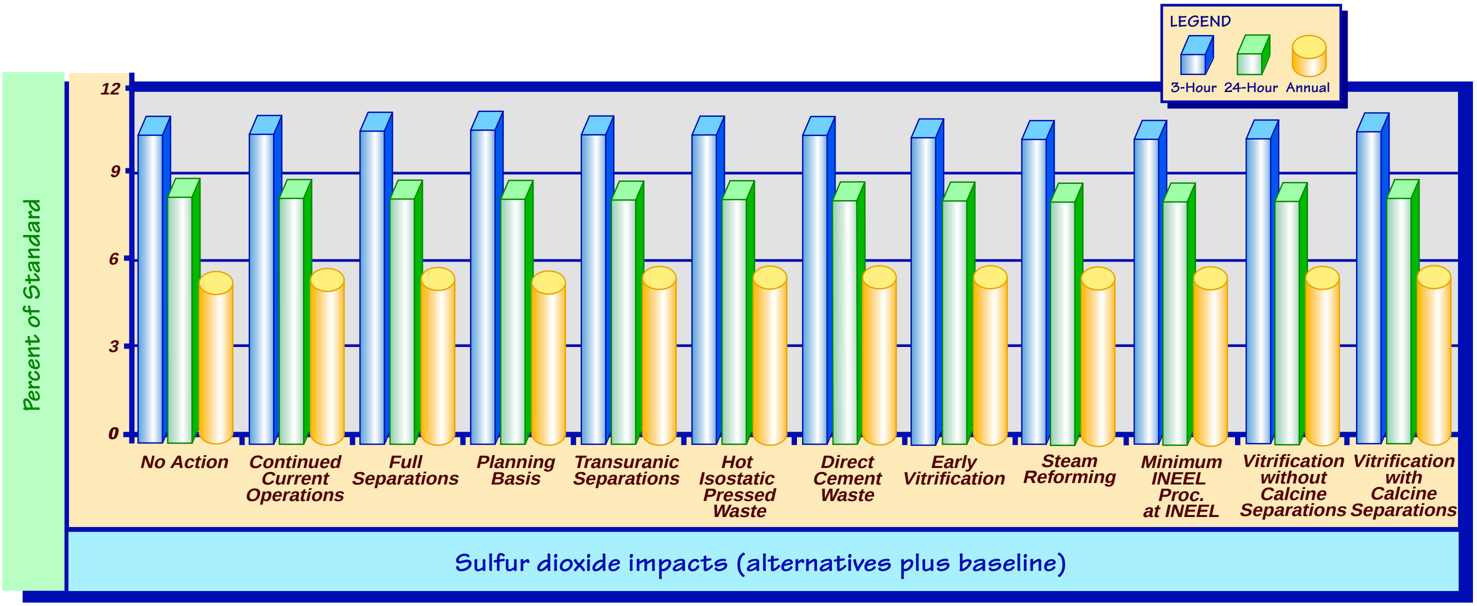


FIGURE 5.2-3. (1 of 4)
Comparison of criteria air pollutant impacts by alternative.



Sulfur dioxide impacts (alternatives only)



Sulfur dioxide impacts (alternatives plus baseline)

FIGURE 5.2-3. (2 of 4)
Comparison of criteria air pollutant impacts by alternative.

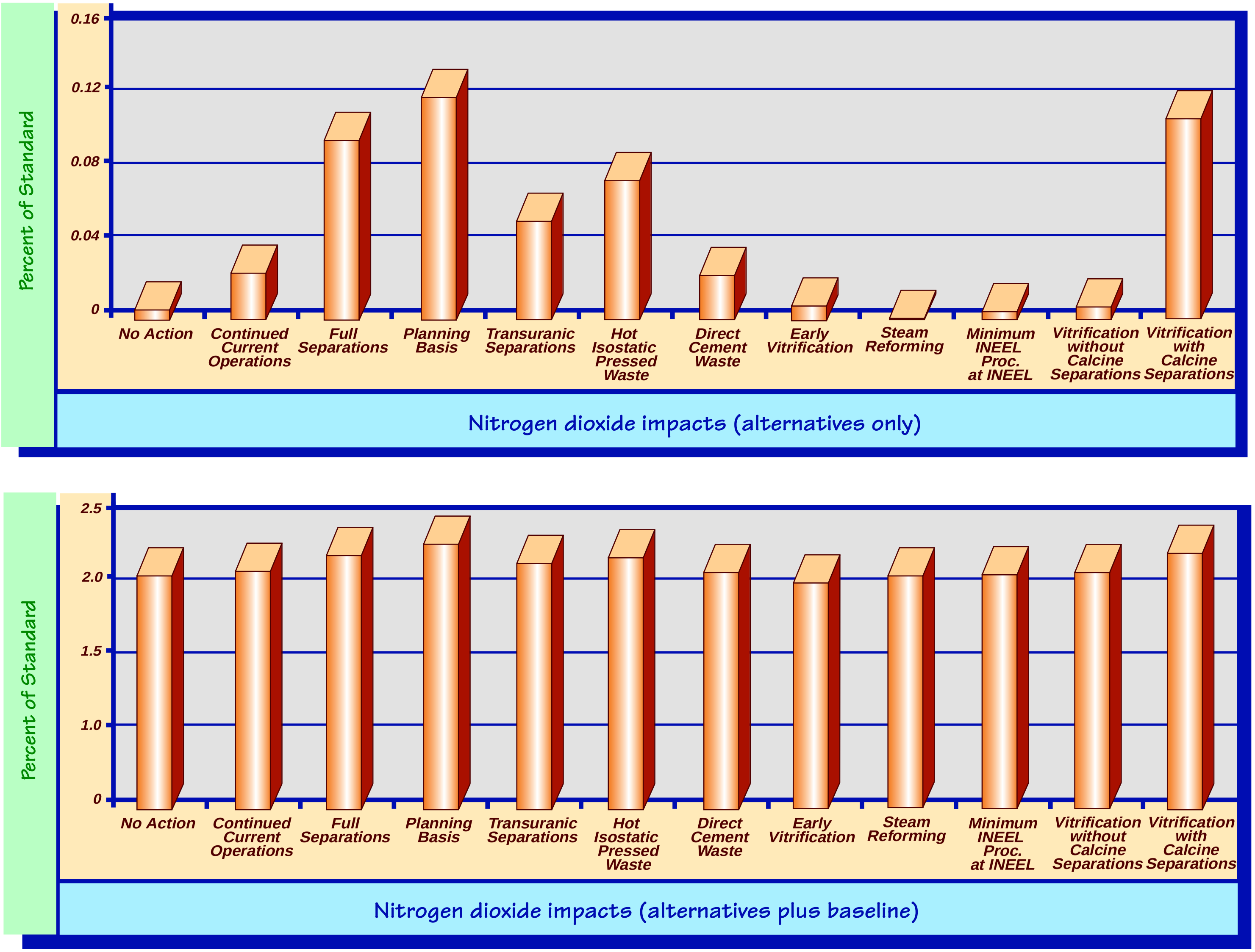
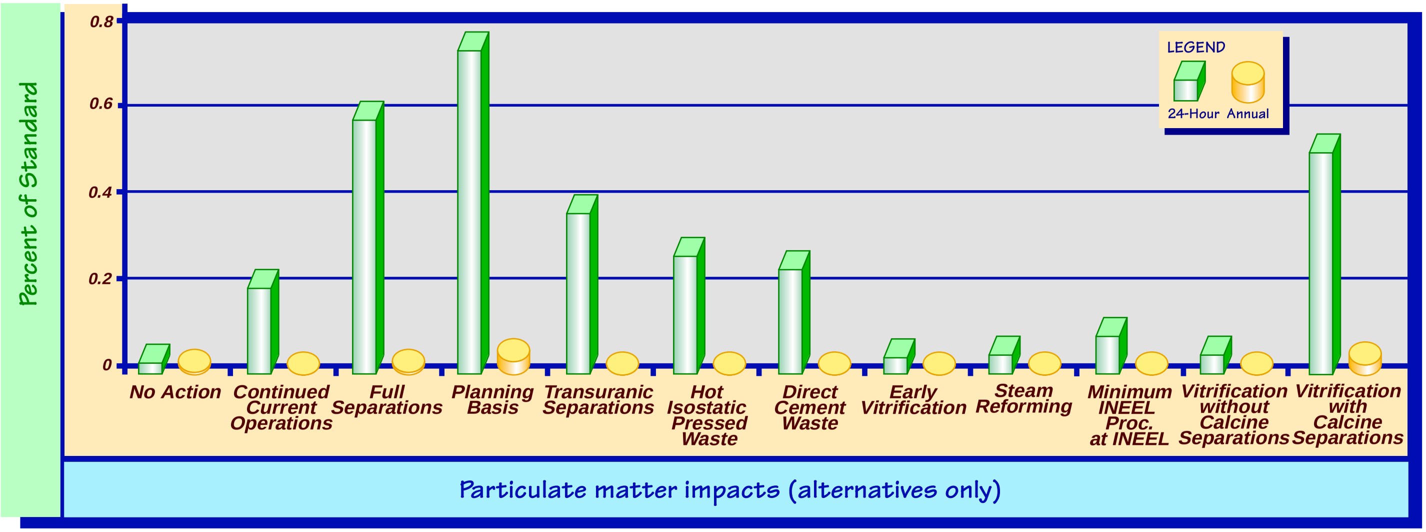
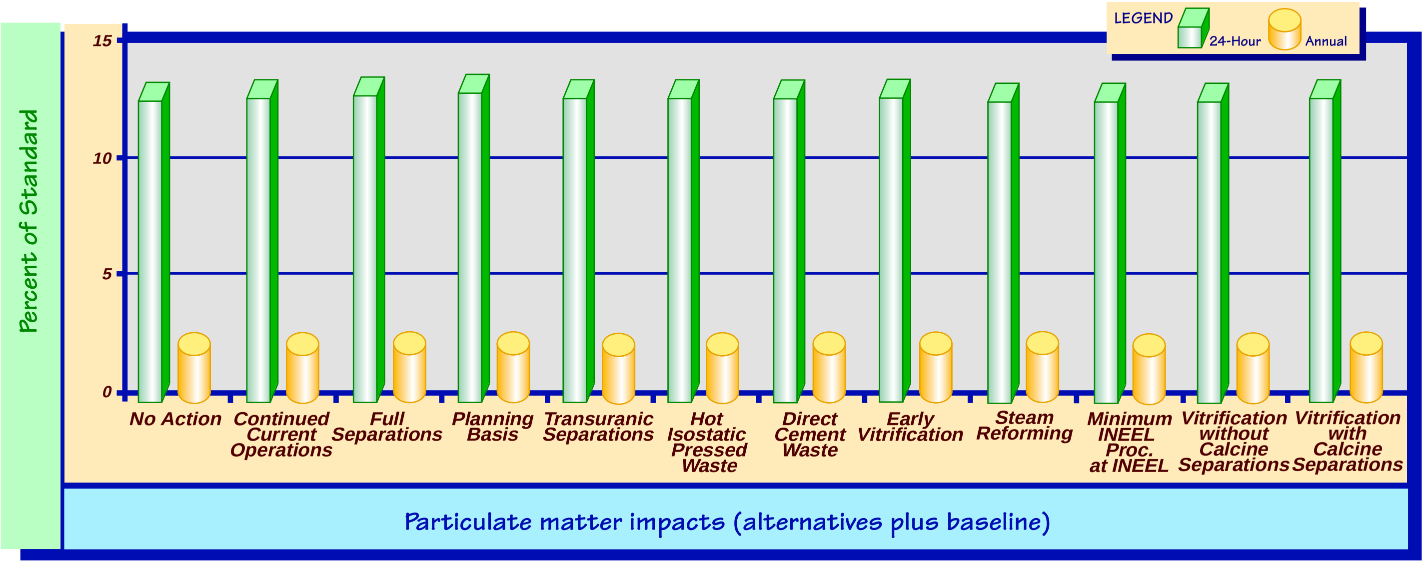


FIGURE 5.2-3. (3 of 4)
Comparison of criteria air pollutant impacts by alternative.



Particulate matter impacts (alternatives only)



Particulate matter impacts (alternatives plus baseline)

FIGURE 5.2-3. (4 of 4)
Comparison of criteria air pollutant impacts by alternative.

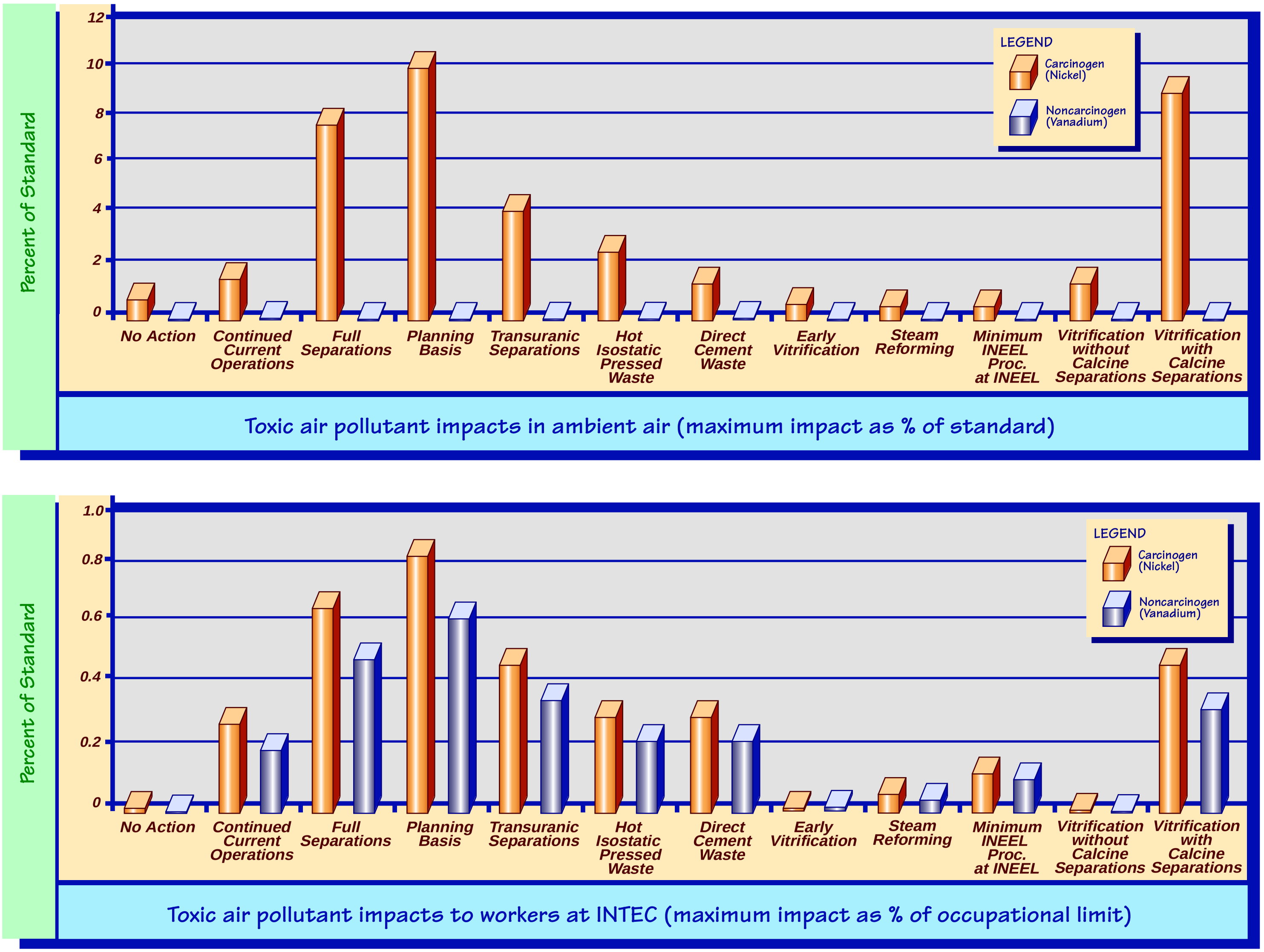


FIGURE 5.2-4.
Comparison of toxic air impacts by alternative.

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 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.

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 PSD regulatory baseline dates are established, be assessed for their incremental contribution to increases of ambient pollutant levels. PSD regulatory requirements for the State of Idaho are specified in IDAPA 58.01.01.579-581. 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 PSD regulations, while the nearest Class I area is Craters of the Moon Wilderness Area. Previous PSD regulations permits for INEEL site projects have consumed a portion of the available Class I and II increments (see Section 4.7).

The degree to which waste processing options would consume additional PSD increment depends primarily on the amount of fossil fuel burning that is needed to meet project energy requirements. DOE projects that there will be negligible change in increment consumption above the levels described in Section 4.7. The levels described in Section 4.7 assume that the newly installed CPP-606 boilers operate continuously at maximum capacity; however, the energy requirements for the alternatives would not require full-time, maximum-level operation. Nevertheless, DOE has quantitatively evaluated the amount of increment consumption for the alternatives. As in the baseline PSD evaluations, DOE conducted these evaluations using both the ISCST and CALPUFF models (see Section 4.7). ISCST modeling was performed for each of the waste processing alternatives, whereas a CALPUFF simulation was performed only for a bounding case (the Planning Basis Option, which is the option with the highest projected emission rates).

Figure 5.2-5 illustrates the receptor "rings" used in the CALPUFF simulations. DOE developed the receptor rings in consultation with the National Park Service. Each ring is set at a distance from INTEC that corresponds to a portion of a Class I area of interest (Craters of the Moon Wilderness Area and Yellowstone and Grand Teton National Parks). Results for PSD increment consumption estimated by the ISCST modeling are presented in Table 5.2-9, while the CALPUFF simulation results are presented in Table 5.2-10. All projected concentrations at INEEL road and boundary locations, Craters of the Moon Wilderness Area, and Yellowstone and Grand Teton National Parks are well within allowable increments. Despite the differences between these two models, the results obtained for Craters of the Moon (the only area assessed by both models) are similar.

For Class II areas (ISCST results), there are only very minor differences between the alternatives. There are no noticeable differences, for example, in sulfur dioxide increment consumption between the alternatives. That is because most of the sulfur dioxide increment consumption to date is associated with projects in the vicinity of Test Area North and these locations are only minimally affected by emissions from sources at INTEC. It should also be noted that nitrogen dioxide increment consumption for the alternatives is less than the baseline level reported in Table 4-14. This is due to the inclusion of the New Waste Calcining Facility calciner emissions in the baseline. The calciner, which is by far the largest source of nitrogen dioxide emissions at the INEEL, is currently in standby. Nevertheless, it was included in a recent air quality permitting action, which is used as the PSD baseline in this EIS.

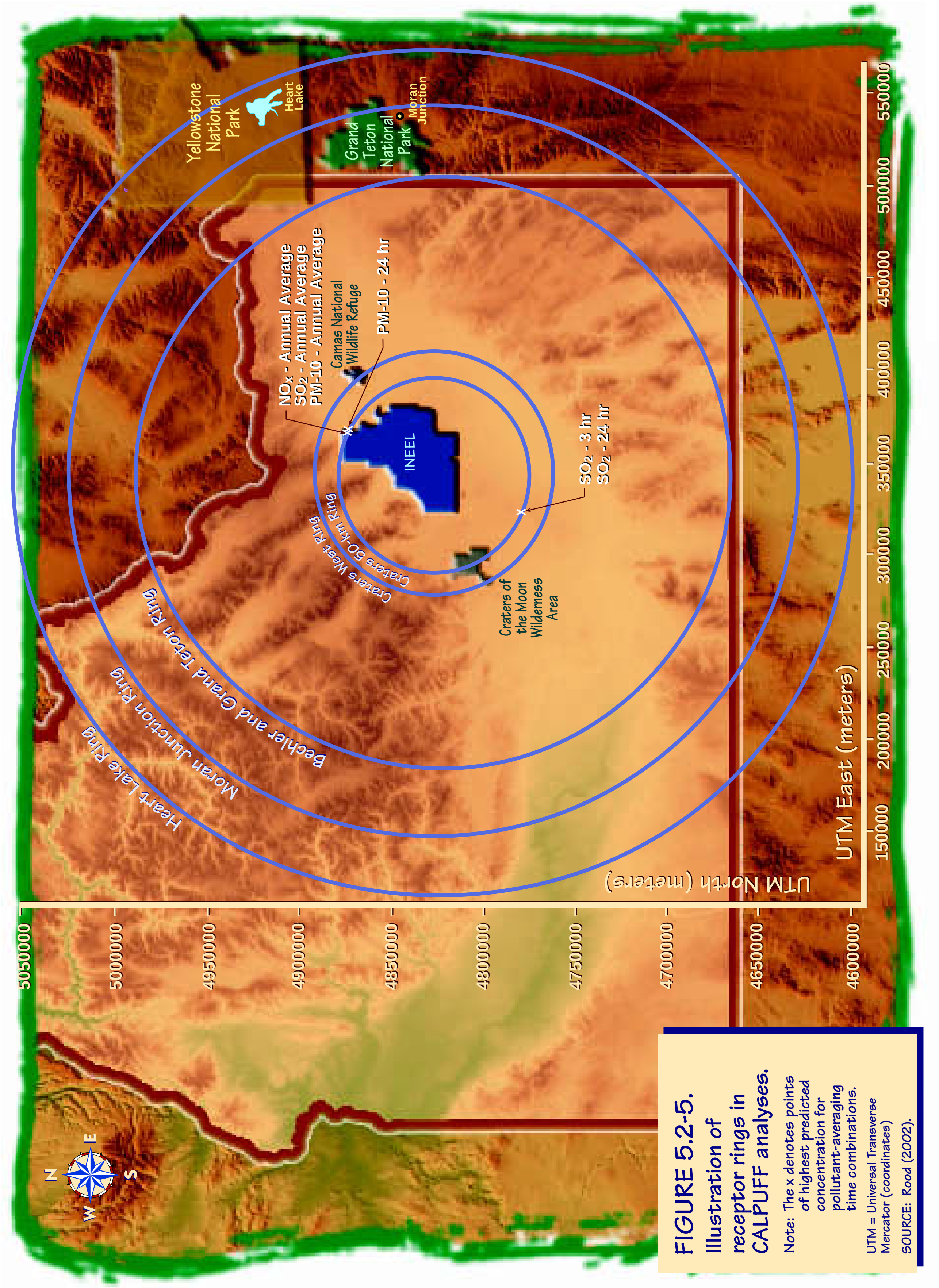


FIGURE 5.2-5. Illustration of receptor rings in CALPUFF analyses.

Note: The x denotes points of highest predicted concentration for pollutant-averaging time combinations.

UTM = Universal Transverse Mercator (coordinates)

SOURCE: Rood (2002).

Table 5.2-9. PSD increment consumption for the combined effects of baseline sources, waste processing alternatives, and other planned future projects.[a,b]

Pollutant	Averaging time	Highest percentage of allowable PSD increment consumed												
				Separations Alternative			Non-Separations Alternative				Minimum INEEL Processing Alternative		Direct Vitrification Alternative	
		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	Steam Reforming Option	At INEEL	At Hanford	Vitrification without Calcine Separations Option	Vitrification with Calcine Separations Option
Class I area (Craters of the Moon)[c]														
Sulfur dioxide	3-hour	26%	27%	29%	31%	28%	28%	27%	26%	26%	26%	NA	26%	29%
	24-hour	34%	35%	38%	40%	36%	36%	36%	34%	34%	34%	NA	34%	38%
	Annual	4.1%	4.3%	4.9%	5.2%	4.5%	4.5%	4.4%	4.2%	4.0%	4.1%	NA	4.2%	5.1%
Particulate matter	24-hour	6.9%	6.9%	7.0%	7.0%	6.9%	6.9%	6.9%	6.9%	6.9%	6.9%	NA	6.9%	7.0%
	Annual	0.42%	0.43%	0.44%	0.44%	0.43%	0.43%	0.43%	0.42%	0.42%	0.42%	NA	0.42%	0.44%
Nitrogen dioxide	Annual	5.0%	5.1%	5.3%	5.5%	5.2%	5.6%	5.2%	5.0%	5.0%	5.0%	NA	5.0%	5.3%
Class II area (INEEL boundary and public roads)														
Sulfur dioxide	3-hour	31%	31%	31%	32%	31%	31%	31%	31%	31%	31%	NA	31%	32%
	24-hour	38%	38%	38%	38%	38%	38%	38%	38%	38%	38%	NA	38%	38%
	Annual	21%	21%	21%	21%	21%	21%	21%	21%	21%	21%	NA	21%	21%
Particulate matter	24-hour	39%	39%	39%	39%	39%	39%	39%	39%	39%	39%	NA	39%	39%
	Annual	2.5%	2.5%	2.5%	2.6%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	NA	2.5%	2.6%
Nitrogen dioxide	Annual	7.3%	7.4%	7.8%	8.0%	7.6%	7.7%	7.6%	7.4%	7.3%	7.4%	NA	7.3%	7.9%

a. Assumes that steam for operation of projects associated with the waste processing alternatives is provided by recently installed CPP-606 boilers that are regulated under PSD; baseline emissions do not include those from the Coal-Fired Steam Generating Facility, which would not operate under this scenario.

b. Assessed using ISCST-3.

c. Includes the eastern boundary of Craters of the Moon Wilderness Area, which is the portion of the Class I area located closest to INTEC.

PSD = Prevention of Significant Deterioration; NA = Not analyzed in the TWRS EIS.

Table 5.2-10. PSD increment consumption at Class I Areas beyond 50 kilometers from INTEC for the combined effects of baseline sources and the Planning Basis Option.[a,b]

	Highest percentage of allowable PSD increment consumed					
	Sulfur dioxide			***Particulate matter***		***Nitrogen dioxide***
	3-hour	***24-hour***	***Annual***	***24-hour***	***Annual***	***Annual***
Craters of the Moon[c]	*29*	*45*	*10*	*5.5*	*0.75*	*6.2*
Yellowstone National Park	*9.2*	*10*	*1.3*	*1.7*	*0.11*	*0.29*
Grand Teton National Park	*8.9*	*10*	*1.3*	*1.7*	*0.11*	*0.29*

a. Source: Rood (2002).

b. Assessed using CALPUFF.

c. Includes only that part of Craters of the Moon National Monument and Wilderness Area that is 50 kilometers or more from INTEC.

PSD = Prevention of Significant Deterioration.

It should be noted that the CALPUFF results represent the maximum values at any point on the receptor ring, regardless of direction. As Figure 5.2-5 shows, the maximum amount of 3-hour sulfur dioxide increment is consumed within Craters of the Moon; however, maximum consumption of other increments occurs in directions that do not correspond to Class I area locations.

For radiological PSD 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 the INEEL. Ozone, unlike the other criteria pollutants, is not emitted directly from facility sources but is formed in the atmosphere through photochemical reactions involving nitrogen oxides and volatile organic compounds (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 ***processing alternatives*** would exceed the non-methane volatile organic compound significance level established by the State of Idaho.

Visibility Degradation - ***Emissions of fine particulate matter, sulfur dioxide and nitrogen dioxide can result in an impairment of visual resources. For this EIS, DOE used the VISCREEN program (a conservative, screening-level model) to evaluate the relative potential for visibility impacts between waste processing alternatives. That analysis includes 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.

DOE also conducted evaluations using the CALPUFF model (Scire et al. 1999). This model is especially well suited for impact evaluations involving distances greater than 50 kilometers, and is specifically recommended by the National Park Service for impact studies at Class I areas. DOE used CALPUFF in the screening mode of operation to estimate visibility degradation at Yellowstone National Park, Grand Teton National Park, and that portion of Craters of the Moon National Monument and Wilderness Area that is more than 50 kilometers from INTEC. The CALPUFF model is more comprehensive than VISCREEN in that it includes algorithms to model the chemical conversion of SO_2 ***and*** SO_4***, and also accounts for the effects of relative humidity. The CALPUFF visibility model estimates maximum 24-hour average light extinction changes. The acceptability criterion for this parameter is 5 percent.***

As with the PSD increment consumption analysis described previously, DOE conducted CALPUFF visibility analysis only for the Planning Basis Option, which is the bounding case. Under this option, the maximum 24-hour light extinction change is 8.4 percent during eight days in the 5-year modeling period, which exceeds the 5 percent acceptance criterion. These conditions occurred in the Craters of the Moon Receptor Ring, with two of the eight occurrences within or in close proximity to Craters of the Moon National Monument and Wilderness Area. There were no exceedances of the 5 percent acceptance criterion at the Yellowstone or Grand Teton National Park receptor rings.

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). ***For the combined effects of the Planning Basis Option and existing INEEL sources, the projected concentrations of sulfur dioxide and nitrogen dioxide at Craters of the Moon National Monument and Wilderness Area would not exceed 3 percent of the National Park Service guidelines.***

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. ***Although*** these levels do not include contributions from baseline or other sources, 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 ***0.3*** percent by weight) could reach levels of about ***190*** tons per year, while emissions of nitrogen dioxide could reach about 90 tons per year. Emissions would be similar or less under other options (***Table 5.2-8***). 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 ***the CPP-606 boiler facility***. 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. ***DOE used CALPUFF simulations to estimate the maximum amount of total sulfur and nitrogen deposition that would occur at Craters of the Moon National Monument and Wilderness Area under the bounding case. The National Park Service interim guidelines for total sulfur deposition is 20 milli-equivalents per square meter per year, which is about 3 kilograms per hectare per year. Under the bounding case of the Planning Basis Option plus existing sources, total sulfur deposition at Craters of the Moon is estimated at 1 kilogram per hectare per year, or about one-third the guideline value (Rood 2002). A similar guideline of 3 kilograms per hectare per year has been used by the U.S. Forest Service (USDA 1992) for total nitrogen deposition in Class I areas. The nitrogen deposition at Craters of the Moon for the bounding case described above is estimated at 0.15 kilograms per hectare per year, or about 5 percent of the guideline (Rood 2002). Thus, the amount of acidic deposition that would result under any of the alternatives is well below the levels established for protection of sensitive plant species.***

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 ***6***0,000 tons per year – would be experienced for operation of facilities under the Planning Basis Option. This level represents a very small part (***roughly*** 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).

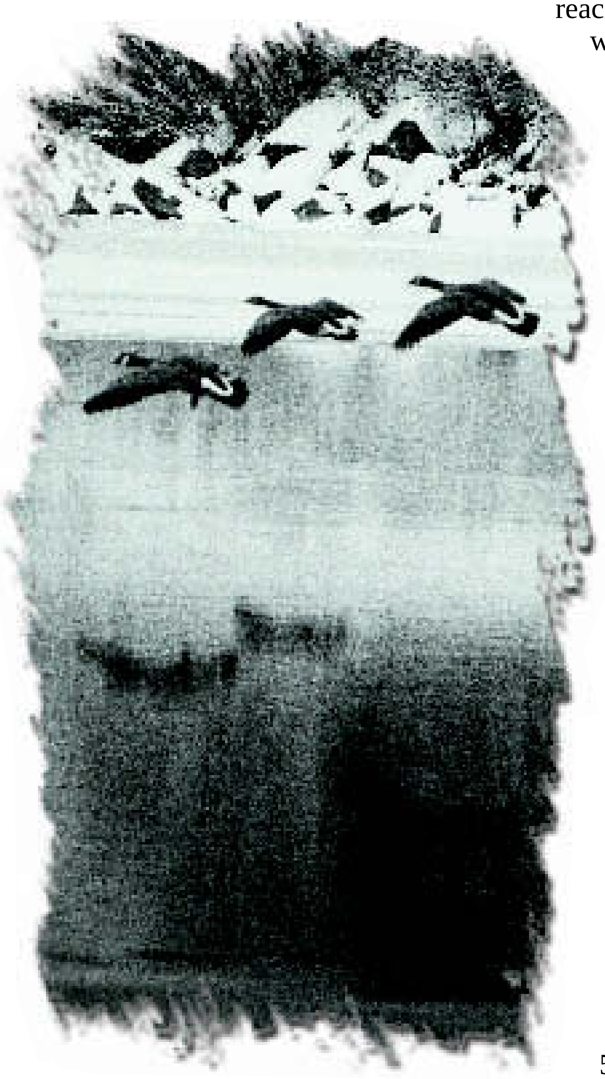
Secondary Particulate Matter Formation - The emissions data and evaluation results presented earlier in this section included data and results for particulate matter. Those data and results apply only to "primary" particulate matter, which refers to particles directly emitted to the atmosphere in particulate 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 standards ***have not yet*** 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, considering the relatively long time required for conversion, the previously described particulate matter-related impacts (i.e., consumption of PSD 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 ***the proposed waste processing*** 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 the Minimum INEEL Processing ***Alternative*** 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 ***six*** 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 the INEEL before the year 2095. Iodine-129 was predicted to migrate to the southern border of the 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 ***would be*** 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 Direct Vitrification Alternative,*** the Non-Separations Alternative, the Minimum INEEL Processing Alternative, the Continued Current Operations Alternative, and the No Action Alternative with the lowest water use. ***During fiscal year 2000,*** INEEL activities ***withdrew about 1.1*** billion gallons of water from the Snake River Plain Aquifer (***Fossum 2002***), most of which ***was*** 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. ***Total INEEL water use would be well below the consumptive use water rights of 11.4 billion gallons per year (Teel 1993).***

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, the Minimum INEEL Processing Alternative, the 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***.1.2***, 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 ***or*** 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 water withdrawal of ***1.1*** billion gallons at the 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.

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 ***by more than*** a factor of two ***in estimated flow rates.*** If, as a result of this EIS, DOE decides to build facilities within the flood plain at INTEC, then some form of mitigation ***could*** be necessary to assure that INTEC facilities would not be impacted by localized flooding. A Mitigation Action Plan would be prepared, if necessary, ***pending results of ongoing flood studies.*** However, before such facilities are constructed, future evaluations and comparative analyses regarding the extent of the 100-year flood at INTEC ***will*** be conducted and used by DOE to determine a more accurate ***evaluation of*** 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 the ***U.S. Geological Survey study*** (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 ***conservative*** design basis bounding event and is discussed in Appendix C.4. ***On January 18, 2001, DOE issued a floodplain determination, an estimate of the 100-year flood elevation, for Resource Conservation and Recovery Act (RCRA) permitting purposes at INTEC (Guymon 2001). The determination is based on Koslow and Van Haaften (1986), as is the probable maximum flood described above. The RCRA determination, however, is based on a 100-year flow scenario which involves the overtopping failure of Mackay Dam resulting in a flood elevation of 4,916 feet, whereas the maximum probable flow estimate results in a flood elevation of 4,917 feet at INTEC. Although this is an extremely conservative assumption, exceeding the requirements for a 10 CFR 1022 floodplain determination, the 4,916 feet elevation is consistent with the safety authorization basis for facilities at INTEC.***

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 ***six*** 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 the Minimum INEEL Processing ***Alternative*** 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.

agement 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 ***by more than*** a factor of two ***in estimated flow rates.*** If, as a result of this EIS, DOE decides to build facilities within the flood plain at INTEC, then some form of mitigation ***could*** be necessary to assure that INTEC facilities would not be impacted by localized flooding. A Mitigation Action Plan would be prepared, if necessary, ***pending results of ongoing flood studies.*** However, before such facilities are constructed, future evaluations and comparative analyses regarding the extent of the 100-year flood at INTEC ***will*** be conducted and used by DOE to determine a more accurate ***evaluation of*** potential inundation.

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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 ***six*** 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 ***and the Vitrification with Calcine Separations Option*** would have the most construction activity, this alternative ***and option*** would have the greatest potential for construction-related disturbances to plant and animal communities in areas adjacent to INTEC. ***The No Action Alternative would have the least impact.***

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 ***described in Section 5.2.1.3.*** 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).

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 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. 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, 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 ***could*** 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 nonradiological chemical 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-***11***). 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.

Nonradiological chemical 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 the 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).

Table 5.2-11. 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	***4.4×10^{-3}***	***Vitrification with Calcine Separations***	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***/Vitrification with Calcine Separations***	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***/Vitrification with Calcine Separations***	14.4	500	100	NA	NA	NA
Mercury	***2.3×10^{-4}***	***Vitrification with Calcine Separations***	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.

Predicted soil concentrations, shown in Table 5.2-***12***, 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 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 ***the*** 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 vitrified HLW, vitrified low-level waste, vitrified transuranic waste, grouted low-level waste, grouted transuranic waste, hot isostatic pressed HLW, cementitious HLW, calcine, ***steam reformed SBW***, solidified HLW fraction, and solidified transuranic waste fraction.

Although transportation of road-ready HLW to a geologic repository is beyond the scope of DOE's Proposed Action (see Chapter 1), 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 ***approved*** 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 the INEEL and Yucca Mountain selected in this EIS are ***representative of*** 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

Predicted soil concentrations, shown in Table 5.2-***12***, 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 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 ***the*** 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 vitrified HLW, vitrified low-level waste, vitrified transuranic waste, grouted low-level waste, grouted transuranic waste, hot isostatic pressed HLW, cementitious HLW, calcine, ***steam reformed SBW***, solidified HLW fraction, and solidified transuranic waste fraction.

Although transportation of road-ready HLW to a geologic repository is beyond the scope of DOE's Proposed Action (see Chapter 1), 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 ***approved*** 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 the INEEL and Yucca Mountain selected in this EIS are ***representative of*** 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

Table 5.2-12. Maximum concentrations of radionuclides in soils outside of INTEC compared to background and ecologically-based screening levels (in picocuries per gram).[a]

					Separations Alternative			Non-Separations Alternative					***Direct Vitrification Alternative***	
Radionuclides	Background concentration[b]	WAG 3 EBSL[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	***Steam Reforming Option***	Minimum INEEL Processing Alternative at INEEL	***Vitrification without Calcine Separations Option***	***Vitrification with Calcine Separations Option***
Americium-241	0.011	355	ND	ND	1.3×10^{-9}	6.1×10^{-10}	2.2×10^{-9}	ND	ND	ND	***ND***	2.7×10^{-6}	***ND***	***ND***
Antimony-125	NA	6,020	5.7×10^{-8}	4.5×10^{-7}	***5.8×10^{-8}***	4.7×10^{-7}	7.3×10^{-8}	4.5×10^{-7}	4.5×10^{-7}	1.8×10^{-7}	***1.8×10^{-7}***	7.1×10^{-7}	***1.2×10^{-7}***	***1.8×10^{-7}***
Cesium-134	NA	1,950	3.1×10^{-9}	2.4×10^{-7}	2.9×10^{-10}	2.4×10^{-7}	***6.4×10^{-9}***	2.4×10^{-7}	2.4×10^{-7}	1.1×10^{-8}	***1.8×10^{-8}***	1.4×10^{-8}	***7.4×10^{-9}***	***7.4×10^{-9}***
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}	***1.8×10^{-4}***	2.9×10^{-4}	***2.9×10^{-4}***	3.3×10^{-4}	***1.9×10^{-4}***	***2.0×10^{-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}	***1.5×10^{-8}***	1.3×10^{-6}	***1.0×10^{-8}***	***1.3×10^{-8}***
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}	***2.4×10^{-8}***	1.3×10^{-6}	***1.6×10^{-8}***	***1.6×10^{-8}***
Europium-155	NA	32,500	ND	ND	3.9×10^{-11}	1.9×10^{-11}	6.5×10^{-11}	ND	ND	ND	***ND***	2.4×10^{-10}	***ND***	***ND***
Iodine-129	NA	47,600	0.012	0.033	1.2×10^{-3}	0.034	5.6×10^{-4}	0.033	0.033	0.037	***0.035***	0.041	***0.025***	***0.026***
Nickel-63	NA	NA	ND	ND	5.4×10^{-13}	2.6×10^{-13}	9.1×10^{-13}	ND	ND	ND	***ND***	3.5×10^{-11}	***ND***	***ND***
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}	***4.5×10^{-6}***	1.2×10^{-5}	***3.0×10^{-6}***	***3.0×10^{-6}***
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}	***1.3×10^{-8}***	4.3×10^{-7}	***8.3×10^{-9}***	***8.3×10^{-9}***
Plutonium-241	NA	373,000	ND	ND	4.4×10^{-9}	2.1×10^{-9}	7.4×10^{-9}	ND	ND	ND	***ND***	3.1×10^{-10}	***ND***	***ND***
Promethium-147	NA	NA	ND	ND	ND	ND	ND	ND	ND	ND	***ND***	6.9×10^{-6}	***ND***	***ND***
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}	***2.7×10^{-7}***	3.1×10^{-7}	***2.0×10^{-7}***	***3.2×10^{-7}***
Samarium-151	NA	NA	ND	ND	1.6×10^{-8}	7.6×10^{-9}	2.7×10^{-8}	ND	ND	ND	***ND***	3.3×10^{-6}	***ND***	***ND***
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}	***6.8×10^{-4}***	9.9×10^{-4}	***4.6×10^{-4}***	***4.6×10^{-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	***ND***	1.1×10^{-7}	***ND***	***ND***

a. Concentrations for the alternatives assume uniform distribution through a 5-centimeter thick soil layer.

b. 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.

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; 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 the INEEL from the waste processing alternatives. Because the Minimum INEEL Processing ***Alternative*** 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.

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 condi-

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 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 period of time is measured in person-rem. For

Assessment of the Health Effects of Ionizing Radiation (continued)

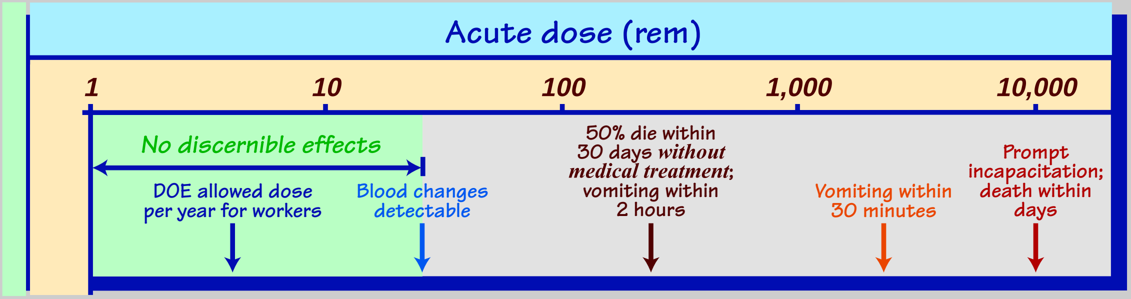
example, if 1,000 people each received a dose of 1 millirem (0.001 rem), the collective dose would be 1,000 persons × 0.001 rem = 1.0 person-rem. Alternatively, the same collective dose (1.0 person-rem) would result from 500 people each of whom received a dose of 2 millirem.

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 × 0.001 rem × 0.0005 latent cancer fatality per person-rem = 0.05 latent cancer fatality).

How should one interpret a number of latent cancer fatalities **less than 1**, 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.



tions 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 ***Section 4.10.1.1***, the existing principal highway (Highway 20) between Idaho Falls and the 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 the 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 5.2-1***3*** and 5.2-1***4*** present the total vehicle-related impacts for each option over the project campaign. Table 5.2-1***3*** presents information based on shipments by truck, and Table 5.2-1***4*** 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 ***estimates*** the Transuranic Separations Option to result in the highest number of accidents and fatalities, 25 and 0.98, respectively. This option is also ***estimated*** 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 the INEEL and Barnwell, South Carolina.

Impacts from emissions were only evaluated for truck shipments and are shown in Table 5.2-1***3***. The Direct Cement Waste Option would result in the greatest ***predicted*** latent fatalities from emissions (***0.099***). 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 5.2-1***5*** for truck and 5.2-1***6*** 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 ***1.4*** 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 (***520*** 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).

Table 5.2-13. 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 ***Solids***	INTEC	WIPP	0.23	8.9×10^{-3}	6.8×10^{-4}
Full Separations Option					
Class A Type Grout	INTEC	Envirocare	1.5	0.075	7.7×10^{-3}
Vitrified HLW ***(at INEEL)***	INTEC	NGR	0.60	0.027	4.3×10^{-3}
Total			2.1	***0.10***	0.012
Solidified ***HAW***[b]	INTEC	Hanford	0.048	3.3×10^{-3}	8.2×10^{-5}
Vitrified HLW (at Hanford)[b]	***Hanford***	***INTEC***	***1.9***	***0.13***	***3.2×10^{-3}***
Planning Basis Option					
Class A Type Grout	INTEC	Envirocare	1.6	0.084	8.6×10^{-3}
Vitrified HLW ***(at INEEL)***	INTEC	NGR	0.60	0.027	4.3×10^{-3}
RH-TRU ***Solids***	INTEC	WIPP	0.23	8.9×10^{-3}	6.8×10^{-4}
Total			***2.4***	0.12	0.014
Transuranic Separations Option					
RH-TRU ***Fraction***	INTEC	WIPP	0.47	0.018	1.4×10^{-3}
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 ***Solids***	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	***0.62***	***0.098***
RH-TRU ***Solids***	INTEC	WIPP	0.23	8.9×10^{-3}	6.8×10^{-4}
Total			14	***0.63***	***0.099***
Early Vitrification Option					
Early Vitrified HLW	INTEC	NGR	9.0	0.41	0.065
Early Vitrified RH-TRU	INTEC	WIPP	0.76	0.029	2.2×10^{-3}
Total			9.8	0.44	0.067
Steam Reforming Option					
Steam Reformed SBW	***INTEC***	***WIPP***	***2.8***	***0.10***	***8.1×10^{-3}***
Calcine	***INTEC***	***NGR***	***4.7***	***0.21***	***0.033***
NGLW Grout	***INTEC***	***WIPP***	***2.7***	***0.10***	***8.0×10^{-3}***
Total			***10***	***0.42***	***0.049***
Minimum INEEL Processing Alternative					
Calcine and Cs resin	INTEC	Hanford	2.3	0.16	4.0×10^{-3}
Grouted CH-TRU	INTEC	WIPP	2.3	0.086	6.6×10^{-3}
Vitrified HLW ***(at Hanford)***	Hanford	INTEC	***1.9***	***0.13***	***3.2×10^{-3}***
Vitrified HLW ***(at Hanford)***	INTEC	NGR	***2.3***	***0.10***	***0.016***
Vitrified LLW fraction ***(at Hanford)***	Hanford	INTEC	0.39	0.026	***6.7×10^{-4}***
Vitrified LLW fraction ***(at Hanford)***	INTEC	Envirocare	0.21	0.011	1.1×10^{-3}
Total			***9.4***	***0.51***	***0.032***

Table 5.2-13. Estimated fatalities from truck emissions and accidents (vehicle-related impacts) (continued).

Waste form	Origin	Destination	Number of accidents	Number of fatalities	LFs from emissions[a]
Vitrification without Calcine Separations Option					
Vitrified Calcine	***INTEC***	***NGR***	***9.0***	***0.41***	***0.065***
Vitrified SBW	***INTEC***	***NGR***	***0.47***	***0.021***	***3.4×10^{-3}***
Vitrified SBW	***INTEC***	***WIPP***	***1.0***	***0.040***	***3.0×10^{-3}***
Total (with SBW to NGR)			***9.5***	***0.43***	***0.068***
Total (with SBW to WIPP)			***10***	***0.45***	***0.068***
NGLW Grout [b]			***2.7***	***0.10***	***8.0×10^{-3}***
Vitrification with Calcine Separations Option					
Class A Type Grout	***INTEC***	***Envirocare***	***1.3***	***0.066***	***6.8×10^{-3}***
Vitrified Calcine (separated)	***INTEC***	***NGR***	***0.50***	***0.023***	***3.6×10^{-3}***
Vitrified SBW	***INTEC***	***NGR***	***0.47***	***0.021***	***3.4×10^{-3}***
Vitrified SBW	***INTEC***	***WIPP***	***1.0***	***0.040***	***3.0×10^{-3}***
Total (with SBW to NGR)			***2.2***	***0.11***	***0.014***
Total (with SBW to WIPP)			***2.8***	***0.13***	***0.013***
NGLW Grout [b]	***INTEC***	***WIPP***	***2.7***	***0.10***	***8.0×10^{-3}***

a. Calculated for travel through urban areas only.
b. Stand-alone project.
CH-TRU = contact-handled transuranic waste; Cs = cesium; ***HAW = high-activity waste;*** HIP = Hot Isostatic Pressed; LLW = low-level waste; LF = latent fatality; ***NGLW = newly generated liquid waste;*** NGR = national geologic repository; RH-TRU = remote-handled transuranic waste; WIPP = Waste Isolation Pilot Plant.

Transportation Accident Impacts - The impacts from the transportation impact analysis are shown in Table 5.2-1***7*** for truck shipments and Table 5.2-1***8*** 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 ***200*** person-rem (***0.10*** latent cancer fatality) for truck shipments. For rail shipments, the highest dose of ***75*** person-rem (***0.038*** latent cancer fatality) would result from the Transuranic Separations Option.

Transportation Accident Radiological Consequences - The results of the RISKIND consequence analyses are included in the last column of Tables 5.2-1***7*** and 5.2-1***8*** 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 ***and NGLW grout***) to ***0.18*** rem (solidified ***high-activity waste***). For moderate severity rail accidents, the effective dose ranges from ***7.7×10^{-6}*** rem (***steam reformed SBW and NGLW grout***) to ***0.36*** rem (solidified ***high-activity waste***).

5.2.9.4 Traffic Noise

As noted in Section 4.10.***6***, 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.

Table 5.2-14. Estimated fatalities from rail accidents (vehicle-related impacts).

Waste form	Origin	Destination	Number of accidents	Number of fatalities
Continued Current Operations Alternative				
RH-TRU ***Solids***	INTEC	WIPP	0.011	2.1×10^{-3}
Full Separations Option				
Class A Type Grout	INTEC	Envirocare	0.074	2.1×10^{-3}
Vitrified HLW ***(at INEEL)***	INTEC	NGR	0.016	4.8×10^{-3}
Total			0.090	0.026
Solidified ***HAW*** [a]	INTEC	Hanford	6.5×10^{-3}	8.6×10^{-4}
Vitrified HLW (at Hanford) [a]	***Hanford***	***INTEC***	***0.13***	***0.017***
Planning Basis Option				
Class A Type Grout	INTEC	Envirocare	0.083	0.024
Vitrified HLW ***(at INEEL)***	INTEC	NGR	0.016	4.8×10^{-3}
RH-TRU ***Solids***	INTEC	WIPP	0.011	2.1×10^{-3}
Total			0.11	0.030
Transuranic Separations Option				
RH-TRU ***Fraction***	INTEC	WIPP	0.022	4.3×10^{-3}
Class C Type Grout	INTEC	Barnwell	0.67	0.13
Total			0.69	0.13
Hot Isostatic Pressed Waste Option				
HIP HLW	INTEC	NGR	0.12	0.035
RH-TRU ***Solids***	INTEC	WIPP	0.011	2.1×10^{-3}
Total			0.13	0.038
Direct Cement Waste Option				
Cementitious HLW	INTEC	NGR	***0.36***	0.11
RH-TRU ***Solids***	INTEC	WIPP	0.011	2.1×10^{-3}
Total			***0.37***	0.11
Early Vitrification Option				
Early Vitrified HLW	INTEC	NGR	0.24	0.073
Early Vitrified RH-TRU	INTEC	WIPP	0.036	7.0×10^{-3}
Total			0.28	0.080
Steam Reforming Option				
Steam Reformed SBW	***INTEC***	***WIPP***	***0.13***	***0.025***
Calcine	***INTEC***	***NGR***	***0.12***	***0.038***
NGLW Grout	***INTEC***	***WIPP***	***0.13***	***0.025***
Total			***0.39***	***0.088***
Minimum INEEL Processing Alternative				
Calcine and Cs resin	INTEC	Hanford	0.16	0.021
CH-TRU	INTEC	WIPP	0.11	0.021
Vitrified HLW ***(at Hanford)***	Hanford	INTEC	***0.13***	***0.017***
Vitrified HLW ***(at Hanford)***	INTEC	NGR	***0.076***	***0.023***
Vitrified LLW fraction ***(at Hanford)***	Hanford	INTEC	0.052	7.0×10^{-3}
Vitrified LLW fraction ***(at Hanford)***	INTEC	Envirocare	0.018	5.2×10^{-3}
Total			***0.54***	***0.094***

Table 5.2-14. Estimated fatalities from rail accidents (vehicle-related impacts) (continued).

Waste form	Origin	Destination	Number of accidents	Number of fatalities
		Vitrification without Calcine Separations Option		
Vitrified Calcine	***INTEC***	***NGR***	***0.24***	***0.073***
Vitrified SBW	***INTEC***	***NGR***	***0.012***	***3.8×10^{-3}***
Vitrified SBW	***INTEC***	***WIPP***	***0.020***	***3.8×10^{-3}***
Total (with SBW to NGR)			***0.25***	***0.077***
Total (with SBW to WIPP)			***0.26***	***0.077***
NGLW Grout [a]	***INTEC***	***WIPP***	***0.13***	***0.025***
		Vitrification with Calcine Separations Option		
Class A Type Grout	***INTEC***	***Envirocare***	***0.066***	***0.019***
Vitrified Calcine (separated)	***INTEC***	***NGR***	***0.013***	***4.1×10^{-3}***
Vitrified SBW	***INTEC***	***NGR***	***0.012***	***3.8×10^{-3}***
Vitrified SBW	***INTEC***	***WIPP***	***0.020***	***3.8×10^{-3}***
Total (with SBW to NGR)			***0.091***	***0.027***
Total (with SBW to WIPP)			***0.099***	***0.027***
NGLW Grout [a]	***INTEC***	***WIPP***	***0.13***	***0.025***

a. Stand-alone project.

CH-TRU = contact-handled transuranic waste; Cs = cesium; MHLW = mixed high-level waste; ***HAW = high-activity waste;*** HIP = Hot Isostatic Pressed; LLW = low-level waste; ***NGLW = newly generated liquid waste;*** NGR = national geologic repository; RH-TRU = remote-handled transuranic waste; WIPP = Waste Isolation Pilot Plant.

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.

Table 5.2-15. Estimated cargo-related incident-free transportation impacts – truck.

					Public							
			Workers[a]		Stops[b]		Sharing route		Along route		Total public 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 ***Solids***	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												
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 ***(at INEEL)***	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	***0.022***	130	0.065	18	9.1×10^{-3}	5.0	2.5×10^{-3}	150	0.077
Solidified ***HAW*** [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
Vitrified HLW (at Hanford) [c]	***Hanford***	***INTEC***	***100***	***0.04***	***550***	***0.27***	***21***	***0.011***	***5.7***	***2.8×10^{-3}***	***570***	***0.29***
Planning Basis Option												
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 ***(at INEEL)***	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 ***Solids***	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	***20***	0.010	***5.5***	2.8×10^{-3}	180	0.091
Transuranic Separations Option												
RH-TRU ***Fraction***	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
Class C Type Grout	INTEC	Barnwell	78	0.031	380	0.19	***25***	0.013	***7.3***	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	***55***	0.028	15	7.4×10^{-3}	910	0.45
RH-TRU ***Solids***	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	***57***	0.028	15	7.5×10^{-3}	930	0.47
Direct Cement Waste Option												
Cementitious HLW	INTEC	NGR	520	0.21	***2.6×10^{3}***	1.3	***170***	***0.087***	***46***	0.023	***2.8×10^{3}***	1.4
RH-TRU ***Solids***	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			***520***	0.21	***2.6×10^{3}***	1.3	***170***	***0.087***	***46***	0.023	2.9×10^{3}	***1.4***

Table 5.2-15. Estimated cargo-related incident-free transportation impacts – truck (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												
Early Vitrified HLW	INTEC	NGR	340	0.14	1.7×10^3	0.87	***110***	0.057	***30***	0.015	1.9×10^3	0.94
Early Vitrified RH-TRU	INTEC	WIPP	15	5.8×10^{-3}	78	0.039	3.7	***1.8×10^{-3}***	0.87	***4.3×10^{-4}***	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
Steam Reforming Option												
Steam Reformed SBW	***INTEC***	***WIPP***	***53***	***0.021***	***280***	***0.14***	***13***	***6.7×10^{-3}***	***3.1***	***1.6×10^{-3}***	***300***	***0.15***
Calcine	***INTEC***	***NGR***	***180***	***0.071***	***890***	***0.45***	***59***	***0.03***	***16***	***7.9×10^{-3}***	***970***	***0.48***
NGLW Grout	***INTEC***	***WIPP***	***52***	***0.021***	***280***	***0.14***	***13***	***6.6×10^{-3}***	***3.1***	***1.6×10^{-3}***	***290***	***0.15***
Total			***280***	***0.11***	***1.5×10^3***	***0.73***	***86***	***0.043***	***22***	***0.011***	***1.6×10^3***	***0.78***
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	***27***	0.011	91	0.046	4.4	2.2×10^{-3}	1.0	5.1×10^{-4}	96	0.048
Vitrified HLW ***(at Hanford)***	Hanford	INTEC	***100***	***0.04***	***550***	***0.27***	***21***	***0.011***	***5.7***	***2.8×10^{-3}***	***570***	***0.29***
Vitrified HLW ***(at Hanford)***	INTEC	NGR	***130***	***0.052***	***650***	***0.32***	***43***	***0.022***	***11***	***5.7×10^{-3}***	***700***	***0.35***
Vitrified LLW fraction ***(at Hanford)***	Hanford	INTEC	***5.1***	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 ***(at Hanford)***	INTEC	Envirocare	2.6	***1.0×10^{-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			***390***	***0.16***	***2.0×10^3***	***1.0***	***98***	***0.049***	***26***	***0.013***	***2.1×10^3***	***1.1***
Vitrification without Calcine Separations Option												
Vitrified Calcine	***INTEC***	***NGR***	***340***	***0.14***	***1.7×10^3***	***0.87***	***110***	***0.057***	***30***	***0.015***	***1.9×10^3***	***0.94***
Vitrified SBW	***INTEC***	***NGR***	***9.7***	***3.9×10^{-3}***	***49***	***0.024***	***3.2***	***1.6×10^{-3}***	***0.86***	***4.3×10^{-4}***	***53***	***0.027***
Vitrified SBW	***INTEC***	***WIPP***	***20***	***7.9×10^{-3}***	***110***	***0.053***	***5.0***	***2.5×10^{-3}***	***1.2***	***5.9×10^{-4}***	***110***	***0.056***
Total (with SBW to NGR)			***350***	***0.14***	***1.8×10^3***	***0.89***	***120***	***0.059***	***31***	***0.016***	***1.9×10^3***	***0.96***
Total (with SBW to WIPP)			***360***	***0.15***	***1.8×10^3***	***0.92***	***120***	***0.060***	***32***	***0.016***	***2.0×10^3***	***0.99***
NGLW Grout [c]	***INTEC***	***WIPP***	***52***	***0.021***	***280***	***0.14***	***13***	***6.6×10^{-3}***	***3.1***	***1.6×10^{-3}***	***290***	***0.15***

Table 5.2-15. Estimated cargo-related incident-free transportation impacts – truck (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
Vitrification with Calcine Separations Option												
Class A Type Grout	***INTEC***	***Envirocare***	***30***	***0.012***	***14***	7.1×10^{-3}	***9.3***	4.7×10^{-3}	***2.6***	1.3×10^{-3}	***26***	***0.013***
Vitrified Calcine (separated)	***INTEC***	***NGR***	***19***	7.6×10^{-3}	***96***	***0.048***	***6.4***	3.2×10^{-3}	***1.7***	8.4×10^{-4}	***100***	***0.052***
Vitrified SBW	***INTEC***	***NGR***	***9.7***	3.9×10^{-3}	***49***	***0.024***	***3.2***	1.6×10^{-3}	***0.86***	4.3×10^{-4}	***53***	***0.027***
Vitrified SBW	***INTEC***	***WIPP***	***20***	7.9×10^{-3}	***110***	***0.053***	***5.0***	2.5×10^{-3}	***1.2***	5.9×10^{-4}	***110***	***0.056***
Total (with SBW to NGR)			***58***	***0.023***	***160***	***0.079***	***19***	9.5×10^{-3}	***5.1***	2.6×10^{-3}	***180***	***0.091***
Total (with SBW to WIPP)			***68***	***0.027***	***220***	***0.11***	***21***	***0.010***	***5.5***	2.7×10^{-3}	***240***	***0.12***
NGLW Grout [c]	***INTEC***	***WIPP***	***52***	***0.021***	***280***	***0.14***	***13***	6.6×10^{-3}	***3.1***	1.6×10^{-3}	***290***	***0.15***

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; ***HAW = high-activity waste;*** HIP = Hot Isostatic Pressed; LLW = low-level waste; LCF = latent cancer fatality (public: 5.0×10^{-4} LCF/person-rem; worker: 4.0×10^{-4} LCF/person-rem); ***NGLW = newly generated liquid waste;*** NGR = national geologic repository; RH-TRU = remote-handled transuranic waste; WIPP = Waste Isolation Pilot Plant.

Table 5.2-16. Estimated cargo-related incident-free transportation impacts – rail.

					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
Continued Current Operations Alternative												
RH-TRU ***Solids***	INTEC	WIPP	3.3	1.3×10^{-3}	0.023	1.1×10^{-5}	***0.011***	***5.3×10^{-6}***	0.15	7.4×10^{-5}	0.18	9.1×10^{-5}
Full Separations Option												
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 ***(at INEEL)***	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 ***HAW*** [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}
Vitrified HLW (at Hanford) [c]	***Hanford***	***INTEC***	***40***	***0.016***	***0.20***	***9.8×10^{-5}***	***0.12***	***5.8×10^{-5}***	***1.3***	***6.6×10^{-4}***	***1.6***	***8.2×10^{-4}***
Planning Basis Option												
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 ***(at INEEL)***	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 ***Solids***	INTEC	WIPP	3.3	1.3×10^{-3}	0.023	1.1×10^{-5}	***0.011***	***5.3×10^{-6}***	0.15	7.4×10^{-5}	0.18	9.1×10^{-5}
Total			45	0.018	0.060	3.0×10^{-5}	***0.084***	4.2×10^{-5}	1.1	5.6×10^{-4}	1.3	6.3×10^{-4}
Transuranic Separations Option												
RH-TRU ***Fraction***	INTEC	WIPP	6.6	2.6×10^{-3}	0.046	2.3×10^{-5}	***0.021***	***1.1×10^{-5}***	0.30	1.5×10^{-4}	0.36	1.8×10^{-4}
Class C Type Grout	INTEC	Barnwell	130	***0.052***	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}	***0.81***	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 ***Solids***	INTEC	WIPP	3.3	1.3×10^{-3}	0.023	1.1×10^{-5}	***0.011***	***5.3×10^{-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	***0.064***	0.64	3.2×10^{-4}	***0.38***	1.9×10^{-4}	4.3	***2.1×10^{-3}***	***5.3***	2.7×10^{-3}
RH-TRU ***Solids***	INTEC	WIPP	3.3	1.3×10^{-3}	0.023	1.1×10^{-5}	***0.011***	***5.3×10^{-6}***	0.15	7.4×10^{-5}	0.18	9.1×10^{-5}
Total			160	***0.065***	***0.66***	3.3×10^{-4}	***0.39***	2.0×10^{-4}	***4.4***	2.2×10^{-3}	***5.5***	***2.7×10^{-3}***

Table 5.2-16. Estimated cargo-related incident-free transportation impacts – rail (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												
Early 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}
Early Vitrified RH-TRU	INTEC	WIPP	11	4.3×10^{-3}	0.074	3.7×10^{-5}	***0.035***	***1.7×10^{-5}***	0.48	2.4×10^{-4}	0.59	3.0×10^{-4}
Total			120	***0.046***	***0.49***	2.5×10^{-4}	0.29	***1.4×10^{-4}***	3.3	1.7×10^{-3}	4.1	***2.0×10^{-3}***
Steam Reforming Option												
Steam Reformed SBW	***INTEC***	***WIPP***	***39***	***0.015***	***0.27***	***1.3×10^{-4}***	***0.13***	***6.3×10^{-5}***	***1.7***	***8.7×10^{-4}***	***2.1***	***1.1×10^{-3}***
Calcine	***INTEC***	***NGR***	***54***	***0.022***	***0.22***	***1.1×10^{-4}***	***0.13***	***6.5×10^{-5}***	***1.5***	***7.3×10^{-4}***	***1.8***	***9.1×10^{-4}***
NGLW Grout	***INTEC***	***WIPP***	***38***	***0.015***	***0.26***	***1.3×10^{-4}***	***0.12***	***6.2×10^{-5}***	***1.7***	***8.6×10^{-4}***	***2.1***	***1.1×10^{-3}***
Total			***130***	***0.053***	***0.75***	***3.8×10^{-4}***	***0.38***	***1.9×10^{-4}***	***4.9***	***2.5×10^{-3}***	***6.1***	***3.0×10^{-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 ***(at Hanford)***	Hanford	INTEC	***40***	***0.016***	***0.20***	***9.8×10^{-5}***	***0.12***	***5.8×10^{-5}***	***1.3***	***6.6×10^{-4}***	***1.6***	***8.2×10^{-4}***
Vitrified HLW ***(at Hanford)***	INTEC	NGR	***39***	***0.016***	***0.20***	***9.9×10^{-5}***	***0.12***	***6.0×10^{-5}***	***1.3***	***6.6×10^{-4}***	***1.6***	***8.2×10^{-4}***
Vitrified LLW fraction ***(at Hanford)***	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 ***(at Hanford)***	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			***150***	***0.062***	***0.70***	***3.5×10^{-4}***	***0.43***	***2.1×10^{-4}***	***4.9***	***2.4×10^{-3}***	***6.0***	***3.0×10^{-3}***
Vitrification without Calcine Separations Option												
Vitrified Calcine	***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 SBW	***INTEC***	***NGR***	***7.5***	***3.0×10^{-3}***	***0.030***	***1.5×10^{-5}***	***0.018***	***9.0×10^{-6}***	***0.20***	***1.0×10^{-4}***	***0.25***	***1.2×10^{-4}***
Vitrified SBW	***INTEC***	***WIPP***	***5.9***	***2.3×10^{-3}***	***0.041***	***2.0×10^{-5}***	***0.019***	***9.5×10^{-6}***	***0.26***	***1.3×10^{-4}***	***0.32***	***1.6×10^{-4}***
Total (with SBW to NGR)			***110***	***0.045***	***0.45***	***2.3×10^{-4}***	***0.27***	***1.4×10^{-4}***	***3.0***	***1.5×10^{-3}***	***3.8***	***1.9×10^{-3}***
Total (with SBW to WIPP)			***110***	***0.045***	***0.46***	***2.3×10^{-4}***	***0.27***	***1.4×10^{-4}***	***3.1***	***1.5×10^{-3}***	***3.8***	***1.9×10^{-3}***
NGLW Grout[c]	***INTEC***	***WIPP***	***38***	***0.015***	***0.26***	***1.3×10^{-4}***	***0.12***	***6.2×10^{-5}***	***1.7***	***8.6×10^{-4}***	***2.1***	***1.1×10^{-3}***

Table 5.2-16. Estimated cargo-related incident-free transportation impacts – rail (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
Vitrification with Calcine Separations Option												
Class A Grout	***INTEC***	***Envirocare***	***27***	***0.011***	7.8×10^{-3}	3.9×10^{-6}	***0.045***	2.2×10^{-5}	***0.62***	3.1×10^{-4}	***0.67***	3.3×10^{-4}
Vitrified Calcine (separated)	***INTEC***	***NGR***	***5.8***	2.3×10^{-3}	***0.023***	1.2×10^{-5}	***0.014***	7.0×10^{-6}	***0.16***	7.9×10^{-5}	***0.19***	9.7×10^{-5}
Vitrified SBW	***INTEC***	***NGR***	***7.5***	3.0×10^{-3}	***0.030***	1.5×10^{-5}	***0.018***	9.0×10^{-6}	***0.20***	1.0×10^{-4}	***0.25***	1.2×10^{-4}
Vitrified SBW	***INTEC***	***WIPP***	***5.9***	2.3×10^{-3}	***0.041***	2.0×10^{-5}	***0.019***	9.5×10^{-6}	***0.26***	1.3×10^{-4}	***0.32***	1.6×10^{-4}
Total (with SBW to NGR)			***41***	***0.016***	***0.061***	3.0×10^{-5}	***0.077***	3.8×10^{-5}	***0.97***	4.9×10^{-4}	***1.1***	5.6×10^{-4}
Total (with SBW to WIPP)			***39***	***0.016***	***0.072***	3.6×10^{-5}	***0.078***	3.9×10^{-5}	***1.0***	5.2×10^{-4}	***1.2***	5.9×10^{-4}
NGLW Grout[c]	***INTEC***	***WIPP***	***38***	***0.015***	***0.26***	1.3×10^{-4}	***0.12***	6.2×10^{-5}	***1.7***	8.6×10^{-4}	***2.1***	1.1×10^{-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; ***HAW = high-activity waste;*** HIP = Hot Isostatic Pressed; LCF = latent cancer fatality (public: 5.0×10^{-4} LCF/person-rem; worker: 4.0×10^{-4} LCF/person-rem); LLW = low-level waste; ***NGLW = newly generated liquid waste;*** NGR = national geologic repository; RH-TRU = remote-handled transuranic waste; WIPP = Waste Isolation Pilot Plant.

Table 5.2-17. Cargo-related impacts from truck transportation accidents.

Waste form	Origin	Destination	Population Risk[a]		Maximum Individual Dose (rem)[b]
			Dose (person-rem)	Latent cancer fatalities	
Continued Current Operations Alternative					
RH-TRU ***Solids***	INTEC	WIPP	***1.1***	***5.7×10^{-4}***	***9.8×10^{-6}***
Full Separations Option					
Class A Type Grout	INTEC	Envirocare	0.18	8.8×10^{-5}	2.4×10^{-5}
Vitrified HLW ***(at INEEL)***	INTEC	NGR	3.0×10^{-3}	1.5×10^{-6}	***5.8×10^{-5}***
Total[c]			0.18	8.9×10^{-5}	***8.2×10^{-5}***
Solidified ***HAW*** [d]	INTEC	Hanford	***6.7***	***3.3×10^{-3}***	0.18
Vitrified HLW (at Hanford) [d]	***Hanford***	***INTEC***	***1.1×10^{-3}***	***5.6×10^{-7}***	***2.2×10^{-5}***
Planning Basis Option					
Class A Type Grout	INTEC	Envirocare	0.19	9.7×10^{-5}	2.4×10^{-5}
Vitrified HLW ***(at INEEL)***	INTEC	NGR	3.0×10^{-3}	1.5×10^{-6}	***5.8×10^{-5}***
RH-TRU ***Solids***	INTEC	WIPP	***1.1***	***5.7×10^{-4}***	***9.8×10^{-6}***
Total[c]			***1.3***	***6.7×10^{-4}***	***9.2×10^{-5}***
Transuranic Separations Option					
RH-TRU ***Fraction***	INTEC	WIPP	***17***	***8.6×10^{-3}***	6.1×10^{-5}
Class C Type Grout	INTEC	Barnwell	190	0.093	2.3×10^{-3}
Total[c]			***200***	***0.10***	***2.4×10^{-3}***
Hot Isostatic Pressed Waste Option					
HIP HLW	INTEC	NGR	3.0×10^{-3}	1.5×10^{-6}	1.6×10^{-5}
RH-TRU ***Solids***	INTEC	WIPP	***1.1***	***5.7×10^{-4}***	***9.8×10^{-6}***
Total[c]			***1.1***	***5.7×10^{-4}***	***2.6×10^{-5}***
Direct Cement Waste Option					
Cementitious HLW	INTEC	NGR	46	0.023	8.8×10^{-3}
RH-TRU ***Solids***	INTEC	WIPP	***1.1***	***5.7×10^{-4}***	***9.8×10^{-6}***
Total[c]			***47***	0.023	8.8×10^{-3}
Early Vitrification Option					
Early Vitrified HLW	INTEC	NGR	2.9×10^{-3}	1.5×10^{-6}	***1.3×10^{-5}***
Early Vitrified RH-TRU	INTEC	WIPP	6.5×10^{-5}	3.2×10^{-8}	8.3×10^{-6}
Total[c]			3.0×10^{-3}	1.5×10^{-6}	***2.1×10^{-5}***
Steam Reforming Option					
Steam Reformed SBW	***INTEC***	***WIPP***	***2.3***	***1.1×10^{-3}***	***7.9×10^{-6}***
Calcine	***INTEC***	***NGR***	***74***	***0.037***	***1.5×10^{-5}***
NGLW grout	***INTEC***	***WIPP***	***0.78***	***3.9×10^{-4}***	***7.7×10^{-6}***
Total [c]			***77***	***0.039***	***3.1×10^{-5}***
Minimum INEEL Processing Alternative					
Calcine and Cs resin	INTEC	Hanford	36	0.018	0.095
Grouted CH-TRU	INTEC	WIPP	***0.60***	***3.0×10^{-4}***	7.7×10^{-6}
Vitrified HLW ***(at Hanford)***	Hanford	INTEC	1.1×10^{-3}	5.6×10^{-7}	***2.2×10^{-5}***
Vitrified HLW ***(at Hanford)***	INTEC	NGR	***2.8×10^{-3}***	1.4×10^{-6}	***2.2×10^{-5}***
Vitrified LLW fraction ***(at Hanford)***	Hanford	INTEC	4.4×10^{-5}	2.2×10^{-8}	1.1×10^{-5}
Vitrified LLW fraction ***(at Hanford)***	INTEC	Envirocare	***4.6×10^{-5}***	***2.3×10^{-8}***	1.1×10^{-5}
Total[c]			***36***	0.018	0.095

Table 5.2-17. Cargo-related impacts from truck transportation accidents (continued).

			Population Risk[a]		
Waste form	Origin	Destination	Dose (person-rem)	Latent cancer fatalities	Maximum Individual Dose (rem)[b]
Vitrification without Calcine Separations Option					
Vitrified Calcine	***INTEC***	***NGR***	2.9×10^{-3}	1.5×10^{-6}	5.8×10^{-5}
Vitrified SBW	***INTEC***	***NGR***	1.9×10^{-5}	9.6×10^{-9}	9.5×10^{-6}
Vitrified SBW	***INTEC***	***WIPP***	5.0×10^{-5}	2.5×10^{-8}	9.5×10^{-6}
Total [c] (with SBW to NGR)			3.0×10^{-3}	1.5×10^{-6}	6.8×10^{-5}
Total [c] (with SBW to WIPP)			3.0×10^{-3}	1.5×10^{-6}	6.8×10^{-5}
NGLW Grout [d]	***INTEC***	***WIPP***	0.78	3.9×10^{-4}	7.7×10^{-6}
Vitrification with Calcine Separations Option					
Class A Type Grout	***INTEC***	***Envirocare***	0.15	7.7×10^{-5}	2.4×10^{-5}
Vitrified Calcine (separated)	***INTEC***	***NGR***	2.9×10^{-3}	1.5×10^{-6}	7.7×10^{-5}
Vitrified SBW	***INTEC***	***NGR***	1.9×10^{-5}	9.6×10^{-9}	9.5×10^{-6}
Vitrified SBW	***INTEC***	***WIPP***	5.0×10^{-5}	2.5×10^{-8}	9.5×10^{-6}
Total [c] (with SBW to NGR)			0.16	7.9×10^{-5}	1.1×10^{-4}
Total [c] (with SBW to WIPP)			0.16	7.9×10^{-5}	1.1×10^{-4}
NGLW Grout [d]	***INTEC***	***WIPP***	0.78	3.9×10^{-4}	7.7×10^{-6}

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. Maximum Individual Dose is not additive. The totals are presented only for comparison between options.

d. Stand-alone project.

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

Table 5.2-18. 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 ***Solids***	INTEC	WIPP	***0.092***	***4.6×10^{-5}***	***1.2×10^{-5}***
Full Separations Option					
Class A Type Grout	INTEC	Envirocare	0.035	1.8×10^{-5}	4.6×10^{-5}
Vitrified HLW ***(at INEEL)***	INTEC	NGR	1.5×10^{-4}	7.5×10^{-8}	***1.2×10^{-4}***
Total[c]			0.035	1.8×10^{-5}	***1.7×10^{-4}***
Solidified ***HAW*** [d]	INTEC	Hanford	***1.4***	***6.8×10^{-4}***	0.36
Vitrified HLW (at Hanford) [d]	***Hanford***	***INTEC***	***2.1×10^{-4}***	***1.0×10^{-7}***	***3.5×10^{-5}***
Planning Basis Option					
Class A Type Grout	INTEC	Envirocare	0.039	2.0×10^{-5}	4.6×10^{-5}
Vitrified HLW ***(at INEEL)***	INTEC	NGR	1.5×10^{-4}	7.5×10^{-8}	***1.2×10^{-4}***
RH-TRU ***Solids***	INTEC	WIPP	***0.092***	***4.6×10^{-5}***	***1.2×10^{-5}***
Total[c]			***0.13***	***6.6×10^{-5}***	***1.8×10^{-4}***
Transuranic Separations Option					
RH-TRU ***Fraction***	INTEC	WIPP	***1.4***	***6.8×10^{-4}***	1.2×10^{-4}
Class C Type Grout	INTEC	Barnwell	74	0.037	6.7×10^{-3}
Total[c]			***75***	***0.038***	***6.8×10^{-3}***
Hot Isostatic Pressed Waste Option					
HIP HLW	INTEC	NGR	1.6×10^{-4}	7.8×10^{-8}	2.4×10^{-5}
RH-TRU ***Solids***	INTEC	WIPP	***0.092***	***4.6×10^{-5}***	***1.2×10^{-5}***
Total[c]			***0.092***	***4.6×10^{-5}***	***3.6×10^{-5}***
Direct Cement Waste Option					
Cementitious HLW	INTEC	NGR	2.5	***1.2×10^{-3}***	0.018
RH-TRU ***Solids***	INTEC	WIPP	***0.092***	***4.6×10^{-5}***	***1.2×10^{-5}***
Total[c]			***2.6***	1.3×10^{-3}	0.018
Early Vitrification Option					
Early Vitrified HLW	INTEC	NGR	1.5×10^{-4}	7.6×10^{-8}	***1.8×10^{-5}***
Early Vitrified RH-TRU	INTEC	WIPP	4.3×10^{-6}	***2.1×10^{-9}***	9.1×10^{-6}
Total[c]			1.6×10^{-4}	7.8×10^{-8}	***2.7×10^{-5}***
Steam Reforming Option					
Steam Reformed SBW	***INTEC***	***WIPP***	***0.17***	***8.3×10^{-5}***	***7.7×10^{-6}***
Calcine	***INTEC***	***NGR***	***3.8***	***1.9×10^{-3}***	***2.3×10^{-5}***
NGLW grout	***INTEC***	***WIPP***	***0.062***	***3.1×10^{-5}***	***7.7×10^{-6}***
Total [c]			***4.0***	***2.0×10^{-3}***	***3.8×10^{-5}***
Minimum INEEL Processing Alternative					
Calcine and Cs resin	INTEC	Hanford	5.7	2.8×10^{-3}	0.18
CH-TRU	INTEC	WIPP	***0.047***	***2.3×10^{-5}***	8.2×10^{-6}
Vitrified HLW ***(at Hanford)***	Hanford	INTEC	***2.1×10^{-4}***	1.0×10^{-7}	***3.5×10^{-5}***
Vitrified HLW ***(at Hanford)***	INTEC	NGR	1.4×10^{-4}	***7.1×10^{-8}***	***3.5×10^{-5}***
Vitrified LLW fraction ***(at Hanford)***	Hanford	INTEC	8.1×10^{-6}	4.0×10^{-9}	1.2×10^{-5}
Vitrified LLW fraction ***(at Hanford)***	INTEC	Envirocare	6.7×10^{-6}	3.3×10^{-9}	1.2×10^{-5}
Total[c]			5.7	***2.9×10^{-3}***	0.18

Table 5.2-18. Cargo-related impacts from rail transportation accidents (continued).

			Population Risk[a]		
Waste form	Origin	Destination	Dose (person-rem)	Latent cancer fatalities	Maximum Individual Dose (rem)[b]
Vitrification without Calcine Separations Option					
Vitrified Calcine	***INTEC***	***NGR***	1.5×10^{-4}	7.6×10^{-8}	1.2×10^{-4}
Vitrified SBW	***INTEC***	***NGR***	3.5×10^{-5}	1.8×10^{-8}	1.1×10^{-5}
Vitrified SBW	***INTEC***	***WIPP***	4.7×10^{-5}	2.4×10^{-8}	1.1×10^{-5}
Total [c] (with SBW to NGR)			1.9×10^{-4}	9.3×10^{-8}	1.3×10^{-4}
Total [c] (with SBW to WIPP)			2.0×10^{-4}	9.9×10^{-8}	1.3×10^{-4}
NGLW Grout [d]	***INTEC***	***WIPP***	***0.062***	3.1×10^{-5}	7.7×10^{-6}
Vitrification with Calcine Separations Option					
Class A Type Grout	***INTEC***	***Envirocare***	***0.023***	1.2×10^{-5}	4.6×10^{-5}
Vitrified Calcine (separated)	***INTEC***	***NGR***	1.5×10^{-4}	7.5×10^{-8}	1.5×10^{-4}
Vitrified SBW	***INTEC***	***NGR***	3.5×10^{-5}	1.8×10^{-8}	1.1×10^{-5}
Vitrified SBW	***INTEC***	***WIPP***	4.7×10^{-5}	2.4×10^{-8}	1.1×10^{-5}
Total [c] (with SBW to NGR)			***0.023***	1.2×10^{-5}	2.1×10^{-4}
Total [c] (with SBW to WIPP)			***0.023***	1.2×10^{-5}	2.1×10^{-4}
NGLW Grout [d]	***INTEC***	***WIPP***	***0.062***	3.1×10^{-5}	7.7×10^{-6}

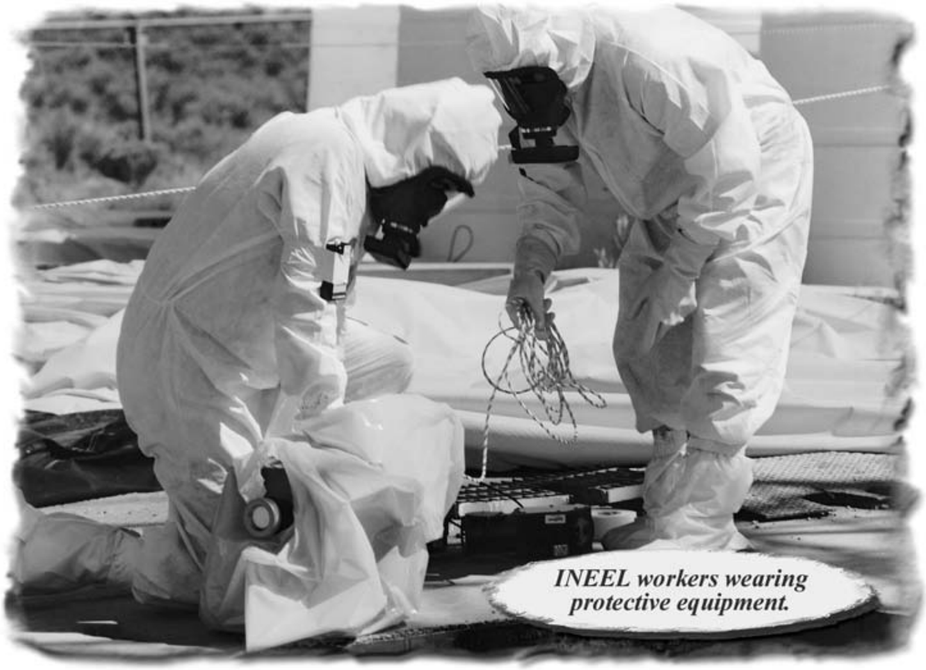
a. Each population risk value is the sum of the consequence (population dose or latent cancer fatalities) times the probability for a range of possible accidents.

b. The maximum individual dose total is the highest value in the group of results.

c. Maximum Individual Dose is not additive. The totals are presented only for comparison between options.

d. Stand-alone project.

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



INEEL workers wearing protective equipment.

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 the Minimum INEEL Processing ***Alternative*** 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 5.2-1***9*** provides summaries of the number of involved workers, 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 ***37*** to ***200*** person-rem. The highest collective dose of ***200*** person-rem occurs under ***the*** Planning Basis, ***Hot Isostatic Pressed Waste and Direct Cement Waste Options***. The corresponding increase in number of latent cancer fatalities for any of these options would be ***0.078***.

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-***20*** 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 1.8×10^{-3} 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 esti-

Table 5.2-19. Estimated radiological impacts to involved workers by alternative during construction activities.

			Separations Alternative			Non-Separations Alternative				Minimum INEEL Processing Alternative		Direct Vitrification 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	Steam Reforming Option	At INEEL	At Hanford[a]	Vitrification without Calcine Separations Option	Vitrification with Calcine Separations Option
Number of involved worker - years	150	390	690	780	690	780	780	540	540	690	NA[b]	540	540
Total construction phase worker dose (person-rem)[c]	37	97	170	200	170	200	200	140	140	170	NA[b]	140	140
Total increase in number of latent cancer fatalities	0.015	0.039	0.069	0.078	0.069	0.078	0.078	0.054	0.054	0.069	NA[b]	0.054	0.054

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. 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 5.2-20. Estimated public and occupational radiological impacts from atmospheric emissions.

			Separations Alternative			Non-Separations Alternative				Minimum INEEL Processing Alternative		***Direct Vitrification 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	***Steam Reforming Option***	At INEEL	At Hanford[a]	***Vitrification without Calcine Separations Option***	***Vitrification with Calcine Separations Option***
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}	***6.2×10^{-4}***	9.5×10^{-4}	2.8×10^{-5}	***6.5×10^{-4}***	***6.8×10^{-4}***
Integrated maximally exposed offsite individual dose (millirem)[c]	0.022	0.019	2.5×10^{-3}	6.3×10^{-3}	1.3×10^{-3}	***0.020***	0.019	0.031	***0.022***	0.024	5.0×10^{-5}	***0.022***	***0.023***
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}	***1.1×10^{-8}***	1.0×10^{-8}	2.5×10^{-11}	***1.1×10^{-8}***	***1.2×10^{-8}***
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}	***2.2×10^{-5}***	1.0×10^{-4}	1.3×10^{-5}	***2.3×10^{-5}***	***2.3×10^{-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}	***4.8×10^{-4}***	1.4×10^{-3}	2.3×10^{-5}	***4.8×10^{-4}***	***4.8×10^{-4}***
Estimated probability of latent cancer fatality for the noninvolved worker	1.0×10^{-10}	***8.0×10^{-11}***	***3.7×10^{-10}***	***3.4×10^{-10}***	***2.8×10^{-10}***	***2.3×10^{-10}***	***1.4×10^{-10}***	***5.2×10^{-10}***	***1.9×10^{-10}***	***5.6×10^{-10}***	***9.2×10^{-12}***	***1.9×10^{-10}***	***1.9×10^{-10}***
Dose to population within 50 miles of INTEC (person-rem per year)[e]	***0.038***	***0.11***	***6.6×10^{-3}***	***0.11***	***3.6×10^{-3}***	***0.11***	***0.11***	***0.056***	***0.040***	***0.056***	$1.3\times10^{-3(f)}$	***0.045***	***0.047***

Table 5.2-20. Estimated public and occupational radiological impacts from atmospheric emissions (continued).

			Separations Alternative			Non-Separations Alternative				Minimum INEEL Processing Alternative		***Direct Vitrification 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	***Steam Reforming Option***	At INEEL	At Hanford[a]	***Vitrification without Calcine Separations Option***	***Vitrification with Calcine Separations Option***
Integrated collective dose to population (person-rem) [c]	***1.4***	***1.2***	***0.14***	***0.39***	***0.075***	***1.3***	***1.3***	***2.0***	***1.4***	***1.4***	2.3×10^{-3}	***1.5***	***1.5***
Estimated number of latent cancer fatalities to population	***7.0×10^{-4}***	***6.0×10^{-4}***	***7.0×10^{-5}***	***2.0×10^{-4}***	***3.8×10^{-5}***	***6.5×10^{-4}***	***6.5×10^{-4}***	***1.0×10^{-3}***	***7.0×10^{-4}***	***7.0×10^{-4}***	1.1×10^{-6}	***7.5×10^{-4}***	***7.5×10^{-4}***

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).

mated doses for the Continued Current Operations Alternative ***and*** the Direct Cement Waste Option. The highest integrated offsite maximally exposed individual dose of ***0.031*** 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 ***0.11*** person-rem would occur for the ***Continued Current Operations Alternative and the Planning Basis,*** Hot Isostatic Pressed Waste, ***and Direct Cement Waste Options***. The highest total collective population dose of ***2.0*** person-rem would occur from the Early Vitrification Option and corresponds to ***1.0×10^{-3}*** LCF for the entire operations period. The total integrated collective population doses associated with the other options are lower and range from ***0.075*** to ***1.5*** person-rem.

Involved Worker Impacts - Table 5.2-2***1*** provides a summary of radiological impacts to involved workers from facility operations. This table provides the number of involved ***worker-years***, total campaign collective worker dose, and estimated increased lifetime number of LCFs for each alternative. 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 ***1.1×10^{3}*** person-rem, which corresponds to ***0.43*** LCF.

Table 5.2-2***2*** 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 ***and Steam Reforming*** Option***s are*** not listed in this table because there would be no interim storage of final waste forms produced under ***these*** options.

Nonradiological Air Emissions - Table 5.2-2***3*** 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 5.2-2***4*** 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 ***4.7×10^{-6}*** for ***dioxins and furans*** to ***0.10*** 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 ***10*** 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 5.2-21. Estimated radiological impacts to involved workers by alternative during facility operations.

			Separations Alternative			Non-Separations Alternative				Minimum INEEL Processing Alternative		Direct Vitrification Alternative	
Receptor	No Action Alternative	Continued Current Operations Alternative	Full Separations Option[a]	Planning Basis Option	Transuranic Separations Option[b]	Hot Isostatic Pressed Waste Option	Direct Cement Waste Option	Early Vitrification Option	Steam Reforming Option	At INEEL	At Hanford[c]	Vitrification without Calcine Separations Option	Vitrification with Calcine Separations Option
Number of involved worker - years	1.8×10^3	2.1×10^3	4.1×10^3	5.1×10^3	3.6×10^3	4.1×10^3	5.7×10^3	3.8×10^3	3.3×10^3	3.6×10^3	1.8×10^3	2.6×10^3	3.4×10^3
Total campaign collective worker dose (person-rem)[d]	350	410	780	980	680	790	1.1×10^3	710	630	690	350	500	650
Total number of latent cancer fatalities	0.14	0.16	0.31	0.39	0.27	0.31	0.43	0.29	0.25	0.27	0.14	0.20	0.26

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.8.4.11.

d. 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 5.2-22. Estimated radiological impacts to involved workers from interim storage operations post-2035.

Alternatives/***Options***[a]	Radiological workers/year	Annual average worker dose (rem)	Annual average collective dose (person-rem)	Estimated ***increase in*** annual latent cancer fatalities
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}
Vitrification without Calcine Separations Option (P61)	***4.5***	***0.19***	***0.86***	***3.4×10^{-4}***
Vitrification with Calcine Separations Option (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.

Table 5.2-23. Projected noncarcinogenic toxic pollutant maximum concentrations at the site boundary for the proposed waste processing alternatives.[a,b]

Pollutant[c]	Maximum concentration option	Concentration (µg/m^3)[d,e]	Idaho standard (µg/m^3)[f]	Hazard quotient
Antimony	Planning Basis Option	***4.7×10^{-4}***	25	***1.9×10^{-5}***
Chloride	Planning Basis Option	***0.032***	150	***2.1×10^{-4}***
Cobalt	Planning Basis Option	***5.4×10^{-4}***	2.5	***2.2×10^{-4}***
Copper	Planning Basis Option	***1.6×10^{-4}***	10	***1.6×10^{-5}***
Fluorides (as F)	***Planning Basis Option***	***1.7×10^{-4}***	125	***1.4×10^{-6}***
Lead	Planning Basis Option	***1.3×10^{-4}***	1.5	***8.7×10^{-5}***
Manganese (as Mn)	Planning Basis Option	***2.7×10^{-4}***	50	***5.4×10^{-6}***
Mercury	Planning Basis Option	***1.2×10^{-5}***	5	***2.4×10^{-6}***
Phosphorus	Planning Basis Option	***8.4×10^{-4}***	5	***1.7×10^{-4}***
Vanadium	Planning Basis Option	***2.8×10^{-3}***	2.5	***1.1×10^{-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.

d. µg/m^3 = micrograms per cubic meter.

e. All concentrations are 24 hour maximum values, except for lead which is a quarterly value.

f. Standards for each pollutant other than lead are toxic air pollutant increments specified in IDAPA 58.01.01.585; lead standard is primary ambient air quality standard from IDAPA 58.01.01.577.

Table 5.2-24. 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,e]	Idaho standard ($\mu g/m^3$)	Hazard quotient
Arsenic	Planning Basis Option	***6.8×10^{-6}***	2.3×10^{-4}	***0.030***
Beryllium	Planning Basis Option	***1.4×10^{-7}***	4.2×10^{-3}	***3.3×10^{-5}***
Cadmium compounds	Planning Basis Option	***2.1×10^{-6}***	5.6×10^{-4}	***3.7×10^{-3}***
Chromium (hexavalent forms)	Planning Basis Option	***1.3×10^{-6}***	8.3×10^{-5}	***0.016***
Dioxins and furans	Hot Isostatic Pressed Waste Option	***1.0×10^{-13}***	2.2×10^{-8}	***4.7×10^{-6}***
Formaldehyde	Planning Basis Option	***1.7×10^{-4}***	0.08	***2.1×10^{-3}***
Hydrazine	***Early Vitrification*** Option	***1.1×10^{-7}***	3.4×10^{-4}	***3.2×10^{-4}***
Nickel	Planning Basis Option	***4.4×10^{-4}***	4.2×10^{-3}	***0.10***

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.

d. $\mu g/m^3$ = micrograms per cubic meter.

e. All concentrations are ***annual average*** values.

For each alternative, maximum incremental impacts of carcinogenic air pollutants are projected to occur at or just beyond the southern site boundary, while maximum noncarcinogenic 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 5.2-2***5*** and 5.2-2***6***. The projected rates for injury are based on observed historic rates at the INEEL. Table 5.2-2***5*** 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. Table 5.2-2***6*** provides similar data for the operations phase for each of the alternatives. The projected injury rates are based on historic injury rates for ***INEEL*** workers over a 5-year period from ***1996*** through ***2000*** multiplied by the employment levels for each alternative. 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 5.2-2***5***, the highest occurrences of lost work days and total recordable cases during a peak construction year are projected to occur for 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.

As shown in Table 5.2-2***6***, the highest occurrences of lost work days and total recordable cases during a peak operations year are projected to occur for the ***Direct Cement Waste*** Option followed by 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 lost work days and total recordable cases would be likely

Table 5.2-25. Estimated worker injury impacts during construction at INEEL by alternative (peak year and total cases).

			Separations Alternative			Non-Separations Alternative				Minimum INEEL Processing Alternative		Direct Vitrification 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	Steam Reforming Option	At INEEL	At Hanford[a]	Vitrification without Calcine Separations Option	Vitrification with Calcine Separations Option
Number of workers during peak year	21	89	850	870	680	360	400	330	550	200	NR[b]	350	670
Peak year lost workdays[c]	6.0	25	240	250	190	100	110	93	160	56	NR	100	190
Peak year total recordable cases[d]	0.78	3.3	32	32	25	13	15	12	20	7.3	NR	13	25
Total lost workdays	30	110	1.5×10^3	1.5×10^3	1.1×10^3	520	620	530	770	620	NR	710	1.3×10^3
Total recordable cases	3.9	14	190	200	150	67	81	69	100	81	230	93	170

a. Data based on analysis of the Interim Storage Scenario.

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 5.2-26. Estimated worker injury impacts at INEEL by alternative during operations (peak year and total cases).

			Separations Alternative			Non-Separations Alternative				Minimum INEEL Processing Alternative		Direct Vitrification 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	Steam Reforming Option	At INEEL	At Hanford[a]	Vitrification without Calcine Separations Option	Vitrification with Calcine Separations Option
Number of workers during peak year	73	280	440	480	320	460	530	330	170	330	NR[b]	310	440
Peak year lost workdays[c]	21	79	130	140	90	130	150	93	49	93	NR	87	130
Peak year total recordable cases[d]	2.7	10	16	18	12	17	19	12	6.4	12	NR	11	16
Total lost workdays	850	1.1×10^3	3.0×10^3	3.7×10^3	2.3×10^3	2.5×10^3	2.9×10^3	2.5×10^3	1.4×10^3	2.0×10^3	NR	1.9×10^3	2.5×10^3
Total recordable cases	110	150	400	480	300	320	380	330	180	270	27	250	330

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.

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 5.2-27 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. ***The Transuranic Separations and Steam Reforming Options are not listed in this table because there would be no interim storage of final waste forms produced under these options.***

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.

- Federal agencies should develop effective public participation strategies that seek to overcome linguistic, cultural, institutional, and geographic barriers to 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 5.2-27 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. ***The Transuranic Separations and Steam Reforming Options are not listed in this table because there would be no interim storage of final waste forms produced under these options.***

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- 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.

- Federal agencies should develop effective public participation strategies that seek to overcome linguistic, cultural, institutional, and geographic barriers to

Table 5.2-27. 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
Full Separations Option	6.5	***1.8***	***0.24***
Planning Basis Option	6.5	***1.8***	***0.24***
Hot Isostatic Pressed Waste Option	13	***3.7***	***0.48***
Direct Cement Waste Option	18	***5.0***	***0.65***
Early Vitrification Option	6.5	***1.8***	***0.24***
Minimum INEEL Processing Alternative	6.5	***1.8***	***0.24***
Vitrification without Calcine Separations Option[a]	***6.5***	***1.8***	***0.24***
Vitrification with Calcine Separations Option[a]	***6.5***	***1.8***	***0.24***

a. Impacts were estimated assuming that the vitrified SBW would be managed as HLW and placed in interim storage pending disposal in a geologic repository. If DOE determines through the waste incidental to reprocessing process that the SBW can be managed as mixed transuranic waste, interim storage of vitrified SBW would not be required and the impacts would be reduced from those reported above.

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 the INEEL) or southwest (into the sparsely-populated area south and west of the 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-***18***). The Fort Hall Indian Reservation is also some 40 miles southeast of INTEC (see Figure 4-***20***). 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 ***compared to airborne releases***, 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.

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 other waste management 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 5.2-2***8*** 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 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 5.2-2***8*** 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 ***twelve*** options under the ***six*** 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

Table 5.2-28. 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
Steam Reforming Option	***3.1×10^3***	***0.26***	***4.1***	***0.15***	***4.1***
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
Direct Vitrification Alternative					
Vitrification without Calcine Separations Option	***1.1×10^3***	***0.67***	***2.4***	***0.31***	***2.4***
Vitrification with Calcine Separations Option	***3.5×10^3***	***0.81***	***4.7***	***0.31***	***4.7***

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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.

Record of Decision (DOE/ID-10660). Following the selection of the preferred alternative for 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 5.2-2***9*** presents the operational utility and energy requirements for each alternative or option. ***The number of years of operations varies by individual project comprising the alternatives and options. The values presented in Table 5.2-29 are a summation of the individual project values. The calculation is conservative (i.e., it presents a peak consumption of utilities assuming that all projects comprising an alternative or option occur at the same time).*** 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 5.2-2***9*** 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-***30***. ***The Transuranic Separations and Steam Reforming Options are not listed in this table because there would be no interim storage of final waste forms produced under these options.***

Table 5.2-29. 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
Steam Reforming Option	$\boldsymbol{2.4\times10^4}$	***0.40***	***2.0***	***6.1***	***2.0***
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
Direct Vitrification Alternative					
Vitrification without Calcine Separations Option	$\boldsymbol{3.9\times10^4}$	***1.3***	***2.9***	***6.3***	***2.9***
Vitrification with Calcine Separations Option	$\boldsymbol{5.2\times10^4}$	***5.0***	***4.4***	***11***	***4.4***

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[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 5.2-30. 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)
Separations Alternative					
Full Separations Option	290	None	0.059	None	0.059
Planning Basis Option	290	None	0.059	None	0.059
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
Direct Vitrification Alternative[a]					
Vitrification without Calcine Separations Option	***4.4×10^3***	***None***	***0.059***	***None***	***0.059***
Vitrification with Calcine Separations Option	***290***	***None***	***0.059***	***None***	***0.059***

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[a] Impacts were estimated assuming that the vitrified SBW would be managed as HLW and placed in interim storage pending disposal in a geologic repository. If DOE determines through the waste incidental to reprocessing process that the SBW can be managed as mixed transuranic waste, interim storage of vitrified SBW would not be required and the impacts would be reduced from those reported above.

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. Project descriptions and data sheets developed for each project include projections of waste generation (by quantity and type) and ***are*** 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 consists 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. ***This EIS further describes product and process wastes in terms of their classification (e.g., hazardous constituents, radioactive waste classification in accordance with DOE Order 435.1 and Manual 435.1-1) and associated management requirements.*** 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.

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 ***to stop accepting contact-handled low-level waste and remote-handled low-level waste*** at the Radioactive Waste Management Complex in ***2020***.

- 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 5.2-3***1*** 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 5.2-3***1*** 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 5.2-3***2*** is based on the same project information used to generate Table 5.2-3***1*** 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 materials are either consumed or become part of the product wastes during treatment.

Process Waste - Table 5.2-3***3*** 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 alter-

Table 5.2-31. Annual average and total process waste volumes (cubic meters) generated during construction.[a]

		Industrial waste		Hazardous waste		Mixed low-level waste		Low-level waste	
Alternatives	Schedule[b]	Average	Total	Average	Total	Average	Total	Average	Total
No Action Alternative	2005-2011	220	1.4×10^3	0	0	35	220	0	0
Continued Current Operations Alternative	2005-2014	680	6.8×10^3	3	30	38	240	3	20
Separations Alternative									
Full Separations Option									
New INEEL disposal option	2005-2034	3.6×10^3	5.5×10^4	52	790	180	1.1×10^3	30	330
Tank Farm, bin set disposal option	2005-2015	4.4×10^3	4.8×10^4	71	780	180	1.1×10^3	30	320
Offsite facility disposal option	2005-2015	4.4×10^3	4.9×10^4	71	790	180	1.1×10^3	30	330
Planning Basis Option									
Offsite facility disposal option	2006-2020	3.7×10^3	6.0×10^4	55	880	99	1.1×10^3	13	210
Transuranic Separations Option									
New INEEL disposal option	2005-2034	2.6×10^3	3.9×10^4	19	280	180	1.1×10^3	21	210
Tank Farm, bin set disposal option	2005-2014	3.2×10^3	3.2×10^4	27	270	180	1.1×10^3	20	200
Offsite facility disposal option	2005-2014	3.3×10^3	3.3×10^4	28	280	180	1.1×10^3	21	210
Non-Separations Alternative									
Hot Isostatic Pressed Waste Option	2005-2014	2.6×10^3	2.6×10^4	79	790	99	1.1×10^3	26	260
Direct Cement Waste Option	2005-2014	3.0×10^3	3.0×10^4	56	560	99	1.1×10^3	34	340
Early Vitrification Option	2005-2014	2.3×10^3	2.3×10^4	64	640	180	1.1×10^3	31	310
Steam Reforming Option	***2006-2015***	2.4×10^3	2.4×10^4	***20***	***200***	***110***	1.1×10^3	***0***	***0***
Minimum INEEL Processing Alternative									
At INEEL	2005-2020	1.7×10^3	2.6×10^4	22	340	270	1.1×10^3	10	110
At Hanford[c]	2010-2027	NA[d]	1.9×10^4	NA	20	0	0	0	0
Direct Vitrification Alternative									
Vitrification without Calcine Separations Option	***2005-2022***	1.4×10^3	2.3×10^4	***33***	***570***	***63***	1.1×10^3	***97***	1.6×10^3
Vitrification with Calcine Separations Option	***2005-2022***	2.5×10^3	4.3×10^4	***49***	***840***	***62***	1.1×10^3	***100***	1.7×10^3

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.

d. NA = not applicable because annual generation varies greatly due to intermittent construction activity.

Table 5.2-32. Peak annual process waste volumes (cubic meters) generated during construction and the year(s) they would occur.[a]

	Industrial waste		Hazardous waste		Mixed low-level waste		Low-level waste	
Alternatives	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	1.2×10^3	2008-2010	5	2008-2010	39	2006-2010	3	2008-2014
Separations Alternative								
Full Separations Option								
New INEEL disposal option	8.5×10^3	2011-2014	140	2011-2014	180	2010-2015	48	2011-2014
Tank Farm, bin set disposal option	7.7×10^3	2011-2014	140	2011-2014	180	2010-2015	47	2011-2014
Offsite facility disposal option	7.9×10^3	2011-2014	140	2011-2014	180	2010-2015	48	2011-2014
Planning Basis Option								
Offsite facility disposal option	8.5×10^3	2016-2019	140	2016-2019	180	2014-2019	24	2016-2019
Transuranic Separations Option								
New INEEL disposal option	6.1×10^3	2011-2014	63	2011-2014	180	2009-2014	29	2011-2014
Tank Farm, bin set disposal option	5.3×10^3	2011-2014	62	2011-2014	180	2009-2014	28	2011-2014
Offsite facility disposal option	5.5×10^3	2011-2014	63	2011-2014	180	2009-2014	29	2011-2014
Non-Separations Alternative								
Hot Isostatic Pressed Waste Option	3.9×10^3	2011-2014	140	2011-2014	180	2009-2014	40	2011-2014
Direct Cement Waste Option	4.5×10^3	2011-2014	98	2011-2014	180	2009-2014	53	2011-2014
Early Vitrification Option	3.8×10^3	2011-2014	110	2011-2014	180	2009-2014	46	2011-2014
Steam Reforming Option	***4.1×10^3***	***2010***	***42***	***2010***	***180***	***2010-2015***	***0***	***-***
Minimum INEEL Processing Alternative								
At INEEL	2.8×10^3	2007-2008	59	2011-2014	270	2007-2010	20	2007-2008
At Hanford[c]	3.4×10^3	2024-2027	3	2009-2010[d]	0	NA	0	NA
Direct Vitrification Alternative								
Vitrification without Calcine Separations Option	***2.7×10^3***	***2012***	***94***	***2012-2013***	***180***	***2017-2022***	***220***	***2017-2022***
Vitrification with Calcine Separations Option	***5.9×10^3***	***2019-2020***	***92***	***2012-2013***	***180***	***2017-2022***	***240***	***2019-2022***

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.

Table 5.2-33. Annual average and total process waste volumes (cubic meters) generated during operations through the year 2035.[a]

	Industrial waste		Hazardous waste		Mixed low-level waste		Low-level waste	
Alternatives	Average	Total	Average	Total	Average	Total	Average	Total
No Action Alternative	390	1.4×10^{4}	0	0	37	1.3×10^{3}	5	190
Continued Current Operations Alternative	660	1.9×10^{4}	0	0	110	3.2×10^{3}	330	9.5×10^{3}
Separations Alternative								
Full Separations Option								
New INEEL disposal option	2.0×10^{3}	5.3×10^{4}	58	1.6×10^{3}	210	5.8×10^{3}	45	1.2×10^{3}
Tank Farm, bin set disposal option	1.9×10^{3}	5.0×10^{4}	58	1.6×10^{3}	220	5.9×10^{3}	45	1.2×10^{3}
Offsite facility disposal option	1.9×10^{3}	5.1×10^{4}	58	1.6×10^{3}	210	5.8×10^{3}	45	1.2×10^{3}
Planning Basis Option								
Offsite facility disposal option	2.0×10^{3}	5.2×10^{4}	57	1.2×10^{3}	300	7.9×10^{3}	400	1.0×10^{4}
Transuranic Separations Option								
New INEEL disposal option	1.6×10^{3}	4.3×10^{4}	36	960	190	5.2×10^{3}	36	960
Tank Farm, bin set disposal option	1.5×10^{3}	4.1×10^{4}	35	940	200	5.3×10^{3}	36	960
Offsite facility disposal option	1.5×10^{3}	4.2×10^{4}	36	960	190	5.2×10^{3}	36	960
Non-Separations Alternative								
Hot Isostatic Pressed Waste Option	1.6×10^{3}	4.3×10^{4}	<1	4	230	6.4×10^{3}	370	1.0×10^{4}
Direct Cement Waste Option	1.9×10^{3}	5.0×10^{4}	<1	4	320	8.6×10^{3}	370	1.0×10^{4}
Early Vitrification Option	1.2×10^{3}	4.2×10^{4}	<1	4	170	6.0×10^{3}	21	750
Steam Reforming Option	***690***	2.5×10^{4}	***2***	***58***	***110***	4.1×10^{3}	***16***	***560***
Minimum INEEL Processing Alternative								
At INEEL	960	3.5×10^{4}	1	40	160	5.7×10^{3}	20	700
At Hanford Site[b]	NA[c]	6.7×10^{3}	NA	23	0	0	NA	1.5×10^{3}
Direct Vitrification Alternative								
Vitrification without Calcine Separations Option	***850***	3.0×10^{4}	***0.11***	***4.0***	***170***	6.0×10^{3}	***21***	***700***
Vitrification with Calcine Separations Option	1.2×10^{3}	4.2×10^{4}	***41***	1.4×10^{3}	***210***	7.5×10^{3}	***37***	1.3×10^{3}

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.

native. 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 5.2-3***4*** is based on the same project information as Table 5.2-3***3*** 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. Some of the alternatives and options that would produce disposable HLW forms at the INEEL 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 5.2-3***5***. ***The Transuranic Separations and Steam Reforming Options are not listed in this table because there would be no interim storage of final waste forms produced under these options.*** 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 5.2-3***5***.

Product Wastes - Table 5.2-3***6*** 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 5.2-3***3*** and 5.2-3***4***, and 110 cubic meters of remote-handled transuranic waste (included in Table 5.2-3***6***). 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 5.2-3***6***.

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 5.2-3***7*** provides a summary of the key feed materials that would be committed to each of the alternatives.

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

Table 5.2-34. 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	1.4×10^3	2015-2016	0	–	250	2015-2016	1.3×10^3	2015-2016
Separations Alternative								
Full Separations Option								
New INEEL disposal option	2.5×10^3	2016-2035	76	2016-2035	260	2016-2035	57	2016-2035
Tank Farm, bin set disposal option	2.4×10^3	2027-2035	76	2016-2035	270	2016-2035	57	2016-2035
Offsite facility disposal option	2.4×10^3	2016-2035	76	2016-2035	260	2016-2035	57	2016-2035
Planning Basis Option								
Offsite facility disposal option	2.8×10^3	2021-2035	80	2021-2035	390	2021-2035	1.0×10^3	2020
Transuranic Separations Option								
New INEEL disposal option	2.0×10^3	2015-2035	46	2015-2035	230	2015-2035	45	2015-2035
Tank Farm, bin set disposal option	1.9×10^3	2015-2035	45	2015-2035	240	2015-2035	45	2015-2035
Offsite facility disposal option	1.9×10^3	2015-2035	46	2015-2035	230	2015-2035	45	2015-2035
Non-Separations Alternative								
Hot Isostatic Pressed Waste Option	2.6×10^3	2015-2016	<1	2009-2035	390	2015-2016	1.4×10^3	2015-2016
Direct Cement Waste Option	2.9×10^3	2015-2016	<1	2009-2035	500	2015-2016	1.4×10^3	2015-2016
Early Vitrification Option	1.8×10^3	2015-2035	<1	2009-2035	240	2015-2035	37	2015-2035
Steam Reforming Option	***930***	***2012***	***29***	***2012***	***160***	***2012***	***42***	***2012***
Minimum INEEL Processing Alternative								
At INEEL	1.8×10^3	2015-2025	2	2016-2035	300	2015-2025	42	2015-2025
At Hanford[b]	4.1×10^3	2029	2	2029	0	–	1.0×10^3	2029
Direct Vitrification Alternative								
Vitrification without Calcine Separations Option	$\boldsymbol{1.5\times10^3}$	***2023-2035***	***0.67***	***2012-2017***	***420***	***2015***	***42***	***2023-2035***
Vitrification with Calcine Separations Option	$\boldsymbol{2.5\times10^3}$	***2023-2035***	***110***	***2023-2035***	***420***	***2015***	***84***	***2023-2035***

a. Source: Project Data Sheets in Appendix C.6

b. Source: Project Data Sheets in Appendix C.8

Table 5.2-35. 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
Separations Alternative				
Full Separations Option	36	2	0	0
Planning Basis Option	36	2	0	0
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[b]	NA	NA	NA
Direct Vitrification Alternative[c]				
Vitrification without Calcine Separations Option	***36***	–	–	–
Vitrification with Calcine Separations Option	***36***	***36***	–	–

a. Source: Project Data Sheets in Appendix C.6.

b. NA = not applicable. There is no storage of HLW associated with this alternative.

c. Impacts were estimated assuming that the vitrified SBW would be managed as HLW and placed in interim storage pending disposal in a geologic repository. If DOE determines through the waste incidental to reprocessing process that the SBW can be managed as mixed transuranic waste, interim storage of vitrified SBW would not be required and the impacts would be reduced from those reported above.

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 off-site 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-

Table 5.2-36. Total volumes (cubic meters) of product waste that would result from the alternatives.[a]

		Transuranic Waste		
Alternatives	Low-level waste	Contact-handled	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	2.7×10^4	0	0	470
Planning Basis Option	3.0×10^4	0	110	470
Transuranic Separations Option	2.3×10^4	0	220	0
Non-Separations Alternative				
Hot Isostatic Pressed Waste Option	0	0	110	3.4×10^3
Direct Cement Waste Option	0	0	110	1.3×10^4
Early Vitrification Option	0	0	360	8.5×10^3
Steam Reforming Option	***0***	***0***	***2.6×10^3***	***4.4×10^3***
Minimum INEEL Processing Alternative				
At INEEL	0	7.5×10^3	0	0
At Hanford[c]	1.4×10^4	0	0	***3.5×10^3***
Direct Vitrification Alternative				
Vitrification without Calcine Separations Option	**–**	**–**	**–**	***8.9×10^3[d]***
Vitrification with Calcine Separations Option	***2.4×10^4***	**–**	**–**	***910[d]***

a. Source: Project Data Sheets in Appendix C.6, Russell et al. (1998), Fewell (1999), McDonald (1999), Barnes (2000).

b. NA = not applicable.

c. Source: Facilities and projects associated with the Hanford option of this alternative are described in Appendix C.8.

d. Value contains 440 cubic meters of vitrified SBW that could be managed as remote-handled transuranic waste, depending on the outcome of the waste incidental to reprocessing determination.

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 the INEEL for disposal in a newly constructed disposal facility at INTEC or at an off-site 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.

Table 5.2-37. Summary of key material quantities (cubic meters) that would be committed to each of the alternative processes.

	Total material quantities (cubic meters)[a]													
Alternatives	***Oxygen gas***	Argon gas	Boiler or blast furnace slag	Cement	Clay	Fly ash	Glass frit	***Calcium Oxide***	Silica	***Nitric Acid***	Sodium hydroxide	Titanium or aluminum powder	***Sucrose***	***Carbon***
No Action Alternative	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Continued Current Operations Alternative	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Separations Alternative														
Full Separations Option	–	–	5.6×10^3	5.1×10^3	–	5.4×10^3	420	–	–	–	–	–	–	–
Planning Basis Option[b]	–	–	5.6×10^3	5.1×10^3	–	5.4×10^3	420	–	–	–	–	–	–	–
Transuranic Separations Option	–	–	6.4×10^3	5.8×10^3	–	6.1×10^3	–	–	–	–	–	–	–	–
Non-Separations Alternative														
Hot Isostatic Pressed Waste Option	–	1.2×10^3	–	–	–	–	–	–	2.3×10^3	–	–	240	–	–
Direct Cement Waste Option	–	–	1.3×10^3	–	8.5×10^3	–	–	–	–	–	500	–	–	–
Early Vitrification Option	–	–	–	–	–	–	7.8×10^3	–	–	–	–	–	–	–
Steam Reforming Option	***1.6×10^6***	–	***140***	***38***	***130***	–	–	***130***	***34***	***500***	–	–	***250***	***2.5×10^3***
Minimum INEEL Processing Alternative[c]	–	–	–	–	–	–	9.2×10^3	–	–	–	7.6×10^3	–	–	–
Direct Vitrification Alternative														
Vitrification without Calcine Separations Option	–	–	–	–	–	–	***7.9×10^3***	–	–	–	–	–	–	–
Vitrification with Calcine Separations Option	–	–	***4.9×10^3***	***4.5×10^3***	–	***4.7×10^3***	***810***	–	–	–	–	–	–	–

a. Source: ***Adapted from*** Helm (1998). ***Materials quantities are assumed to be scaleable based on estimated product waste volumes.***

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.

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 the contact-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). ***Under the Steam Reforming Option, DOE could produce up to 2,600 cubic meters of remote-handled transuranic waste. The combination of this waste volume and other remote-handled transuranic waste identified for disposal in DOE (1997b) would exceed by 4 percent the disposal capacity for remote-handled transuranic waste authorized by DOE's Consultation and Cooperation Agreement with the State of New Mexico. The Waste Isolation Pilot Plant would have adequate disposal capacity for the amount of remote-handled transuranic waste produced under the other alternatives and options (up to 360 cubic meters under the Early Vitrification Option).***

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 the Waste Isolation Pilot Plant. An estimated 1.3 million curies remains, some of which may be used under this option.

Under the Steam Reforming Option, DOE would treat the post-2005 newly generated liquid waste with the mixed transuranic waste/SBW until the steam reformer's mission is completed in 2013, producing a total of 1,300 cubic meters of remote-handled transuranic waste. The steam-reformed waste would average less than 1 curie per liter and total about 410,000 curies of activity. After 2013, DOE would grout the newly generated liquid waste, producing approximately 1,300 cubic meters of remote-handled transuranic waste. The grouted waste would average less than 1 curie per liter and total about 150,000 curies of activity. Although grouting of newly generated liquid waste is only analyzed under the Steam Reforming Option, DOE could employ this

method for newly generated liquid waste treatment under any of the options analyzed in this EIS. Subsequent studies could determine that the grouted newly generated liquid waste could be classified as low-level waste.

Product High-Level Waste - The final disposition point for the 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 ***as described in Section 2.2.4***. 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 of 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 5.2-3***6***, the volume of HLW that would be generated by the 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 the 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 5.2-3***2***) and about 3,000 cubic meters per year during operations (Table 5.2-3***4***). 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 5.2-3***4***, 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 5.2-3***2*** and 5.2-3***3***. 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-***30***), annual production of low-level waste at the INEEL is currently about ***2,900*** 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 ***190*** to ***1.0×10^4*** cubic meters over the ***operating*** life of the project, depending on the alternative (see Table 5.2-3***3***). 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

This section presents a summary of the accident analysis conducted to identify impacts associated with the waste processing alternatives described in Chapter 3. Appendix C.4, Facility Accidents, contains additional details and discussion. This section does not include the following accident analyses, which are found under other subject headings in this EIS or other documents as noted below:

- Industrial accidents and occupational risks due to waste processing operations. These health and safety impacts are evaluated separately in Section 5.2.10.
- 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.
- Bounding accidents associated with facility disposition activities. The impacts of facility disposition activities are included in Section 5.3.12
- Facility accidents at Hanford due to the processing of INEEL waste under the Minimum INEEL Processing Alternative, are addressed in the Tank Waste Remediation EIS prepared for processing the liquid HLW stored at that site. If DOE decides to treat INEEL HLW at Hanford, a determination will be made as to whether additional National Environmental Policy Act analysis is necessary.
- Accidents at offsite disposal facilities such as the Waste Isolation Pilot Plant (transuranic waste), the proposed Yucca Mountain geologic repository (HLW), and the Hanford Site or Nevada Test Site (low-level waste and mixed low-level waste), which are evaluated in other National Environmental Policy Act documents.
- Accidents at other INEEL facilities.

Facility accidents are unplanned, unexpected, and undesired events (such as earthquakes, operational errors, or process equipment failures) that can occur during or as a result of implementing a waste processing alternative and that have the potential to impact human health and the environment. Facility accidents with the potential to harm the public include structural failures, fires, and explosions that could result in the release of radioactive and chemical contaminants. Such releases may result in immediate health impacts, for example a lethal chemical exposure. However, they are more likely to have a delayed health impact that occurs over time, such as exposure to ionizing radiation that could eventually result in a cancer fatality.

Implementation of the various projects associated with each of the waste processing alternatives temporarily adds risk to humans and the environment. This implementation risk is illustrated qualitatively in Appendix C.4, Figure C.4-1.

Compliance with DOE Orders and Standards provides the assurance that facility accident risk from implementation of waste processing alternatives is minimized through the incorporation of safety features in the design, construction, and operation of new facilities. Many of the actions under the waste processing alternatives are continuations or modifications of past or present activities at INTEC. As such DOE would continue to control the hazards associated with any of the waste processing alternatives consistent with the operating history at the INEEL. DOE has an ongoing commitment to high levels of safety to assure that the risk of facility accidents is minimized under any of the waste processing alternatives. A thorough review of historical accident experience at the INEEL has been completed.

An analysis has been performed to identify the potential for immediate and long-term environmental impacts, particularly human health impacts, that could occur as a result of implementing the waste processing alternatives and options. The postulated accidents that were analyzed would not necessarily occur but are considered reasonably foreseeable.

5.2.14.1 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 1993). These technical guidelines define a bounding facility accident for alternatives as the reasonably foreseeable accident that has the highest potential for environmental impacts, particularly human health and safety impacts, among all identified reasonably foreseeable accidents. An accident scenario that does not require extraordinary initiating events or unrealistic assumptions about the progression of events or the resulting releases is said to be "reasonably foreseeable." For the purposes of this EIS accident analysis, reasonably foreseeable refers to facility accidents for which the frequency is estimated to be greater than once in ten million years. The guidelines also recommend identification of a bounding accident in each of three broad frequency ranges: abnormal, design basis, and beyond design basis. Abnormal events have estimated frequencies of occurrence equal to or greater than once in a thousand years; 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 that are less than once in a million years. Within each frequency range, selection of the bounding accident assures that any other reasonably foreseeable accident (in that range) would be expected to have smaller consequences. DOE frequency ranges are compared in Table 5.2-38.

Several general assumptions were used to identify bounding facility accidents in this EIS.

- Facilities are assumed to be designed, constructed, and operated in compliance with DOE Orders, directives, and standards and within regulatory requirements. However, accidents are defined using bounding reasonably foreseeable assumptions regarding initiator severity and facility design response.

- Potential source terms of radioactive or chemically hazardous releases during accidents are evaluated assuming the design features of the facility perform as expected, but no further mitigating actions, including evacuation, are included.

- Potential receptors of postulated air releases are assumed to be directly downwind of the release; as close as the site boundary for a member of the public; and 640 meters for the noninvolved worker.

- Releases to groundwater are assumed to occur immediately, without any holdup as a result of the leak path. Potential receptors are assumed to be directly over the location of the spill, consuming only contaminated groundwater from the aquifer over a 30-year period of exposure, in most cases.

Although this approach overstates the risk of accidents, it provides a level of certainty that the estimated risks reported in this EIS are not likely to be exceeded and it provides a reasonable basis for comparing one waste processing alternative to another.

DOE performed accident analyses of waste processing facilities that are currently operating using safety assurance information from facility safety analysis reports, along with 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 EIS to implement waste processing alternatives) uses information primarily from technical feasibility studies performed to ascertain process feasibility and identify process implementation costs. Such information 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. The EIS accident analyses of waste processing facilities incorporates the following three levels of screening analyses.

1. DOE performed a screening evaluation of major facilities and identified various operations needed to implement waste

Table 5.2-38. DOE facility accident frequency categories.

	Accident Frequency Categories	Accident Frequency Category Descriptions	Percent chance of an accident occurring in any given year.	Number of years during which a particular accident could occur. (Accident / Years)
	Accident frequency is a tool used to determine risk to a receptor population. It is not a prediction of when an accident will occur. For example a Design Basis Event with a chance of occurring once in ten thousand years could occur within the first 100 years.		The less probable an accident, the less likely it is to occur in any given year.	The more probable an accident, the shorter the time period in which it could occur.
Reasonably Foreseeable Accidents	Abnormal Event	Accidents that could occur once in a thousand years.	100 %	1/1
			10 %	1/10
			1%	1/100
			0.1%	1/1000
	Design Basis Event	Accidents that could occur once in a million years but not more frequently than once in a thousand years.	0.01%	1/10,000
			0.001%	1/100,000
			0.0001%	1/1,000,000
	Beyond Design Basis Event	Accidents that could occur once in ten million years but not more frequently than once in a million years.	0.00001%	1/10,000,000
Not Reasonably Foreseeable Accidents	Not analyzed in the EIS because of the extreme unlikelihood of these events.	Accidents that could occur less frequently than once in ten million years.	< 0.00001%	< 1/10,000,000

processing alternatives (referred to as process elements) to assess the potential for significant facility accidents. Process elements 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. An accident initiating event consists of an occurrence (i.e., natural phenomena, human error, or equipment failure) that can challenge and sometime degrade the safety functions of a facility. An "accident scenario" consists of a set of causal events starting with an initiating event that can lead to a 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. 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. The accident scenario in each frequency range category 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. DOE performed detailed consequence (health impact) evaluations for each of these potentially bounding accidents, selecting the reasonably foreseeable accident with the largest impact on human health in each frequency category for each waste processing alternative as bounding.

For purposes of the facility accident analysis, DOE considered six classes of initiating events:

- Fires during facility operations
- Explosions during facility operations
- Spills (of radiological or hazardous material) during facility operations
- Criticality (uncontrolled nuclear chain reaction) during facility operations
- Natural phenomena (for example: flood, lightning, seismic event, high wind) during facility operations
- External events (human-caused events that are external to a facility and may impact the safe operation and integrity of the facility) during facility operations

As noted above, the accident analysis assessed the potential for criticality accidents for each waste processing activity. There have been three criticalities at INTEC (October 16, 1959; January 25, 1961; and October 17, 1978). All three events were a result of a high uranium concentration aqueous solution being placed in a geometrically unsafe storage condition. The sets of conditions leading to the historically recorded criticality events (i.e., sufficient inventory of fissile material in an aqueous environment) are considered reasonably foreseeable only for the Transuranic Separations Option and the Minimum INEEL Processing Alternative. Implementing these alternatives could involve circumstances where a potentially high concentration of transuranic species exists in a stored or handled waste that is not immobilized.

In the aftermath of the tragic events of September 11, DOE is continuing to assess measures that it can take to minimize the risk of potential consequences of radiological sabotage or terrorists attacks against the INEEL site. For this reason, sabotage and terrorist activities are not addressed in the facility accident analysis. The threat of significant health impacts due to sabotage and terrorist activities requires the coexistence of significant radioactive inventories and energy sources capable of causing a substantial release. The defense in depth approach used to design nuclear facilities with significant radiological inventories at the INEEL, combined with limited sources of release energy, precludes a major impact from terrorist action.

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 for several alternatives could be identified using a single accident evaluation. The resulting set of required accident analyses used to identify potentially bounding accident scenarios for the waste processing alternatives is shown in Table 5.2-39. From Table 5.2-39, there are 22 separate accident analyses used to identify potentially bounding accident scenarios. Each accident analysis identifies potentially bounding accident scenarios in the three frequency classes, abnormal events, design basis events, and beyond design basis events.

Source Term Identification

Radiological Releases - Most of the accidents analyzed in this EIS result in releases to the atmosphere. This is because air release accidents generally show the highest potential to result in health impacts. For non-criticality radiological releases, the source term is defined as the amount of respirable material 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 term 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.

Table 5.2-39. Accident evaluations required.

Waste Processing Alternatives												
Processing Elements	No Action	Continued Current Operations	Full Separations	Planning Basis	Transuranic Separations	Hot Isostatic Pressed Waste	Direct Cement Waste	Early Vitrification	Steam Reforming	Min. INEEL Processing	Vitrification without Calcine Separations	Vitrification with Calcine Separations
SBW/Newly Generated Liquid Waste Processing[a]		X		X		X	X		X			
New Waste Calcining Facility High Temperature and MACT Modifications		X		X		X	X					
Calcine Retrieval and Onsite Transport[b]	c	c	X	X	X	X	X	X	X	X	X	X
Full Separations[d]			X	X								X
Transuranic Separations					X							
Cesium Separations		X[e]								X		X
Class C Grout					X					X		
Borosilicate Vitrification (cesium, transuranic, strontium)[f]			X	X								X
Borosilicate Vitrification (Calcine and SBW)[g]								X			X	
HLW/SBW Immobilization for Transport (Calcine & Cs IX)										X		
HLW/SBW Immobilization for Transport (HIP)						X						
HLW/SBW Immobilization for Transport (Direct Cement)							X					
HLW/SBW Immobilization for Transport (Calcine & SBW)[h]												
Liquid Waste Stream Evaporation[i,j]		X	X	X	X	X	X		X			X
Additional Offgas Treatment[k]			X	X	X	X	X	X	X	X	X	X
Class C Grout Disposal					X							
HLW Interim Storage for Transport									X	X		
HLW/HAW Stabilization and Preparation for Transport (Calcine and Cs Resin Feedstocks)										X		
HLW/HAW Stabilization and Preparation for Transport (Calcine and SBW Feedstocks)[h]												
Storage of Calcine in Bin Sets[l,m]	X[n]	X[n]	X	X	X	X	X	X	X	X	X	X
Transuranic Waste Stabilization and Preparation for Transport					X					X		

Table 5.2-39. Accident evaluations required (continued).

Waste Processing Alternatives Processing Elements	No Action	Continued Current Operations	Full Separations	Planning Basis	Transuranic Separations	Hot Isostatic Pressed Waste	Direct Cement Waste	Early Vitrification	Steam Reforming	Min. INEEL Processing	Vitrification without Calcine Separations	Vitrification with Calcine Separations
Storage of SBW[o]	X	X	X	X	X	X	X	X	X	X	X	X
SBW Stabilization and Preparation for Transport[p]								X	X		X	X
SBW Retrieval and Transport[q]		X	X	X	X	X	X	X	X	X	X	X

HAW = high-activity waste; SBW = mixed transuranic waste/SBW

a. Title reflects completion of liquid HLW calcining mission. DOE has placed calciner in standby.

b. Process elements associated with calcine retrieval are assumed to be identical to the calcine retrieval process for other waste processing alternatives.

c. Prior engineering assessment indicated bin set 1 to be potentially structurally unstable under static load thus possibly unable to meet requirements of DOE Order 420.1. This condition resulted in an Unresolvd Safety Question, and an assumption that retrieval of calcine from bin set 1 was required to implement any of the waste processing alternatives. Additional structural evaluation since that time resolved this Unresolved Safety Question and calcine retrieval from bin set 1 for the No Action and Continued Current Operations Alternatives is not anticipated.

d. Assumed to be identical to full separations process for Full Separations Option.

e. Requirement for Cs separations for Continued Current Operations Alternative was based on concern that treatment of mixed transuranic waste/SBW, newly generated liquid waste, and tank heels may require additional or alternate processing other than calcination. Currently, DOE has no planned Cs separations facility although Vitrification With Calcine Separations may utilize a partial separations process.

f. Smaller borosilicate vitrification process is analyzed for immobilization of HAW fractions after separation.

g. For Vitrification Without Calcine Separations, process element is assumed to be identical to Borosilicate Vitrification process for Early Vitrification Option.

h. Defined and analyzed based on preliminary descriptions of treatment alternatives and implementing processes. Later information indicated that modeled processes were identical to others or similar to and bounded by other processes (in terms of potential for health impacts) so this accident is not required for analysis.

i. Analyzed liquid waste stream evaporation as post-treatment for separations process. Application to mixed transuranic waste/SBW pretreatment, requires elimination of accidents with no physical basis.

j. Smaller borosilicate vitrification process requires mixed transuranic waste/SBW volume reduction beyond what is currently planned for near term management of mixed transuranic waste/SBW inventories, prior to vitrification.

k. In this EIS, all borosilicate vitrification and separation processes are assumed to require offgas treatment. Continued Current Operations Alternative would rely on current evaporators, which are also analyzed.

l. Identical to equivalent process element for other waste processing alternatives that address calcine waste and includes accidents covering short-term storage of calcine over a 35-year period of vulnerability.

m. Accident analysis process element assumes vulnerability to short term storage accidents over a 35-year period of vulnerability except for the No Action and Continued Current Operations Alternatives, where storage of calcine in the bin sets is permanent.

n. Includes long-term storage accidents that could occur over a 10,000 year period of vulnerability.

o. Evaluation of this process element addresses accidents involving long-term storage and degradation of mixed transuranic waste/SBW storage facilities (10,000 year exposure). However, potentially bounding design basis and beyond design basis accident scenarios could occur at any time. Therefore, the analysis has been expanded to evaluate design basis and beyond period of vulnerability.

p. Process element is assumed to be identical to mixed transuranic waste/SBW stabilization and preparation process for Early Vitrification Option. The radiological source term in a container of vitrified mixed transuranic waste/SBW is about twice the source term in a container of vitrified calcine. Therefore, accident for mixed transuranic waste/SBW provides a bounding analysis.

q. Process element is assumed to be identical to mixed transuranic waste/SBW retrieval process for waste processing alternatives.

The potential for a criticality was assessed in each accident analysis evaluation. Only one reasonably foreseeable criticality accident scenario was identified in the accident analysis evaluations. An inadvertent criticality during transuranic waste shipping container-loading operations results from a vulnerability to loss of control over storage geometry. This scenario is identified under both the Transuranic Separations Option and the Minimum INEEL Processing Alternative. The frequency for this accident is estimated to be between once in a thousand years and once in a million years of facility operations. This event could result in a large dose to a nearby, unshielded maximally exposed worked that is estimated to be 218 rem, representing a 1 in 5 chance of a latent cancer fatality. However, this same 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, representing a 2 per million increase in cancer risk to the receptor.

Chemical Releases - Facility accidents may include sets of conditions leading to the release of hazardous chemicals that directly or indirectly threaten involved workers and the public. This EIS facility accident review includes an evaluation of the potential for chemical release accidents. Currently, there is insufficient information on chemical inventories of proposed future waste processing facilities to support a comprehensive and systematic review of chemical release accidents. However, DOE assumed that future requirements for hazardous chemicals during waste processing would be similar to present requirements.

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 involved workers. However, the potential for these types of chemicals to become airborne and travel to nearby or offsite facilities is low. The facility accident analysis focused on those chemicals that are gases at ambient conditions. Appendix C.4 of this EIS provides additional information on chemical releases.

Receptor Identification

Radiological Releases - For radiological releases, DOE calculated the health impact of the bounding accidents by estimating the dose to human receptors. Human receptors are people who could potentially be exposed to or affected by radioactive releases resulting from accidents associated with the waste processing alternatives.

Four categories of human receptors are considered in this EIS:

- **Involved Worker:** A worker who is associated with a treatment activity or operation of the HLW treatment facility itself;

- **Maximally Exposed Individual:** A hypothetical individual located at the nearest site boundary from the facility location where the release occurs and in the path of an air release.

- **Noninvolved Worker:** An onsite employee not directly involved in the site's HLW management operations.

- **Offsite Population:** The population of persons within a 50-mile radius the INTEC and in the path of an air release.

Doses to individual receptors from a radiological release are estimated in rem. Doses to receptor populations are estimated in person-rem. A person-rem is the product of the number of persons exposed to radiation from a single release and the average dose in rem.

Most bounding accidents evaluated in this EIS impact the receptor population by releasing radioactive particles into the environment, which are then inhaled or settle on individuals or surfaces such that humans are exposed. Such exposures usually result in chronic health impacts that manifest over the long-term and are calculated as latent cancer fatalities. Consequences to receptors impacted by a radiological release are expressed as an increase in the probability of developing a fatal cancer (for an individual) or as an increase in the number of latent cancer fatalities (for a population).

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.

The facility accident analysis assumes that accident scenarios with the potential for ERPG-2 or ERPG-3 health impacts are bounding scenarios for the waste processing alternatives.

Consequence Assessment

DOE used the "Radiological Safety Analysis Computer Program (RSAC-5)" to estimate human health consequences for radioactive releases. Radiological source terms were used as input to the computer program to determine radiation doses at receptor locations for each potentially bounding facility accident scenario. Meteorological data used in the program are consistent with previous INEEL EIS analyses (i.e., SNF & INEL EIS; DOE 1995) for 95 percent meteorological conditions (i.e. conditions whose severity, from the standpoint of induced consequences to an offsite population, is not exceeded more than 5 percent of the time).

DOE converted radiation doses to various receptors into potential health effects using dose-to-risk conversion factors recommended by the National Council on Radiation Protection and Measurements (NCRP). For conservatism, the NCRP guidelines assume that any additional exposure to radiation carries some incremental additional risk of inducing cancer. In the evaluation of facility accident consequences, DOE adopted the NCRP dose-to-risk conversion factor of 5×10^{-4} latent cancer fatalities for each person-rem of radiation dose to the general public. DOE calculated the expected increase in the number of latent cancer fatalities above those expected for the potentially exposed population. For individual receptors, a dose-to-risk conversion factor of 5×10^{-4} represents the increase in the probability of cancer for an individual member of the general public per rem of additional exposure. For larger doses, where the total exposure during an accident could exceed 20 rem, the increased likelihood of latent cancer fatality is doubled, assuming the body's diminished capability to repair radiation damage.

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 this EIS are consistent with those applied in other EIS documents prepared at the INEEL, such as the SNF & INEL EIS. However, there were some assumptions that differed.

In this EIS, DOE 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 is that DOE did analyze bounding groundwater release accidents for which effective mitigation might not be feasible.

In this EIS, DOE 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 in this EIS. Preliminary sensitivity calculations indicate that accidents which bounded the potential for human health impacts also bounded the potential for land contamination and other environmental impacts.

DOE decided not to evaluate impacts from some initiators (i.e., volcanoes) because they determined that such evaluations would not provide new opportunities to identify bounding accidents. Based on evaluations in the accident analysis, volcanic activity impacting INTEC was considered a beyond design basis event. This would place the event with initiators such as external events and beyond design basis earthquakes. This is because the lava flow from the eruption (basaltic volcanism) would likely cover some affected structures, limiting the amount of hazardous and radioactive waste that is released from process vessels and piping. Therefore, the impacts due to a lava flow event are assumed to be bounded by other external events, where the entire inventory would be impacted and available for release. Appendix C.4 contains additional information on volcanism.

5.2.14.2 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, and 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 results 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 evaluation of risk 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. On the average, the dose at 100 meters was 9 times greater than the dose 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 this 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.

5.2.14.3 Bounding Radiological Impacts to Noninvolved Workers and the Public of Implementing the Alternatives

This EIS 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. 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 risk accruing processes associated with each waste processing alternative.

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 as bounding.

The results for radiological impacts due to releases of radioactive material are expressed in terms of risk. Risk is quantified in terms of the estimated probability of fatality for the maximally exposed individual, involved worker, and noninvolved worker, and the estimated increase in latent cancer fatalities for the INEEL offsite population. A dose-to-risk conversion factor of 5×10^{-4} per person-rem represents the increase in the probability of a fatal cancer for an individual member of the public. For conservatism, this same conversion to dose was used to analyze risk to the noninvolved worker.

Bounding accidents are identified in this EIS based on analysis of those activities, projects, and facility operations that are required to implement the waste processing alternative, and that potentially pose a risk of health impacts to various receptor populations. These bounding accidents are presented in Appendix C.4.

5.2.14.4 Anticipated Radiological Risks of Bounding Facility Accidents

The systematic accident analysis process employed by DOE identified potentially bounding facility accident scenarios for the waste processing alternatives. The potentially bounding accident scenarios were identified for each of the functional activities that implement the various alternatives. 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 alternative. Table 5.2-40 summarizes the bounding facility accidents for each of the alternatives, along with their forecast consequences. Table 5.2-40 contains the following information:

Radiation Dose to Receptors - For each potentially bounding facility accident scenario, this section estimates doses to each receptor given that an accidental release of radioactivity has

Table 5.2-40. Anticipated risk for bounding radiological events for the various waste processing alternatives.[a]

Frequency of occurrence	Abnormal Event (AB) Could occur more than once in a thousand years of facility operation		Design Basis Event (DBE) Could occur more than once in a million years but less than once in a thousand years of facility operation	Beyond Design Basis Event (BDB) Could occur less than once in a million years of facility operation	
Process title	Long Term Storage of Calcine in Bin Sets	Calcine Retrieval Onsite Transport	Short Term Storage of Calcine in Bin Sets	Short Term Storage of Calcine in Bin Sets	Borosilicate Vitrification
Window of exposure (years)	9.5×10^{3}	35	35	35	20
Accident scenario (Event description)	Seismic induced failure of degraded bin set 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.	Equipment failure results in release of calcine during retrieval and transport operations.	A short-term flood induced 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).	An external event results in a bin set release (calcine) during short term storage.	An external event results in release of high activity waste from the borosilicate vitrification facility containment.
Risk to Receptors					
Maximally exposed individual					
Dose (millirem)	8.3×10^{4}	40	880	1.4×10^{4}	1.7×10^{4}
Latent cancer fatality probability	0.042	2.0×10^{-5}	4.4×10^{-4}	7.0×10^{-3}	8.5×10^{-3}
Noninvolved worker					
Dose (millirem)	5.7×10^{6}	2.7×10^{3}	5.9×10^{4}	9.3×10^{5}	1.2×10^{6}
Latent cancer fatality probability	1.0	1.4×10^{-3}	0.059	0.94	1.0
Offsite population					
Dose (person-rem)	5.3×10^{5}	470	5.7×10^{4}	1.2×10^{5}	1.5×10^{5}
Latent cancer fatalities	270	0.23	29	61	76

Table 5.2-40. Anticipated risk for bounding radiological events for the various waste processing alternatives[a] (continued).

Frequency of occurrence	Abnormal Event (AB) Could occur more than once in a thousand years of facility operation		Design Basis Event (DBE) Could occur more than once in a million years but less than once in a thousand years of facility operation	Beyond Design Basis Event (BDB) Could occur less than once in a million years of facility operation	
Process title	Long Term Storage of Calcine in Bin Sets	Calcine Retrieval Onsite Transport	Short Term Storage of Calcine in Bin Sets	Short Term Storage of Calcine in Bin Sets	Borosilicate Vitrification
Accident Analysis included in Alternatives/Options					
No Action Alternative	✔[b]		✔	✔	
Continued Current Operations Alternative	✔		✔	✔	
Separations Alternative					
Full Separations Option		✔	✔		✔
Planning Basis Option		✔	✔		✔
Transuranic Separations Option		✔	✔	✔	
Non-Separations Alternative					
Hot Isostatic Pressed Waste Option		✔	✔	✔	
Direct Cement Waste Option		✔	✔	✔	
Early Vitrification Option		✔	✔	✔	
Steam Reforming Option		✔	✔	✔	
Minimum INEEL Processing Alternative		✔	✔	✔	
Direct Vitrification Alternative					
Vitrification without Calcine Separations Option		✔	✔	✔	
Vitrification with Calcine Separations Option		✔	✔		✔

a. See Table C.4-2 for additional information.

b. Check mark indicates this analyzed accident applies to these EIS alternatives/options occurred. Source terms are evaluated in the accident analysis. Doses are estimated for unit radioactive source terms (i.e. assuming one curie of each radioactive substance is released) using RSAC-5. Dose estimates for accident scenario source terms are then estimated using an Excel spreadsheet to correct for radioactivity content of the released material.

Health Impacts - Conditional risk estimates the probability of health impacts assuming that an accidental release has occurred. For individual receptors, conditional risk is the probability of a fatality given exposure to the release. For the INEEL offsite public, conditional risk is the number of latent cancer fatalities. Consistent with assumptions discussed above regarding dose-to-risk conversion (i.e., a dose-to-risk conversion factor of 5×10^{-4} latent cancer fatalities for each person-rem of radiation received in the accident) the conditional risk of health impacts (fatalities only) is estimated for offsite receptors and is for noninvolved workers.

5.2.14.5 Impacts of Chemical Release Accidents on Noninvolved Workers and the Public of Implementing the Alternatives

DOE has analyzed the consequences of chemical releases from accidents that occur as a result of implementing the waste processing alternatives and their options. This section 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 ERPG values. Potentially bounding chemical release accidents from the accident analysis include mercury and ammonia. Mercury could be released during calcining operations 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.

The major processes or functions that could produce chemical releases from accidents during implementation of waste processing alternatives are the New Waste Calcining Facility High Temperature and Maximum Achievable Control Technology Modifications, and the Additional Offgas Treatment. The analysis of these accidents shows that failures involving ammonia handling and storage equipment represent the bounding abnormal, design basis, and beyond design basis chemical release accidents for all alternatives requiring additional offgas treatment. The beyond design basis accident, which involves an external event and subsequent fire could result in a release from another waste processing facility due to operator incapacitation or evacuation. The impacts due to these bounding accidents are shown in Table 5.2-41.

5.2.14.6 Groundwater Impacts to the Public of Implementing the Alternatives

The bounding accident scenarios described in Appendix C.4 produce human health consequences mainly as a result of inhalation of airborne released contaminants. In this EIS accident analysis, DOE 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 identified in the accident analysis 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 presented in the Remedial Investigation/Feasibility Study process in terms of expected exposure to contamination as a func-

Table 5.2-41. Summary of bounding chemical events for the various waste processing alternatives.[a]

Events	Process title	Event description	Contaminant	Peak atmospheric concentration (ERPG)
Abnormal	Additional Offgas 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	Additional Offgas 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	Additional Offgas 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

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a. Results based on modeling assumptions used for CERCLA analyses as reported in Rodriguez et al. (1997).

tion of time. Therefore, the measures of environmental risk such as the EPA drinking water standards or 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 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 potential economic impact of the accident.

Appendix C.4 presents analyses of three major processes or functions that could produce groundwater releases from accidents. These are New Waste Calcining Facility Operations, Long-term Storage of Calcine in Bin Sets, and Storage of Mixed Transuranic Waste/SBW. The predicted impacts to groundwater from accident scenarios resulting in major groundwater releases are described below and the impacts are summarized in Table 5.2-42.

New Waste Calcining Facility Operations

Operation of the New Waste Calcining Facility requires the combustion of kerosene for fluidized bed operation. An accident could leak 15,000 gallons of kerosene (which contains benzene) 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, beyond design basis event, would be an external event involving both kerosene storage tanks causing a release of 30,000 gallons of kerosene and a fire. The estimated chance of occurrence for this event is less than one in one million.

For the abnormal and beyond design basis kerosene spill accidents, DOE analyzed the risk to a resident drinking 2 liters per day of the benzene contaminated groundwater from beneath the INTEC Tank Farm. The additional risk of developing cancer over a 30-year lifetime due to these accidents is 1.9×10^{-4} for the abnormal

Table 5.2-42. Groundwater impacts due to accidents.

Process Title	Event	Accident Frequency	Constituent	Peak groundwater concentration (µg/L or pCi/L)	Maximum contaminant level (µg/L or pCi/L)
New Waste Calcining Facility Operations	A leak through failed process connections leaks 15,000 gallons of kerosene.	Abnormal Event	Benzene in kerosene	120	5
New Waste Calcining Facility Operations	An external event results in the failure of both kerosene storage tanks and a subsequent fire.	Beyond Design Basis Event	Benzene in kerosene	180	5
Long-Term Storage of SBW-Single Tank Failure	A seismic event causes the failure of a single full SBW tank and a release of SBW directly to the soil column in the year 2001.	Design Basis Event	I-129 Tc-99 Np-237 Total Pu	0.13[a] 100[a] 0.030[a] 1.1[a]	1 900 15 15
Long-Term Storage of SBW-5 Tank Failure	Degradation and simultaneous failure of 5 full SBW tanks in 2500.	Abnormal Event	I-129 Tc-99 Np-237 Total Pu	0.47[a] 380[a] 0.34[a] 8.6[a]	1 900 15 15

a. Results based on modeling assumptions used for CERCLA analyses as reported in 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).

MACT = maximum achievable control technology; SBW = mixed transuranic waste/SBW; µg/L = micrograms per liter; pCi/L = picocuries per liter.

event and 2.9×10^{-4} for the beyond design basis event (Jenkins 2001a). Cancer fatalities were not estimated for either event.

Long-Term Storage of Calcine in Bin Sets

This accident assumes that a bin set full of mixed HLW calcine degrades and fails during a seismic event after 500 years. The bin set is assumed to breach releasing the entire inventory of calcine directly to the soil column. Once released, the calcine would partially dissolve under the influence of local precipitation and would release contaminants to the groundwater. Because this event is assumed to occur after 500 years, it is treated as an abnormal event although the seismic initiator is considered a design basis event.

As discussed in Appendix C.4, the radionuclides released from this accident would be a fraction of the radionuclides released from the assumed failure of five full mixed transuranic waste/ SBW tanks at 500 years. The 5-tank failure is discussed below. For the bin set failure at 500 years, the percent of the radionuclide inventory released the first year compared to the inventory released from the 5-tank failure is: iodine-129 (1 percent); technetium-99 (11 percent); neptunium-237 (7 percent), and total plutonium (less than 1 percent).

The additional risk for developing cancer for a potential groundwater user after bin set failure at 500 years was not analyzed since groundwater impacts would be easily bounded by the 5-tank failure at 500 years as shown below.

The nonradiological impact of this accident was analyzed by comparing the percentage of the nonradionuclides inventory released during the first year of bin set failure, to the nonradionuclide inventory released for the 5-tank failure in 2500. The analysis (Jenkins 2001b) shows that the most impacting contaminants are beryllium

(8 percent of the 5-tank failure inventory) and molybdenum (4 percent of the 5-tank failure inventory). All other nonradionuclides would be less than 1 percent of the inventory released from the 5-tank failure. Therefore, the impacts from nonradionuclide contaminants released from the failure of a bin set would be bounded by the 5-tank failure at 500 years and the concentrations would be much less than drinking water standards.

Storage of Mixed Transuranic Waste/SBW

Two accidents associated with storage of mixed transuranic waste/SBW in the INTEC Tank Farm were analyzed for this EIS. These are:

- Failure of a full mixed transuranic waste/SBW tank vault with subsequent tank rupture and release of mixed transuranic waste/SBW directly to the soil column due to a seismic event. This event was analyzed to occur in the year 2001 and is considered a design basis event.
- Degradation and eventual simultaneous failure of 5 full mixed transuranic waste/SBW tanks and their vaults after 500 years with a release of mixed transuranic waste/SBW directly to the soil column. This is treated as an abnormal event since it is assumed that the event occurs at 500 years.

Failure of a Full Mixed Transuranic Waste/SBW Tank in the Year 2001 - The rupture of a full mixed transuranic waste/SBW tank in the year 2001 due to a seismic event is assumed to release liquid waste directly to the soil column, where it infiltrates and disperses through the vadose zone and migrates in the groundwater. The impacts for this accident were analyzed using similar modeling assumptions to those considered for CERCLA analyses in 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). Under these assumptions, the predicted peak groundwater concentration for iodine-129 is 0.13 pCi/L, which is 13 percent of the maximum contaminant level of 1.0 pCi/L. The peak iodine-129 concentration would occur in the year 2075. The predicted groundwater concentration for total plutonium (plutonium-239, plutonium-240, and plutonium-242) is 1.1 pCi/L, which does not exceed the maximum contaminant level of 15 pCi/L for alpha-particle emitters such as plutonium. The peak plutonium concentration would occur in the year 6000. The predicted groundwater concentrations for technetium-99 and neptunium-237 are 110 pCi/L and 0.7 pCi/L, respectively; well below their maximum contaminant levels of 900 pCi/L and 15 pCi/L. The peak concentration for these radionuclides would occur in the years 2095 and 2075, respectively (Bowman 2001a).

The potential nonradionuclide contaminants of concern included those constituents that could reasonably be expected to reach the aquifer in sufficient concentrations to impact the groundwater and pose a threat to the environment. Following screening, the contaminants of concern analyzed were: arsenic, barium, beryllium, cadmium, chromium, fluoride, mercury, molybdenum, nitrates, nickel, lead and uranium. For the single tank failure, the peak concentrations for the 12 species analyzed were all well below the drinking water standards. The peak concentrations for cadmium and nitrate were the closest, but were still more than a factor of 10 below their maximum contaminant levels based on the CERCLA model.

Degradation and Simultaneous Failure of 5 Full Mixed Transuranic Waste/SBW Tanks After 500 Years - For the No Action Alternative, mixed transuranic waste/SBW would be stored in the underground tanks indefinitely. The impact of the tank failures has been analyzed under the assumptions that (a) all five tanks fail simultaneously and (b) prior to failure all other tank contents and tank heels have been pumped into the five tanks. Although five times more mixed transuranic waste/SBW would be released to the soil column (relative to the single tank failure described above), many of the radionuclides would have decayed to very low activities over the 500 years. The impacts for this accident were analyzed using similar modeling assumptions to those considered for the CERCLA analyses in Rodriguez et al. (1997). Under these assumptions, the analysis shows that the impact from the tank failures would result in peak concentrations of iodine-129 at 0.47 pCi/L in the year 2575, technetium-99 at 390 pCi/L in the year 2595, neptunium-237 at 8.1 pCi/L in the year 2575, and total plutonium about 9 pCi/L in the year 6500. Thus, the peak concentrations for these key radionuclides would be less than current drinking water standards (Bowman 2001b).

The risk to an assumed long-term resident drinking the groundwater from beneath the INTEC Tank Farm was analyzed for this accident. Using the concentration-to-dose conversion factor from DOE (1988), and assuming 72 years of water ingestion at 2 liters per day, DOE estimated a lifetime whole-body dose equivalent to 420 millirem due to total plutonium for this accident. This equates to a 210 per million increase in the probability of a fatal cancer. This accident would release at least 5 times more source term to the soil column than considered for the single tank failure. Nevertheless, the concentrations of nonradionuclide contaminants in the aquifer would be less than the drinking water standards.

For nonradionuclide contaminants, the analysis for the 5-tank failure shows the greatest impact would be due to cadmium which would be about 41 percent of its maximum contaminent level. The next most impacting contaminant, uranium, would be about 0.5 percent of its maximum contaminant level based on the CERCLA model.

For purposes of this EIS, DOE calculated the groundwater impacts beneath the mixed transuranic waste/SBW tanks at INTEC. As for the single tank failure, these results could be non-conservative depending on the assumed mass release time for the 5-tank failure. Since doses are directly related to concentrations, a faster release time would be expected to increase concentration and doses accordingly. These impacts are provided for comparison purposes between alternatives under accident conditions and are not meant to fulfill the needs of or replace a performance assessment or INEEL-wide composite analysis as required by DOE Order 435.1. Facilities disposition and closure activities would eventually require such assessments but it is premature to attempt performance assessments until the waste processing technology is selected and the facilities to implement the selected technology are chosen.

5.2.14.7 Consideration of Other Accident Initiators

Each of the process elements associated with the waste processing alternatives were evaluated 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. 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 accident analysis consequence modeling was generally performed using very conservative assumptions to assure bounding results. For the most part, the assumptions in this EIS were consistent with those applied in other EIS documents prepared at the INEEL, such as the SNF & INEL EIS. However, there were some assumptions that differed. Of the assumptions incorporated in consequence modeling for this EIS, exposure pathways, exposure time, breathing rate, meteorology, location (for the population dose), and mass release times for tank failures were some that had significant impact on the results. The approach taken in this EIS ensures a "consequence envelope" is provided. As discussed above, this approach differs in part from the approach taken in other EISs, such as the SNF & INEL EIS. Therefore, the impacts presented in this EIS are generally larger than the impacts that would have been obtained by applying the SNF & INEL EIS assumptions. This EIS provides 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.

5.2.14.9 Risk to Involved Worker

This EIS provides comprehensive and integrated evaluation of involved worker risk (in fatalities over life of the activity) as a result of industrial accidents, occupational exposures, and facility accidents. This EIS developed baseline estimates of involved worker risk using point estimates of risk contributors. Results of the point estimates are presented in Table 5.2-43. The involved worker risks do not include the risks posed by transportation or facility disposition. Appendix C.4, Facility Accidents, provides more information.

From Table 5.2-43 several conclusions can be drawn:

- 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. Consistent with the state of knowledge regarding projects and activities associated with implementation of alternatives, the point estimates provide a means for comparison of alternatives.

- Estimates of involved worker risk due to industrial accidents do not favor options that require the largest amount of manpower during implementation. Thus, waste processing options which rely on separations technology pose the highest risk to involved workers. The separations options encompass the largest requirements for facility construction as well as the longest facility operation campaigns.

- Industrial accidents are the largest contributors to involved worker risk. Therefore, estimates of integrated involved worker risk (including all sources) favor the options that involve less site activity over time.

Table 5.2-43. Point estimates of integrated involved worker risk for the waste processing alternatives.

	Involved worker risk (fatalities)[a]			
	Industrial accidents[b]	Occupational radiation dose[b]	Facility accidents[b]	Integrated worker risk[b]
No Action Alternative	0.44	0.15	21	21
Continued Current Operations Alternative	0.54	0.20	21	21
Separations Alternative				
Full Separations Option	1.8	0.38	2.3×10^{-3}	2.2
Planning Basis Option	1.9	0.47	2.3×10^{-3}	2.4
Transuranic Separations Option	1.2	0.36	2.3×10^{-3}	1.6
Non-Separations Alternative				
Hot Isostatic Pressed Waste Option	1.2	0.44	2.3×10^{-3}	1.6
Direct Cement Waste Option	1.4	0.51	2.3×10^{-3}	1.9
Early Vitrification Option	1.1	0.37	2.3×10^{-3}	1.5
Steam Reforming Option	0.82	0.31	2.3×10^{-3}	1.1
Minimum INEEL Processing Alternative[c]	0.92	0.32	2.3×10^{-3}	1.2
Direct Vitrification Alternative				
Vitrification without Calcine Separations Option	0.90	0.29	2.3×10^{-3}	1.2
Vitrification with Calcine Separations Option	1.6	0.31	2.3×10^{-3}	1.9

a. Does not include risk associated with decontamination and decommissioning (addressed in Section 5.3.12) or transportation (addressed in Section 5.2.9) activities.

b. Fatalities over life of activities.

c. Does not include activities at the Hanford Site.

5.3 Facility Disposition Impacts

Section 5.3 presents a discussion of potential impacts associated with the disposition of existing HLW ***management*** 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 ***management*** 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 ***management*** 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 ***six*** 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 ***management*** 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-***3*** lists existing HLW ***management*** 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 ***management*** 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 ***management*** 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 ***management*** 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 mixed transuranic waste/SBW. The analysis is presented in Appendix C.9, Facility Closure Modeling. Potential impacts of continued storage of calcine and mixed transuranic waste/SBW 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).

The Preferred Alternative for the disposition of existing HLW management facilities at INTEC is to use performance-based closure methods. These methods encompass three of the six facility disposition alternatives analyzed in this EIS: Clean Closure, Performance-Based Closure, and Closure to Landfill Standards. Performance-based closure would be implemented in accordance with applicable regulations and DOE Orders. However, any of the disposition alternatives analyzed in this EIS could be implemented under performance-based closure criteria. Table 3-3 identifies the facility disposition alternatives analyzed in this EIS for existing facilities. The potential impacts associated with the disposition of existing HLW management facilities are presented in Section 5.3.

Consistent with the objectives and requirements of DOE Order 430.1A, Life Cycle Management, and DOE Manual 435.1-1, Radioactive Waste Management Manual, all newly constructed facilities necessary to implement the waste processing alternatives would be designed and constructed consistent with measures that facilitate clean closure. Therefore, the Preferred Alternative for disposition of new facilities is Clean Closure. Table 3-1 identifies the major facilities that may be constructed to implement the waste processing alternatives. This section presents the potential impacts of short-term actions to disposition the new HLW management facilities.

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 ***management*** 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 ***management*** 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 disposition 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 disposition 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 disposition is included in Appendix C.1.

Since the publication of the Draft EIS, Census 2000 and related data have been incorporated into the socioeconomic analyses. Population figures, housing characteristics, labor information, and economic multipliers (such as employment and earnings multipliers) have been updated to reflect the most current socioeconomic environment in the region of influence.

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-***3***.

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Table 5.3-1. Summary of employment and income from disposition of facilities that would be constructed under the waste processing alternatives.[a,b]

Number	Project description	Duration of disposition activity[c] (years)	Employment			Total earnings ***(Dollars)***[d]
			Direct[c]	Indirect	Total	
	Continued Current Operations Alternative					
P1A	Calcine SBW including New Waste Calcining Facility Upgrades (MACT) and Storage Tanks	2	***58***	***56***	***110***	***4,400,000***
P1B	Newly Generated Liquid Waste and Tank Farm Heel Waste Management	1	***48***	***46***	***94***	***3,600,000***
Peak Year Employment (2018)			***58***	***56***	***110***	***4,400,000***
	Full Separations Option[e]					
P9A	Full Separations	3	220	***220***	***440***	***17,000,000***
P9B	Vitrification Plant	3	***72***	***70***	***140***	***5,400,000***
P9C	Class A Grout Plant	2.5	120	***120***	***230***	***9,000,000***
P18	Remote Analytical Lab	2	***88***	***85***	***170***	***6,600,000***
P24	Vitrified Product Interim Storage	2.8	***31***	30	***61***	***2,300,000***
P27	Grout Disposal	2	140	***130***	***270***	***10,000,000***
P25A	Packaging and Loading Vitrified HLW at INTEC for Shipment to NGR	1	2	2	4	***150,000***
P35D	Class A Grout Packaging	2	30	***29***	***59***	***2,300,000***
P59A	Calcine Retrieval and Transport	1	160	***160***	***320***	***12,000,000***
P118	Separations Organic Incinerator	1	2	2	4	***150,000***
P133	Waste Treatment Pilot Facility	2	***45***	***44***	***89***	***3,400,000***
Peak Year Employment (2036)			***790***	***760***	***1,600***	***59,000,000***
	Planning Basis Option					
P1A	Calcine SBW including New Waste Calcining Facility Upgrade	2	***42***	***41***	***83***	***3,200,000***
P1B	Liquid Waste Tank Farm	1	***48***	***46***	***94***	***3,600,000***
P59A	Calcine Retrieval and Transport	1	160	***160***	***320***	***12,000,000***
P23A	Full Separations	3	220	***220***	***440***	***17,000,000***
P23B	Vitrification Plant	4	***78***	***76***	***150***	***5,900,000***
P23C	Class A Grout Plant	4	110	***100***	***210***	***8,100,000***
P24	Vitrified Product Interim Storage	2.8	***31***	30	***61***	***2,300,000***
P25A	Packaging and Loading Vitrified HLW at INTEC	1	2	2	4	***150,000***
P18	New Analytical Laboratory	2	***88***	***85***	***170***	***6,600,000***
P118	Separations Organic Incinerator	1	2	2	4	***150,000***
P133	Waste Treatment Pilot Facility	2	***45***	***44***	***89***	***3,400,000***
Peak Year Employment (2036)			***660***	***640***	***1,300***	***50,000,000***

Table 5.3-1. Summary of empbyment and income from disposition of facilities that would be constructed under the waste processing alternatives[a,b] (continued).

Number	Project description	Duration of disposition activity[c] (years)	Employment			Total earnings ***(Dollars)***[d]
			Direct[c]	Indirect	Total	
Transuranic Separations Option[e]						
P18	New Analytical Lab	2	***88***	***85***	***170***	***6,600,000***
P27	Class A/C Grout in New Waste Disposal Facility	2	220	***220***	***440***	***17,000,000***
P39A	Packaging and Loading TRU at INTEC for Shipment to the Waste Isolation Pilot Plant	1.5	7	7	14	***530,000***
P49A	TRU-C Separations	3	150	***140***	***290***	***11,00,000***
P49C	Class C Grout Plant	2	***93***	***90***	***180***	***7,000,000***
P49D	Class C Grout Packaging and Shipping to INEEL Landfill	2	***57***	***55***	***110***	***4,300,000***
P59A	Calcine Retrieval and Transport	1	160	***160***	***320***	***12,000,000***
P118	Separations Organic Incinerator	2	2	2	4	***150,000***
P133	Waste Treatment Pilot Facility		***45***	***44***	***89***	***3,400,000***
Peak Year Employment (2036)			***730***	***710***	***1,400***	***55,000,000***
Hot Isostatic Pressed Waste Option						
P1A	Calcine SBW including New Waste Calcining Facility Upgrades (MACT) and Storage Tanks	2	***42***	***41***	***83***	***3,200,000***
P1B	Newly Generated Liquid Waste and Tank Farm Heel Waste Management	1	***48***	***46***	***94***	***3,600,000***
P18	Remote Analytical Lab	2	***88***	***85***	***170***	***6,600,000***
P59A	Calcine Retrieval and Transport	1	160	***160***	***320***	***12,000,000***
P71	Mixing and HIPing	5	200	***190***	***390***	***15,000,000***
P72	HIP HLW Interim Storage	3	150	***150***	***300***	***12,000,000***
P73A	Packaging and Loading HIP Waste at INTEC for Shipment to a Geologic Repository	2.5	7	7	14	***530,000***
P133	Waste Treatment Pilot Facility	2	***45***	***44***	***89***	***3,400,000***
Peak Year Employment (2036)			***450***	***440***	***890***	***34,000,000***
Direct Cement Waste Option						
P1A	Calcine SBW including New Waste Calcining Facility Upgrades (MACT) and Storage Tanks	2	***42***	***41***	***83***	***3,200,000***
P1B	Newly Generated Liquid Waste and Tank Farm Heel Waste Management	1	***48***	***46***	***94***	***3,600,000***
P18	Remote Analytical Lab	2	***88***	***85***	***170***	***6,600,000***

Table 5.3-1. Summary of employment and income from disposition of facilities that would be constructed under the waste processing alternatives[a,b] (continued).

Number	Project description	Duration of disposition activity[c] (years)	Employment			Total earnings ***(Dollars)***[d]
			Direct[c]	Indirect	Total	
	Direct Cement Waste Option (continued)					
P59A	Calcine Retrieval and Transport	1	160	***160***	***320***	***12,000,000***
P80	Mixing and FUETAP Grout	3	160	***160***	***320***	***12,000,000***
P81	Unseparated Cementitious HLW Interim Storage	3	290	***280***	***570***	***22,000,000***
P83A	Packaging & Loading of Cement Waste at INTEC for Shipment to a Geologic Repository	3.5	7	7	14	***530,000***
P133	Waste Treatment Pilot Facility	2	***45***	***44***	***89***	***3,400,000***
Peak Year Employment (2036)			***420***	***400***	***820***	***31,000,000***
	Early Vitrification Option					
P18	Remote Analytical Lab	2	***88***	***85***	***170***	***6,600,000***
P59A	Calcine Retrieval and Transport	1	160	***160***	***320***	***12,000,000***
P61	Vitrified HLW Interim Storage	3	250	***240***	***490***	***19,000,000***
P62A	Packaging/Loading Vitrified HLW at INTEC for Shipment to a Geologic Repository	3	10	10	20	***750,000***
P88	Vitrifying SBW and Calcine including MACT Upgrades	5	120	***110***	***230***	***8,800,000***
P90A	Packaging & Loading Vitrified SBW at INTEC for Shipment to the Waste Isolation Pilot Plant	1.5	7	7	14	***530,000***
P133	Waste Treatment Pilot Facility	2	***45***	***44***	***89***	***3,400,000***
Peak Year Employment (2036)			***320***	***310***	***630***	***24,000,000***
	Steam Reforming Option					
P13	***New Storage Tanks***	***2***	***19***	***18***	***37***	***1,400,000***
P59A	***Calcine Retrieval and Transport***	***1***	***160***	***160***	***320***	***12,000,000***
P117A	***Calcine Packaging and Loading to Hanford***	***2***	***52***	***50***	***100***	***3,900,000***
P2001	***NGLW Grout Facility***	***1***	***16***	***15***	***31***	***1,200,000***
P35E	***Grout Packaging and Loading for Offsite Disposal***	***2***	***30***	***29***	***59***	***2,300,000***
P2002A	***Steam Reforming***	***1***	***72***	***70***	***140***	***5,400,000***
Peak Year Employment (2036)			***280***	***270***	***550***	***21,000,000***

Table 5.3-1. Summary of employment and income from disposition of facilities that would be constructed under the waste processing alternatives [a,b] (continued).

Number	Project description	Duration of disposition activity[c] (years)	Employment			Total earnings ***(Dollars)***[d]
			Direct[c]	Indirect	Total	
	Minimum INEEL Processing Alternative[f]					
P18	Remote Analytical Lab	2	***88***	***85***	***170***	***6,600,000***
P24	Remote Analytical Lab	2.8	***31***	30	***61***	***2,300,000***
P25A	Packaging and Loading Vitrified HLW at INTEC for Shipment to NGR	1	2	2	4	***150,000***
P27	Vitrified Product Interim Storage	3	140	***130***	***270***	***10,000,000***
P59A	Calcine Retrieval and Transport	1	160	***160***	***320***	***12,000,000***
P111	SBW and Newly Generated Liquid Waste Treatment with CsIX to CH TRU Grout and LLW Grout	1	100	***100***	210	***7,800,000***
P112A	Packaging and Loading CH-TRU for Transport to the Waste Isolation Pilot Plant	4.5	7	7	14	***530,000***
P117A	Packaging and Loading Calcine for Transport to Hanford	2	***52***	***50***	***100***	***3,900,000***
P133	Waste Treatment Pilot Facility	2	***45***	***44***	***89***	***3,400,000***
Peak Year Employment (2026)			***320***	***310***	***640***	***24,000,000***
	Vitrification without Calcine Separations Option					
P13	***New Storage Tanks***	***2***	***19***	***18***	***37***	***1,400,000***
P18	***New Analytical Laboratory***	***2***	***88***	***85***	***170***	***6,600,000***
P59A	***Calcine Retrieval and Transport***	***1***	***160***	***160***	***320***	***12,000,000***
P61	***Vitrified HLW Interim Storage***	***3***	***250***	***240***	***490***	***19,000,000***
P62A	***Packaging and Loading Vitrified HLW at INTEC for Shipment to a Geologic Repository***	***3***	***10***	***10***	***20***	***750,000***
P88	***Vitrification with MACT***	***5***	***120***	***110***	***230***	***8,800,000***
P133	***Waste Treatment Pilot Plant***	***2***	***45***	***44***	***89***	***3,400,000***
Peak Year Employment (2036)			***340***	***330***	***670***	***26,000,000***

Table 5.3-1. Summary of employment and income from disposition of facilities that would be constructed under the waste processing alternatives [a,b] (continued).

Number	Project description	Duration of disposition activity[c] (years)	Employment			Total earnings ***(Dollars)***[d]
			Direct[c]	Indirect	Total	
Vitrification with Calcine Separations Option						
P9A	***Full Separations***	***3***	***220***	***220***	***440***	***17,000,000***
P9C	***Grout Plant***	***2.5***	***120***	***120***	***230***	***9,000,000***
P13	***New Storage Tanks***	***2***	***19***	***18***	***37***	***1,400,000***
P18	***New Analytical Laboratory***	***2***	***88***	***85***	***170***	***6,600,000***
P24	***Vitrified Product Interim Storage***	***2.8***	***31***	***30***	***61***	***2,300,000***
P25A	***Packaging and Loading Vitrified HLW at INTEC for Shipment to a Geologic Repository***	***<1***	***2***	***2***	***4***	***150,000***
P35E	***Grout Packaging and Loading for Offsite Disposal***	***2***	***30***	***29***	***59***	***2,300,000***
P59A	***Calcine Retrieval and Transport***	***1***	***160***	***160***	***320***	***12,000,000***
P88	***Vitrification with MACT***	***5***	***120***	***110***	***230***	***8,800,000***
P133	***Waste Treatment Pilot Plant***	***2***	***45***	***44***	***89***	***3,400,000***
Peak Year Employment (2036)			***710***	***690***	***1,400***	***54,000,000***

a. The EIS analyzes treatment of post-2005 newly generated liquid waste as mixed transuranic waste/SBW for comparability of impacts between alternatives. The newly generated liquid waste could be treated in the same facility as the mixed transuranic waste/SBW or DOE could construct a separate facility to grout the newly generated liquid waste.

b. HLW storage-related projects were eliminated from the peak year analysis because storage timing and durations are dependent on outside factors such as the completion of the national geologic repository. It would be difficult to form estimates based on these unknowns.

c. Source: Data from Project Data Sheets in Appendix C.6.

d. Source: IDOL (2002) presented in 2000 dollars.

e. Table presents bounding scenario for low-level waste fraction disposal.

f. 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 disposition of the Tank Farm and bin sets by facility disposition alternative.[a]

Facility	Annual employment and income (***2000***$)	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	***280***	20	***12***	***11***	***49***
	Indirect employment	***270***	***19***	***12***	***11***	***47***
	Total employment	***550***	***39***	***24***	***22***	***96***
	Total income	***21,000,000***	***1,500,000***	***900,000***	***830,000***	***3,700,000***
Bin sets	Direct employment	***58***	***55***	***27***	***11***	***49***
	Indirect employment	***56***	***53***	***26***	***11***	***47***
	Total employment	***110***	110	***53***	***22***	***96***
	Total income	***4,400,000***	***4,100,000***	***2,000,000***	***830,000***	***3,700,000***

a. Source: Data from Project Data Sheets in Appendix C.6.

Table 5.3-3. Summary of annual employment and income for disposition of existing HLW ***management*** facility groups.[a]

Facility	Annual employment			Annual income
	Direct	Indirect	Total	(***2000***$)
Tank Farm-related facilities (ancillary facilities)	2	***2***	***4***	***150,000***
Bin set-related facilities (ancillary facilities)	<1	***<1***	<1	0
Process Equipment Waste Evaporator & related facilities	***50***	***48***	***98***	***3,800,000***
Fuel Processing Building and related facilities				
Performance-based closure	40	***39***	***79***	***3,000,000***
Closure to landfill standards	32	***31***	***63***	***2,400,000***
Fluorinel and Storage Facility and related facilities	54	***52***	***110***	***4,100,000***
Transport line group	3	3	6	***230,000***
New Waste Calcining Facility				
Performance-based closure	47	***45***	***92***	***3,500,000***
Closure to landfill standards	44	***43***	***87***	***3,300,000***
Remote Analytical Laboratory	7	7	14	***530,000***

a. Source: Data from Project Data Sheets in Appendix C.6.

As can be seen from the tables for existing facilities, the largest number of jobs would be required for Tank Farm Clean Closure (about ***280*** workers). The other scenarios would require relatively smaller numbers of workers and would in all cases be much fewer than the workers required for disposition ***of*** the proposed new facilities.

For both new and existing facilities, DOE would retrain and reassign workers to conduct disposition 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 disposition missions, reductions in the number of jobs would probably occur unless new missions have been identified.

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 ***management*** facilities are no longer operational. Section 3.2 provides descriptions of the facility disposition alternatives being considered and explains how the various HLW ***management*** facilities would be closed. HLW ***management*** 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

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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 ***management*** 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-***3***. 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). ***Table 5.3-5*** 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-***1*** 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. ***(The applicable offsite dose limit is 10 millirem per year, as specified in 40 CFR 61.92; the occupational standard that applies to onsite doses is 5,000 millirem per year, as specified in 10 CFR 835.202.)*** Nonradiological impacts are illustrated in Figures 5.3-***2*** (for criteria pollutants) and 5.3-***3*** (for toxic air pollutants). When baseline levels are added to projected nonradiological impacts, criteria pollutant levels would remain well below applicable standards ***(IDAPA 58.01.01.577)*** for all alternatives. Toxic air pollutant levels would also well below reference levels ***(IDAPA 58.01.01.585-586)*** for all alternatives.

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Table 5.3-4. Summary of annual and cumulative emissions from disposition of facilities that would be constructed under the waste processing alternatives.

	Maximum 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
Steam Reforming Option	***2.5×10^{-7}***	***4.1×10^{-7}***	***160***	***250***	***190***	***290***	***3.6×10^{3}***	***5.5×10^{3}***	***83***	***160***
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
Direct Vitrification Alternative										
Vitrification without Calcine Separations Option	***2.9×10^{-7}***	***7.3×10^{-7}***	***360***	***1.1×10^{3}***	***410***	***$1.2\ \times10^{3}$***	***8.0×10^{3}***	***2.4×10^{4}***	***160***	***510***
Vitrification with Calcine Separations Option	***4.0×10^{-7}***	***1.1×10^{-6}***	***490***	***1.4×10^{3}***	***560***	***1.6×10^{3}***	***1.1×10^{4}***	***3.1×10^{4}***	***210***	***650***

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 ***Table*** 5.3-***5*** 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-***6***.

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-***6***.

g. Assumes "just-in-time" shipping scenario; nonradiological emissions impacts of the interim storage shipping scenario would be somewhat less.

- New Information -

Table 5.3-5. Comparison of criteria pollutant emission rates (tons/year) for disposition of facilities associated with the waste processing alternatives.

Alternative	Sulfur dioxide	Particulate matter	Carbon monoxide	Nitrogen dioxide	Volatile organic compounds
No Action Alternative	0	0	0	0	0
Continued Current Operations Alternative	10	3.7	66	56	12
Separations Alternative					
Full Separations Option	34	12	220	190	39
Planning Basis Option	42	15	260	230	47
Transuranic Separations Option	29	10	180	160	32
Non-Separations Alternative					
Hot Isostatic Pressed Waste Option	30	11	190	160	34
Direct Cement Waste Option	34	12	210	180	38
Early Vitrification Option	27	10	170	150	31
Steam Reforming Option	12	4.1	73	63	13
Minimum INEEL Processing Alternative	24	8.3	150	130	27
Direct Vitrification Alternative					
Vitrification without Calcine Separations Option	25	9.0	160	140	29
Vitrification with Calcine Separations Option	35	12	220	190	39

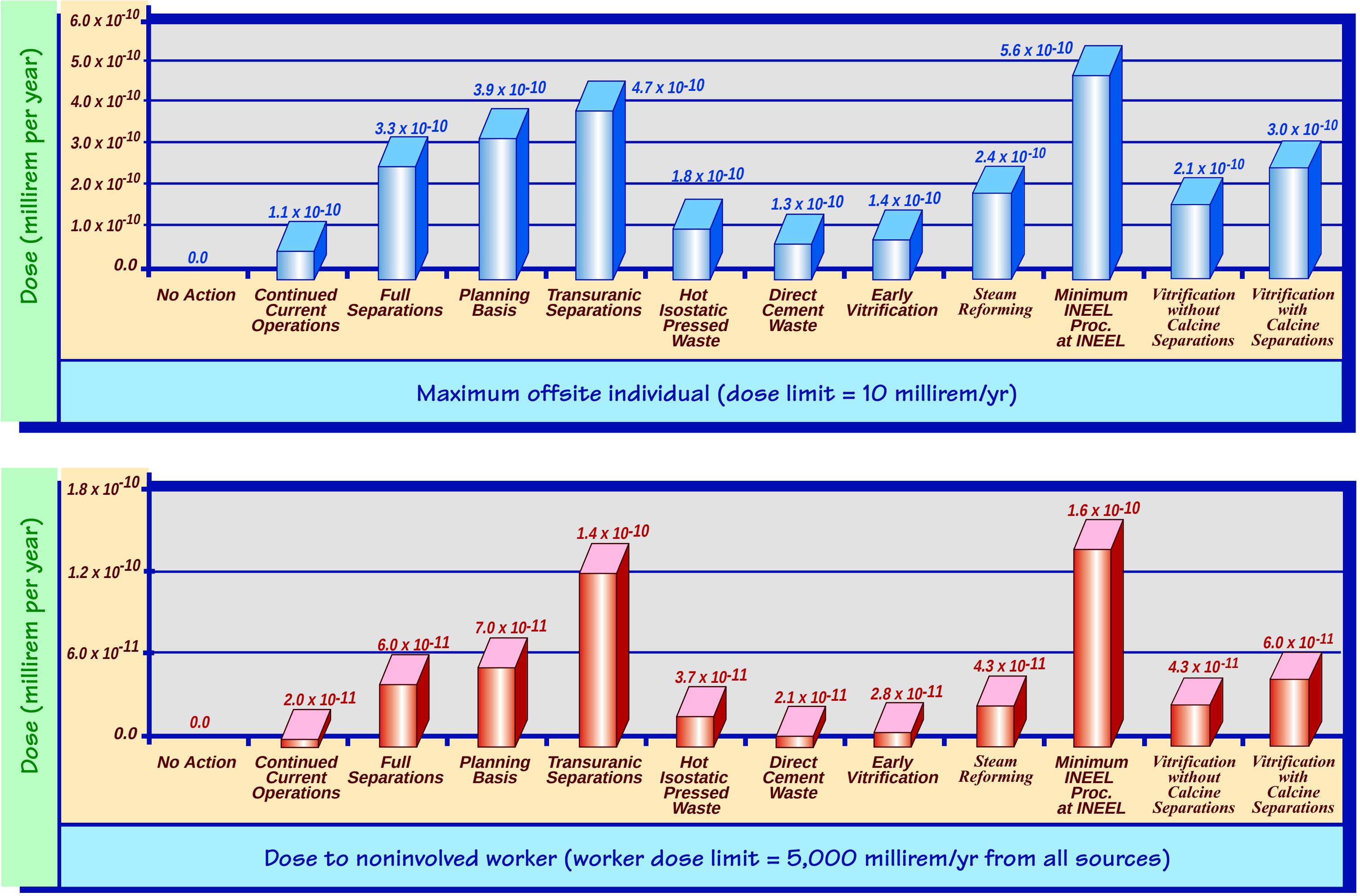


FIGURE 5.3-*1*. (1 of 2)
Comparison of air pathway doses for disposition of facilities associated with waste processing alternatives.

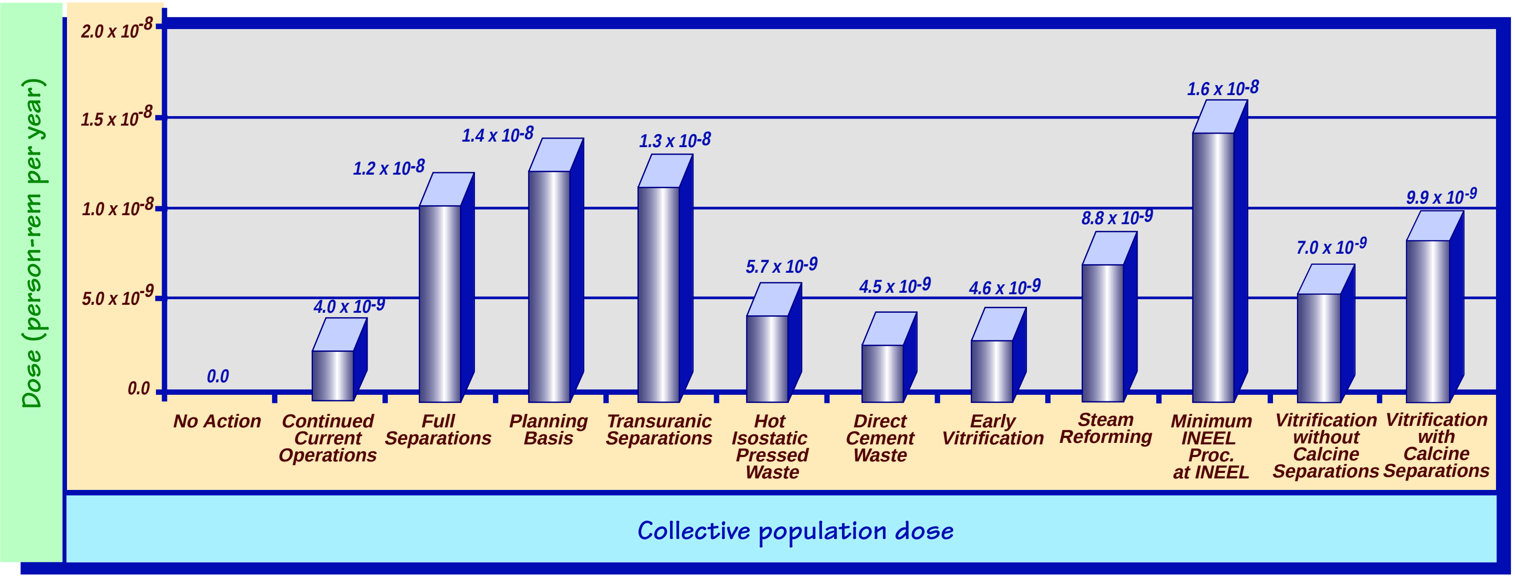


FIGURE 5.3-1. (2 of 2)
Comparison of air pathway doses for disposition of facilities associated with waste processing alternatives.

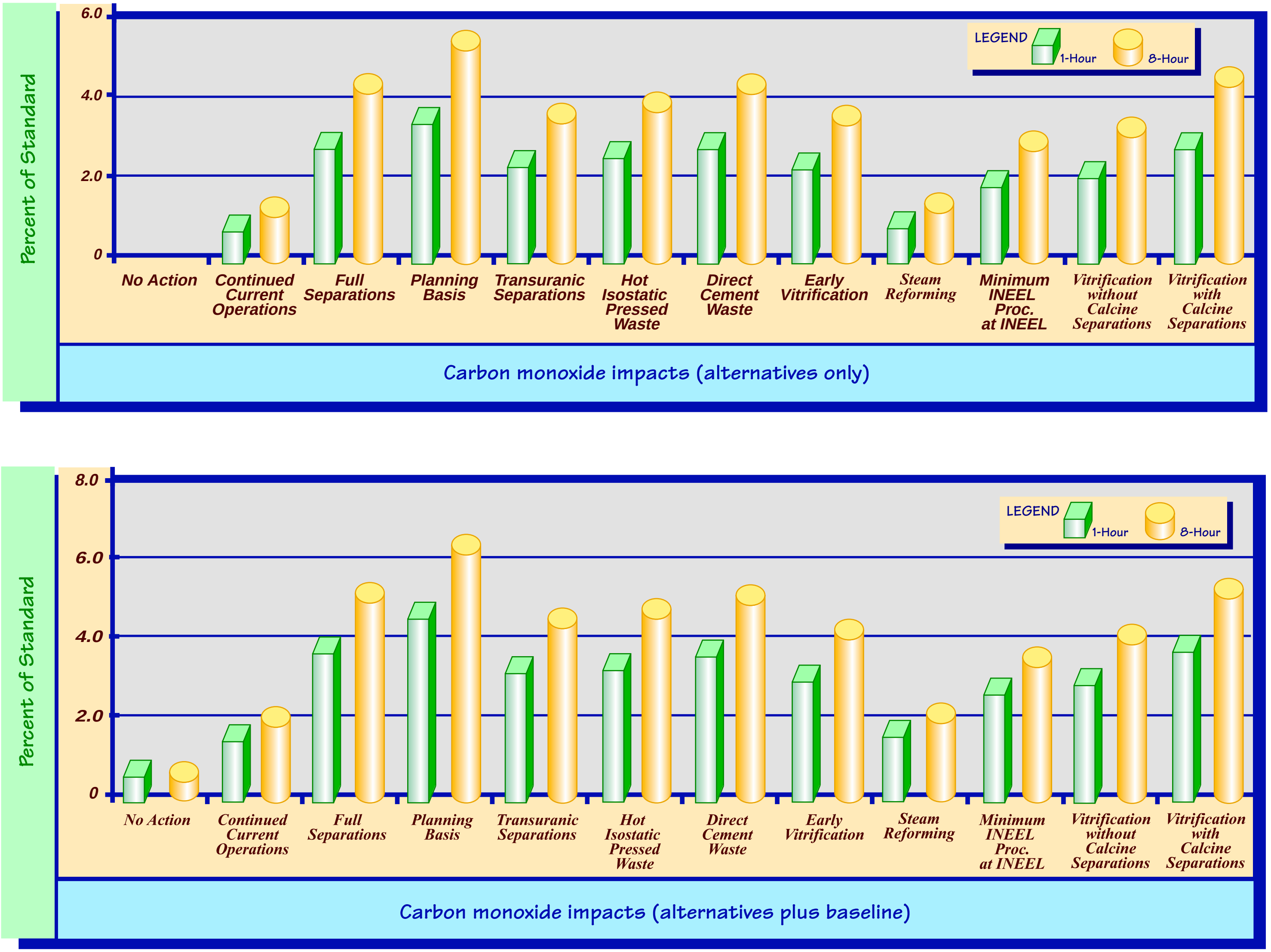
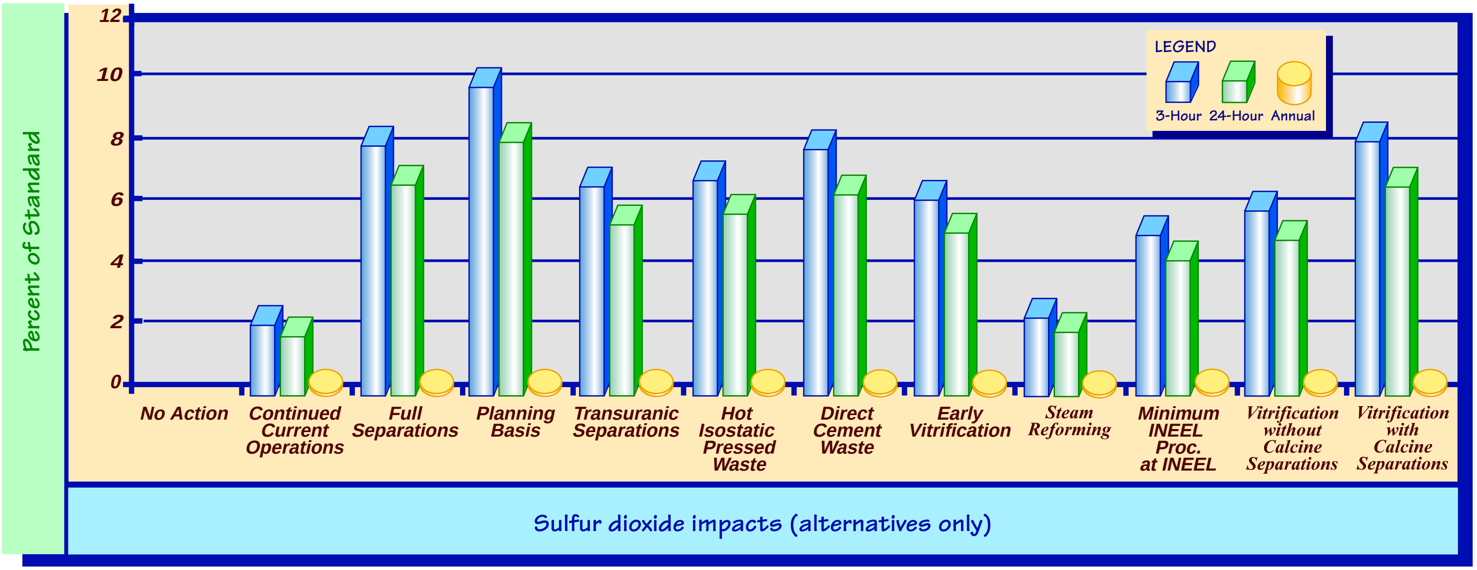
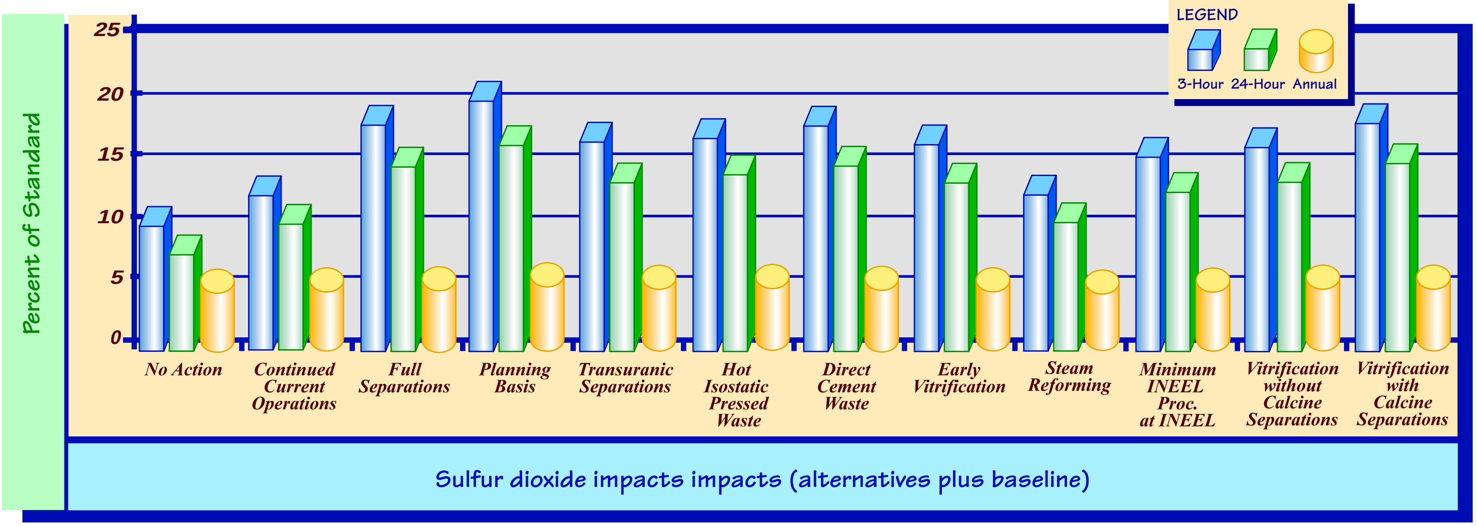


FIGURE 5.3-2. (1 of 4)
Comparison of criteria air pollutant impacts for disposition of facilities associated with waste processing alternatives.

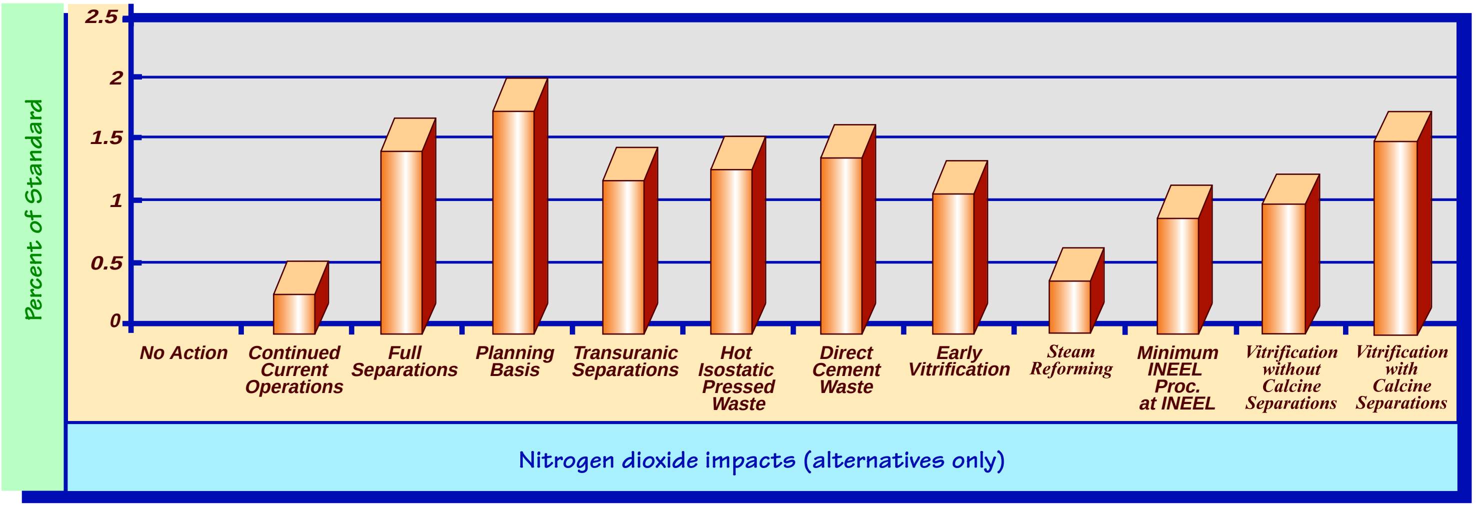


Sulfur dioxide impacts (alternatives only)

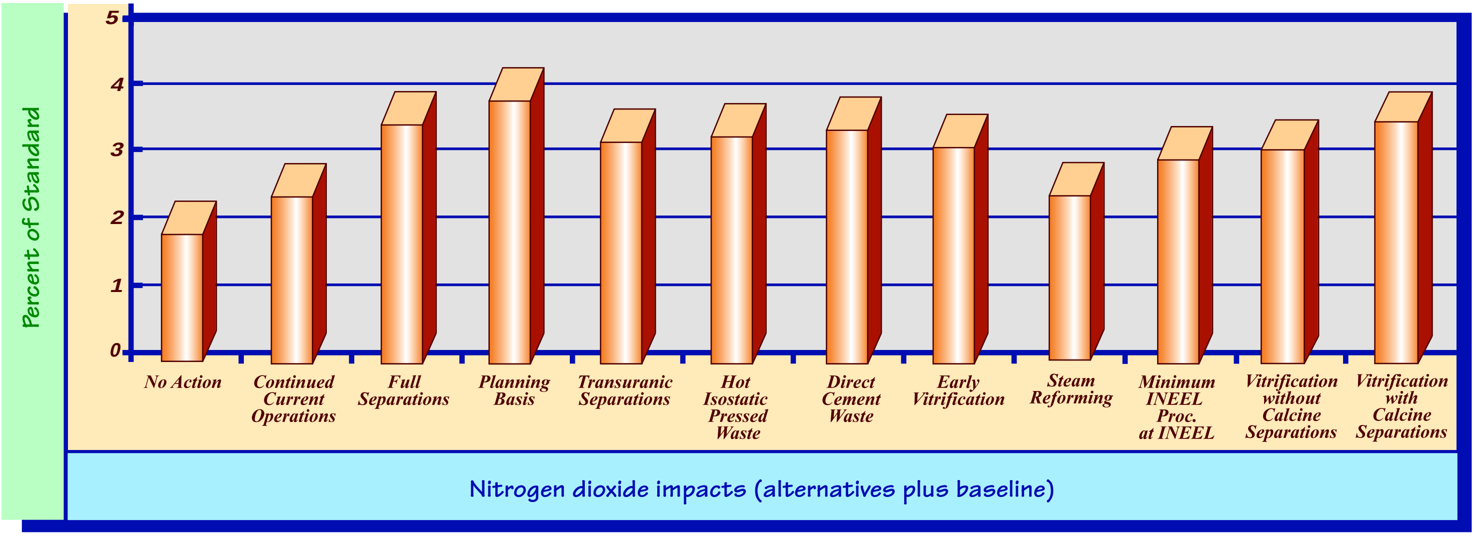


Sulfur dioxide impacts impacts (alternatives plus baseline)

FIGURE 5.3-2. (2 of 4)
Comparison of criteria air pollutant impacts for disposition of facilities associated with waste processing alternatives.

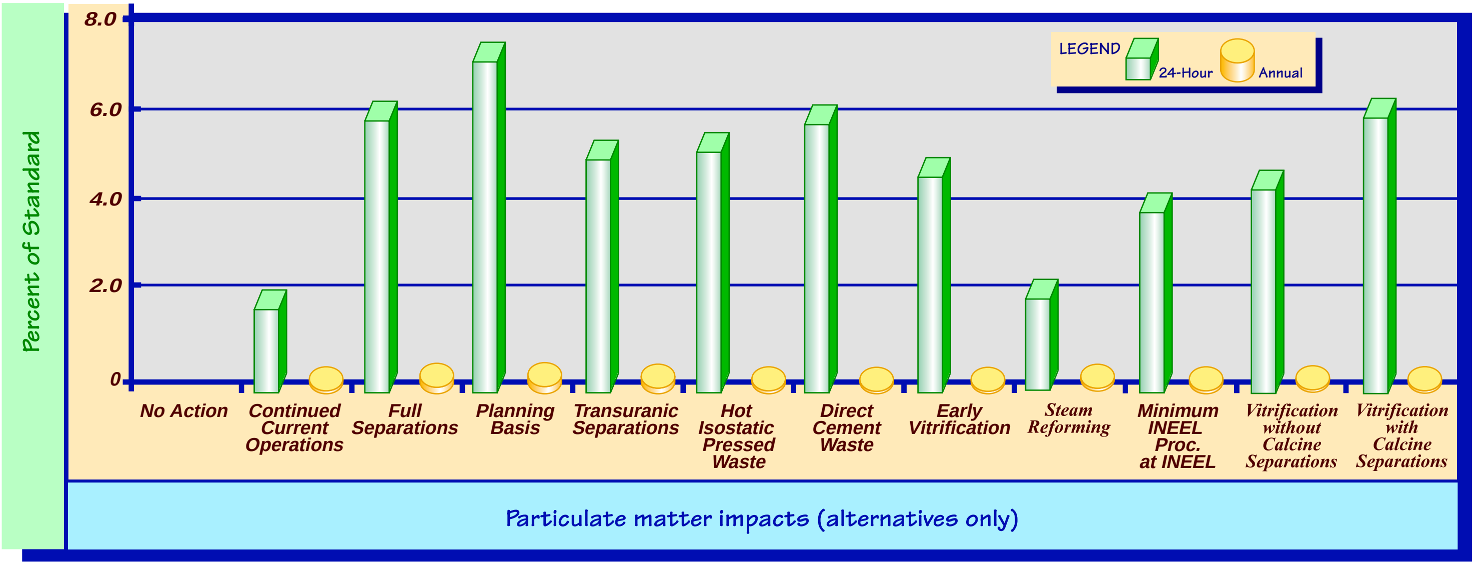


Nitrogen dioxide impacts (alternatives only)



Nitrogen dioxide impacts (alternatives plus baseline)

FIGURE 5.3-2. (3 of 4)
Comparison of criteria air pollutant impacts for disposition of facilities associated with waste processing alternatives.



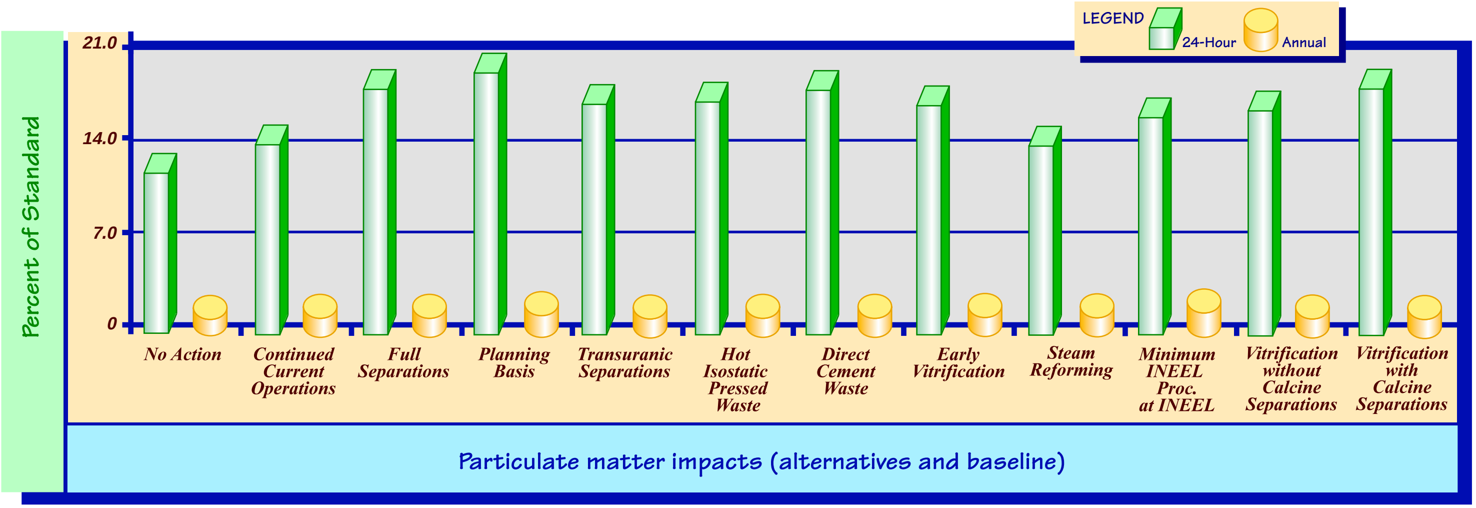
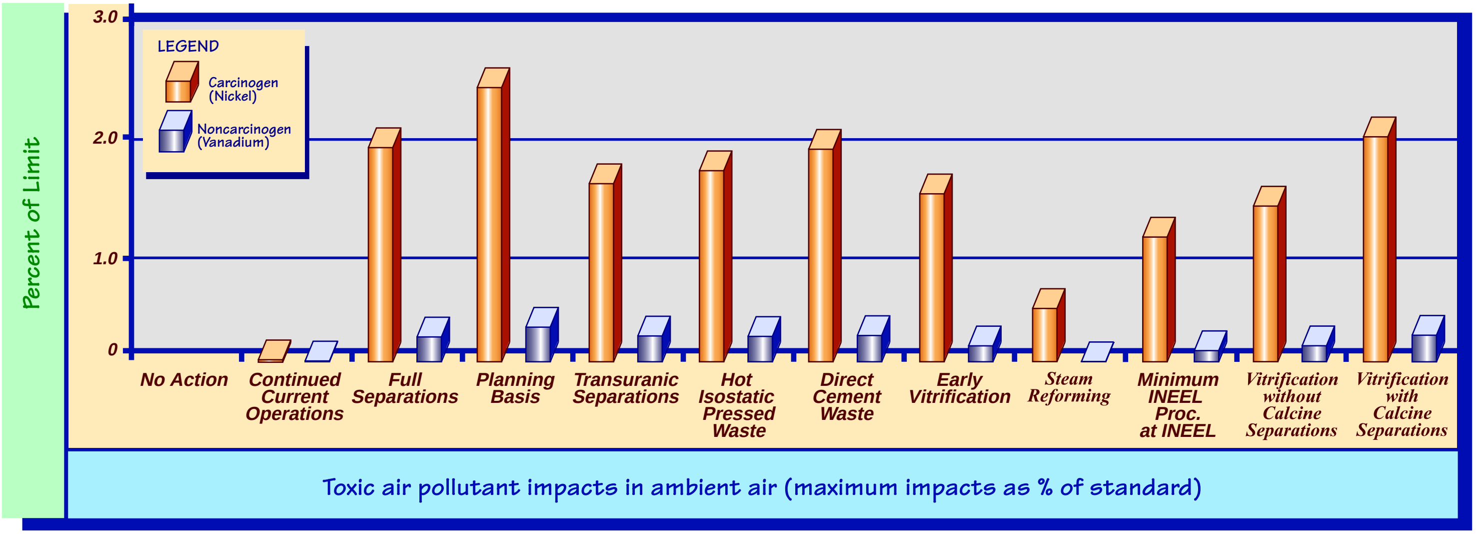
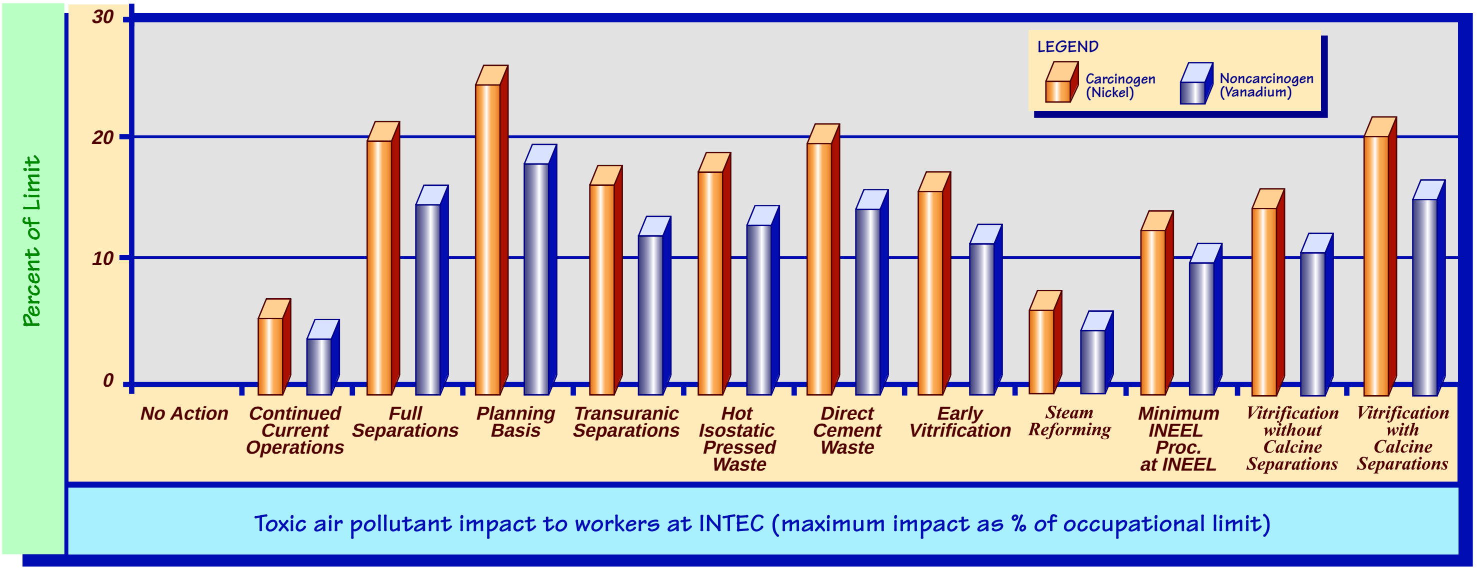


FIGURE 5.3-2. (4 of 4)
Comparison of criteria air pollutant impacts for disposition of facilities associated with waste processing alternatives.



Toxic air pollutant impacts in ambient air (maximum impacts as % of standard)



Toxic air pollutant impact to workers at INTEC (maximum impact as % of occupational limit)

FIGURE 5.3-3.
Toxic air pollutants impacts for disposition of facilities associated with waste processing 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-***3***). 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-***3***, 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-***6***. 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-***7***.

DOE estimated emissions for the maximum year and over the entire duration of each project. 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-***4*** through 5.3-***6*** compare the results of the assessments for the Tank Farm, bin sets, and related facilities under the alternative closure scenarios. Figures 5.3-***7*** through 5.3-***9*** show the radiological and nonradiological impacts of dispositioning other existing facilities. All radiological and nonradiological ambient air impacts would be well below applicable standards.

Table 5.3-6. Summary of annual and cumulative emissions from disposition of the Tank Farm and bin sets under alternative closure scenarios.

			Maximum annual and total emissions [a]			
Facility	Pollutant	Units	Clean closure	Performance-based closure	Closure to landfill standards	Performance-based closure with Class A or C grout disposal
Tank Farm	Radionuclides[b]	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[c]	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[d]	Tons per year	1.5×10^{3}	180	130	110
		Total tons	2.6×10^{4}	3.0×10^{3}	2.1×10^{3}	***2.2×10^{3}***
	Fugitive dust	Tons per year	130	19	19	37
		Total tons	2.2×10^{3}	150	***150***	670
Bin Sets	Radionuclides[b]	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}	$2.4x10^{-5}$	2.5×10^{-6}
	Criteria pollutants[c]	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[d]	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. 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.

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.

Table 5.3-7. Summary of maximum annual and cumulative emissions from decontaminating and decommissioning other existing facilities associated with HLW management.

Facility Group[b]	Maximum annual emission rate and total emissions[a]									
	Radionuclides[c]		Criteria pollutants[d]		Toxic air pollutants		Carbon dioxide[e]		Dust	
	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	***7.3×10^{-8}***	3.8×10^{-7}	***65***	***340***	***0.036***	***0.19***	***1.3×10^{3}***	***6.7×10^{3}***	0.72	4.3
Bin set-related (ancillary) facilities	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	***1.0×10^{-7}***	***5.5×10^{-7}***	***440***	2.5×10^{3}	***0.25***	1.4	***8.8×10^{3}***	***5.0×10^{4}***	***66***	390
Fuel Processing Building and Related Facilities										
Performance-based closure	1.7×10^{-7}	1.7×10^{-6}	150	1.5×10^{3}	0.084	0.84	***3.0×10^{3}***	***3.0×10^{4}***	71	710
Closure to landfill standards	1.7×10^{-7}	1.7×10^{-6}	150	1.5×10^{3}	0.084	0.84	***3.0×10^{3}***	***3.0×10^{4}***	71	710
FAST and Related Facilities	5.8×10^{-8}	3.5×10^{-7}	50	300	0.028	0.17	1.1×10^{3}	***6.0×10^{3}***	120	690
Transport Lines Group	–	–	36	36	-	-	750	750	7.2	7.2
New Waste Calcining Facility[f]										
Performance-based closure	5.8×10^{-8}	1.7×10^{-7}	50	150	0.028	0.84	***1.0×10^{3}***	3.1×10^{3}	63	190
Closure to landfill standards	5.8×10^{-8}	1.7×10^{-7}	50	150	0.028	0.84	***1.0×10^{3}***	3.1×10^{3}	63	190
Remote Analytical Laboratory	2.9×10^{-8}	1.7×10^{-7}	33	200	-	-	680	***4.1×10^{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-***3*** 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. Radionuclide emissions would consist primarily of strontium-90/yttrium-90 and cesium-137, with much smaller amounts of transuranic isotopes.

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.

f. The decontamination and decommissioning of this facility is also included in some of the waste processing alternatives presented in Table 5.3-4.

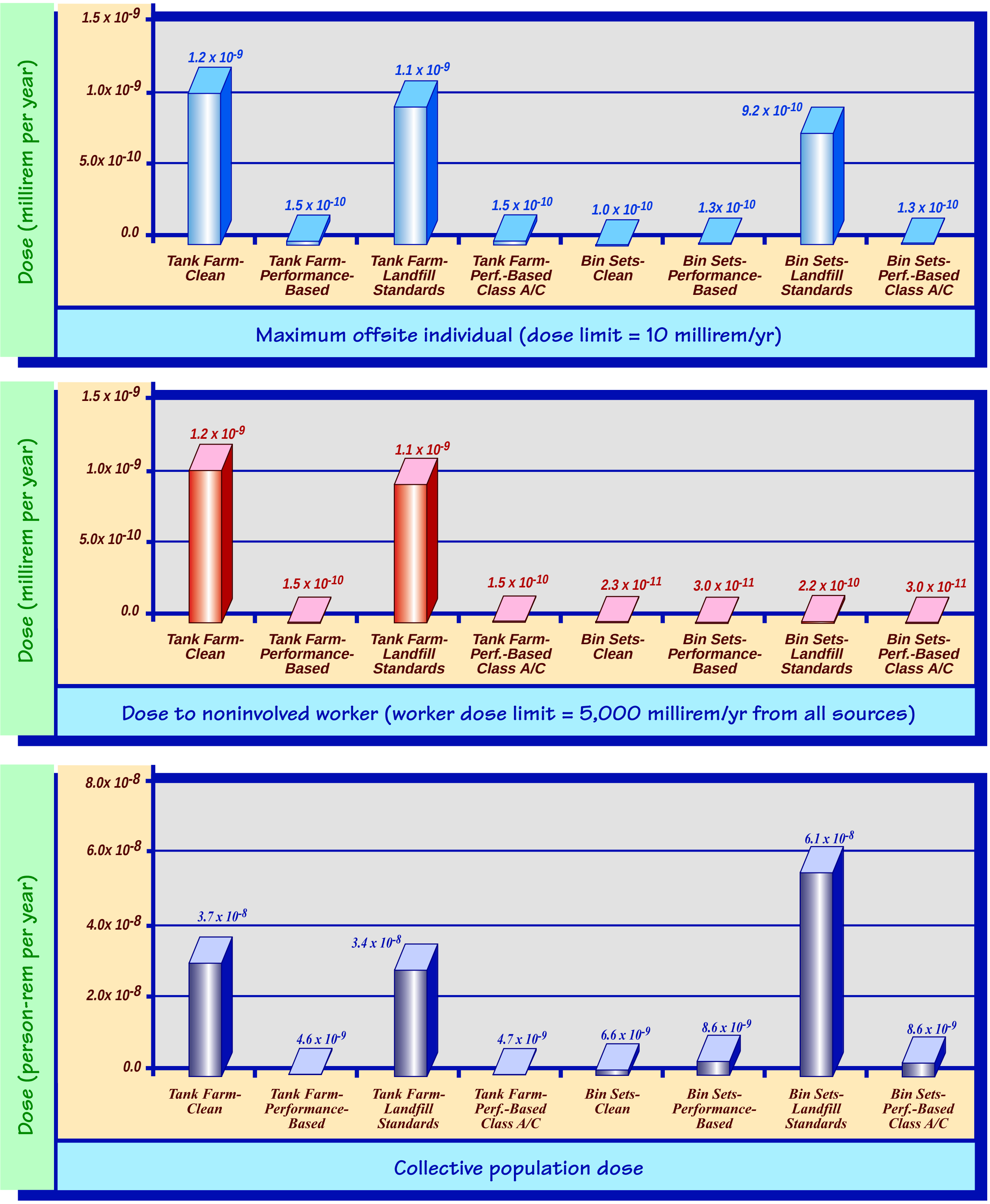
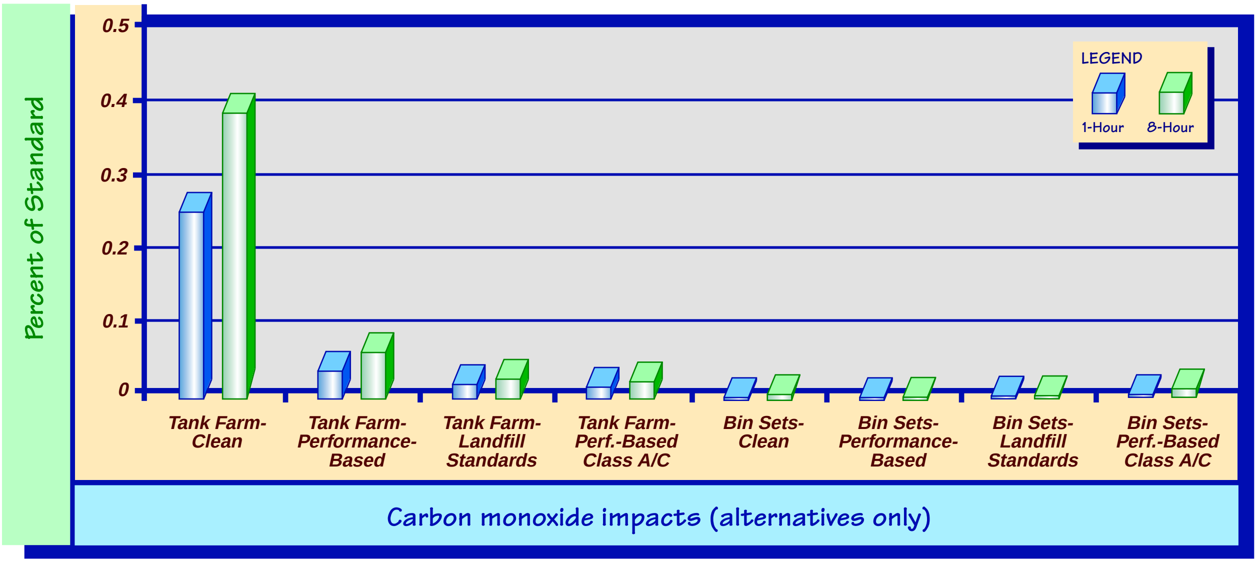


FIGURE 5.3-4.
Air pathway doses by Tank Farm and bin set closure option.



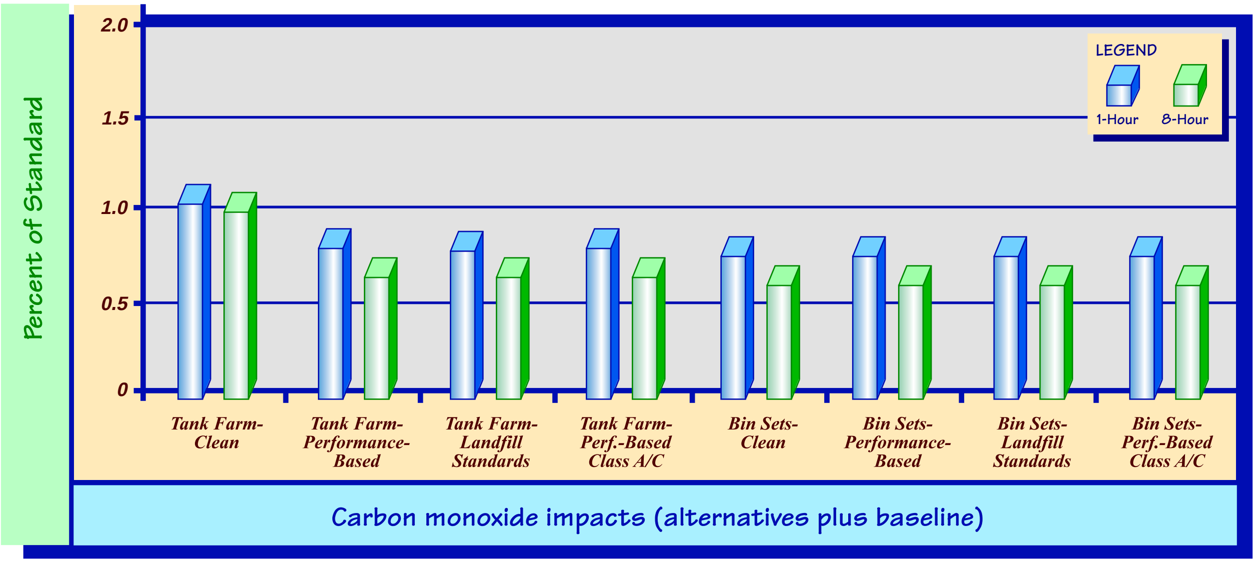
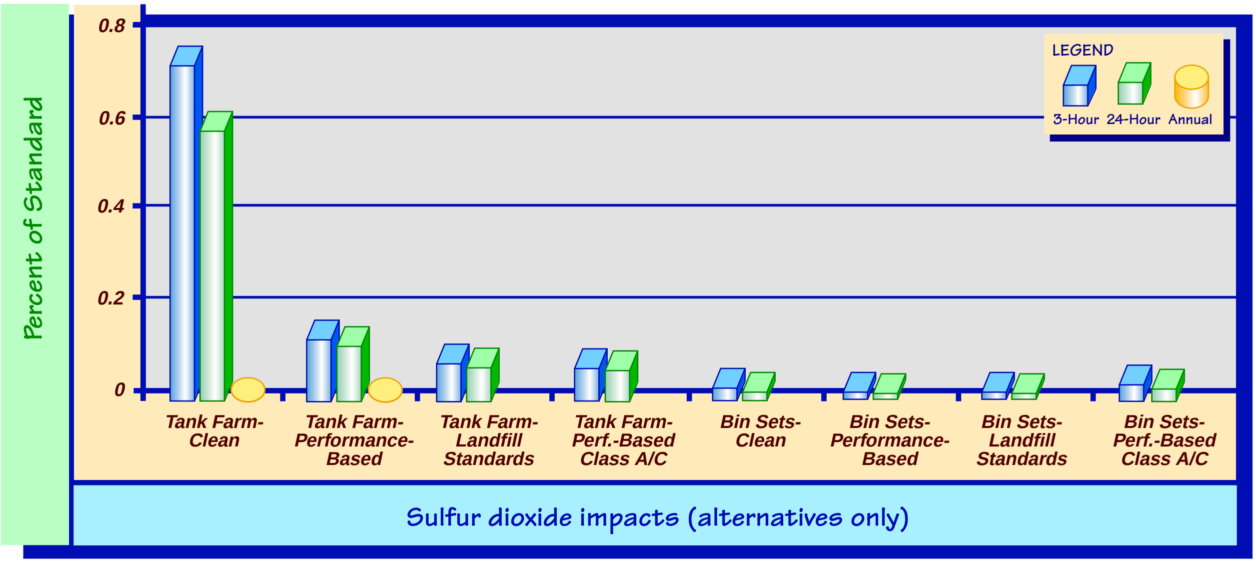


FIGURE 5.3-5. (1 of 4)
Criteria air pollutant impacts by Tank Farm and bin set closure alternative.



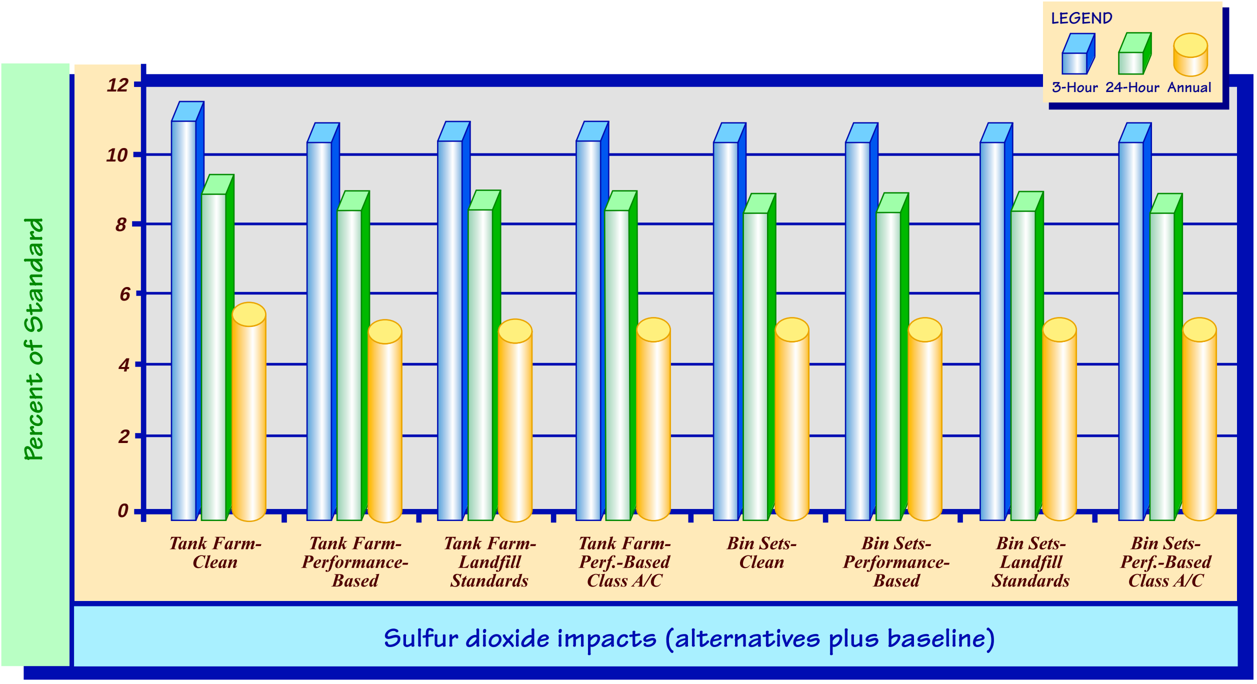
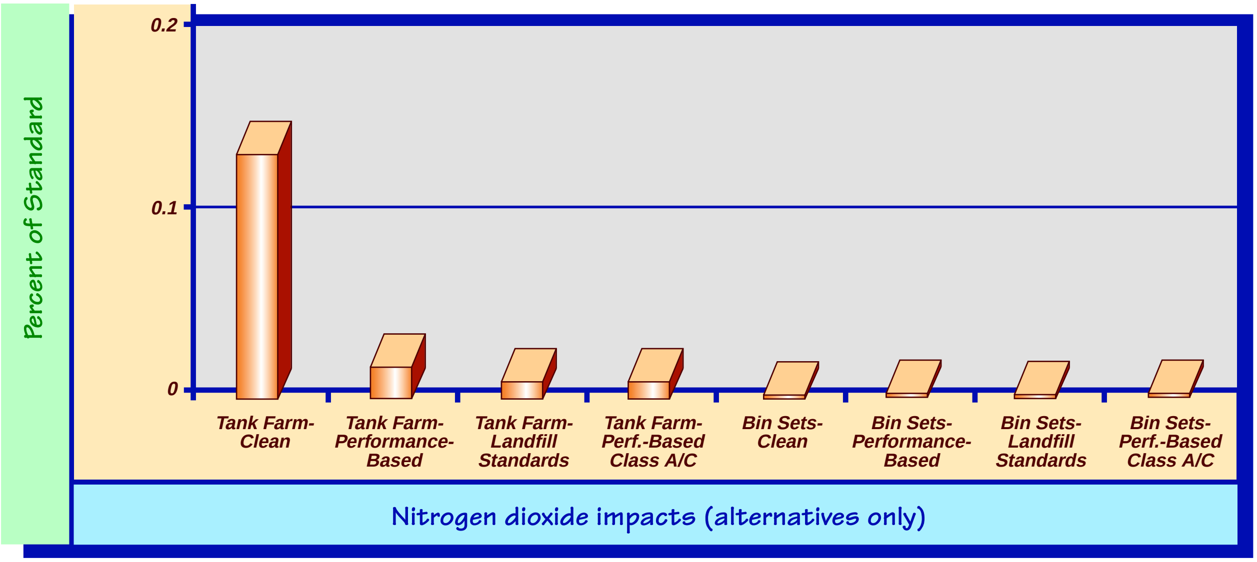


FIGURE 5.3-5. (2 of 4)
Criteria air pollutant impacts by Tank Farm and bin set closure alternative.



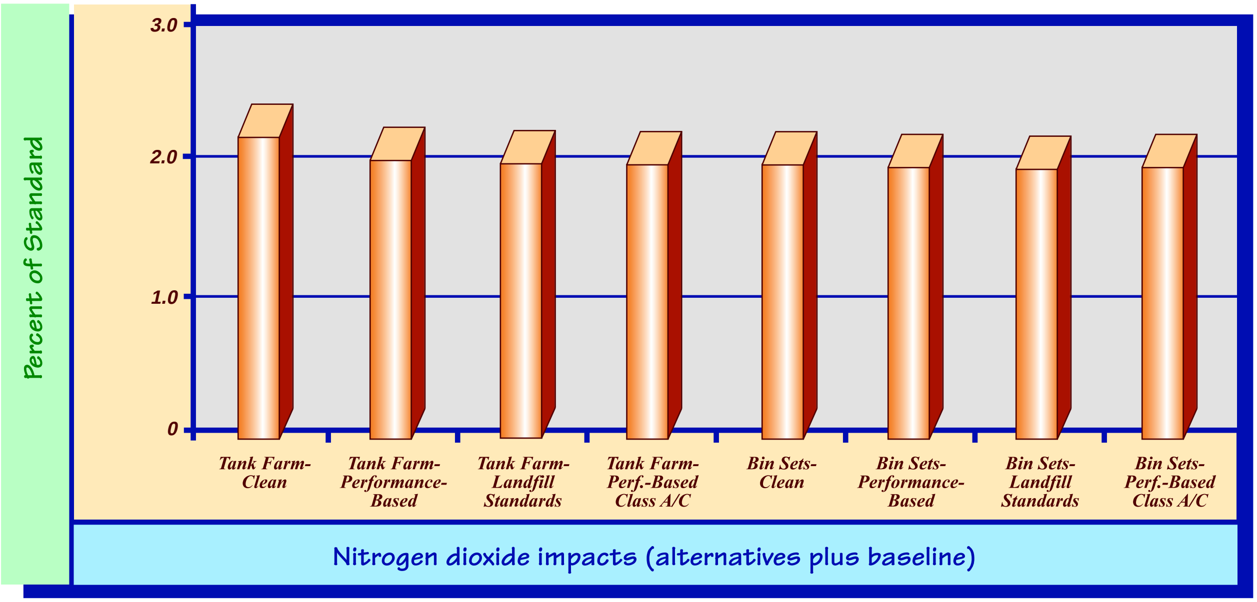
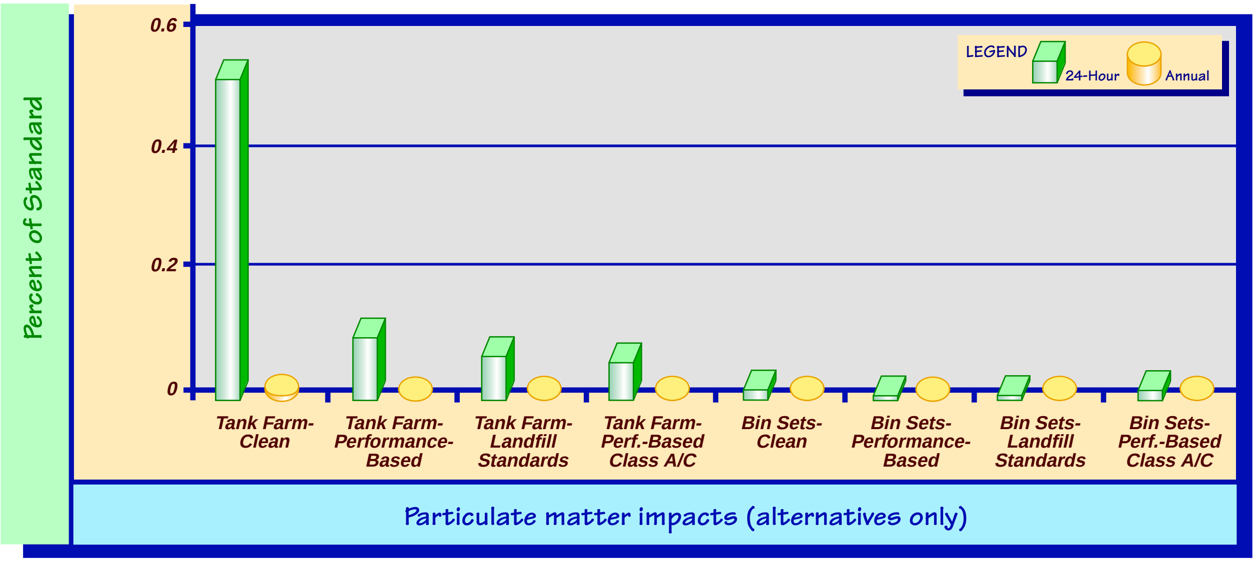


FIGURE 5.3-5. (3 of 4)
Criteria air pollutant impacts by Tank Farm and bin set closure alternative.



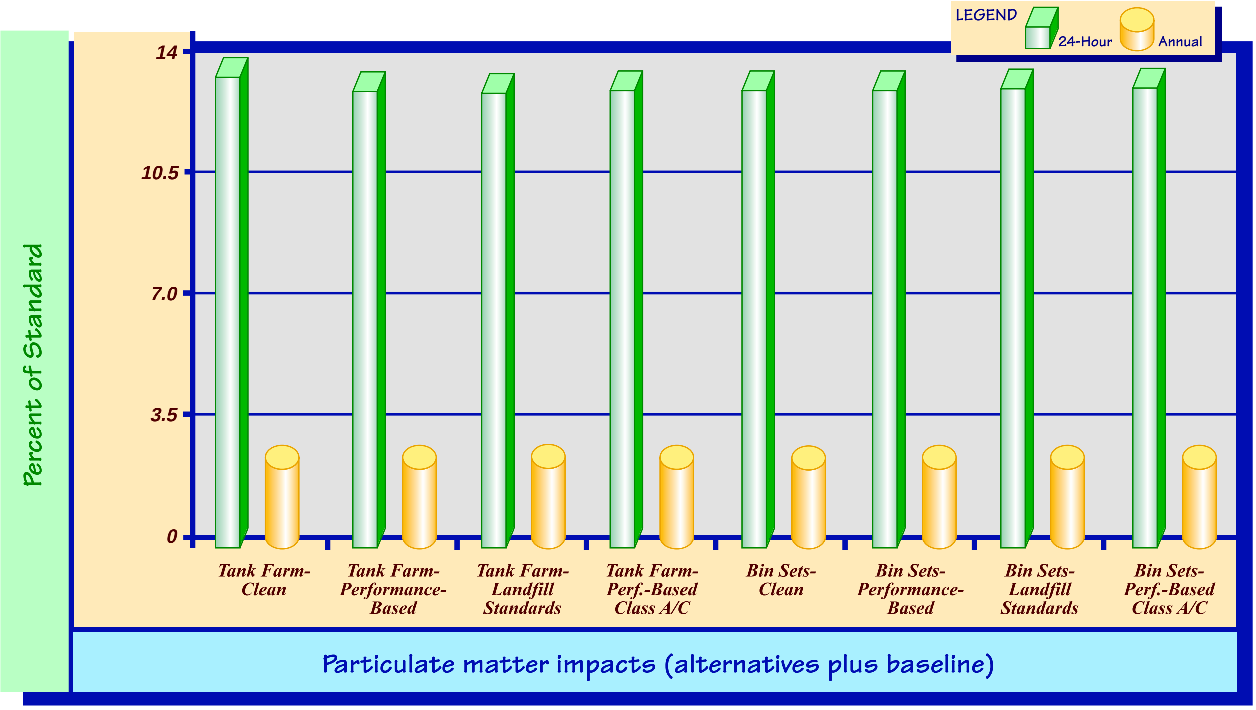
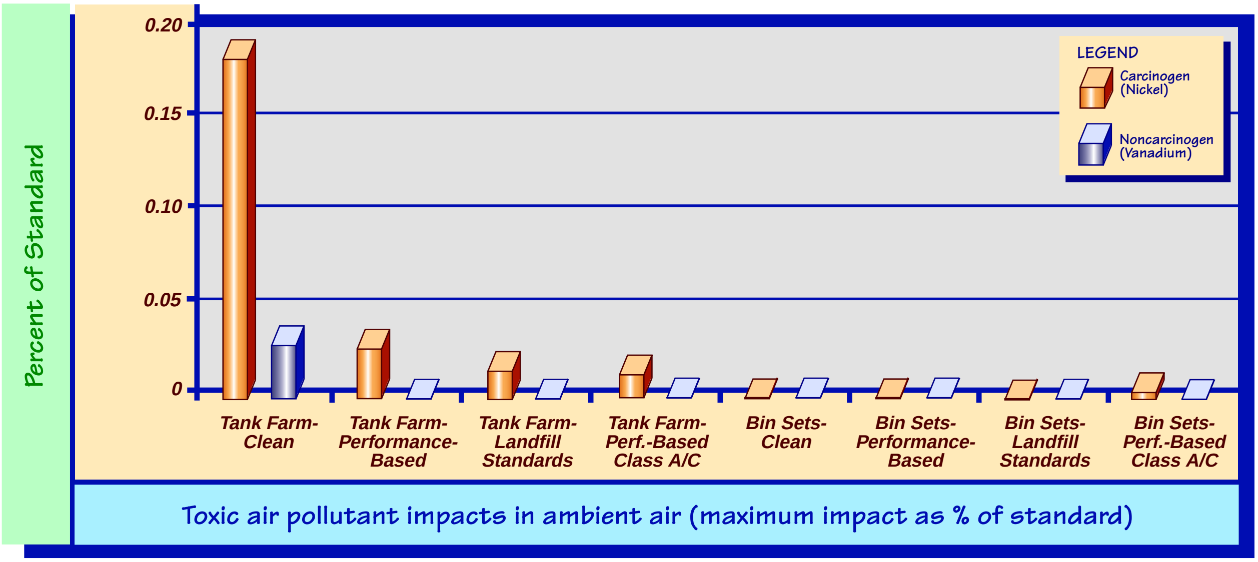


FIGURE 5.3-5. (4 of 4)
Criteria air pollutant impacts by Tank Farm and bin set closure alternative.



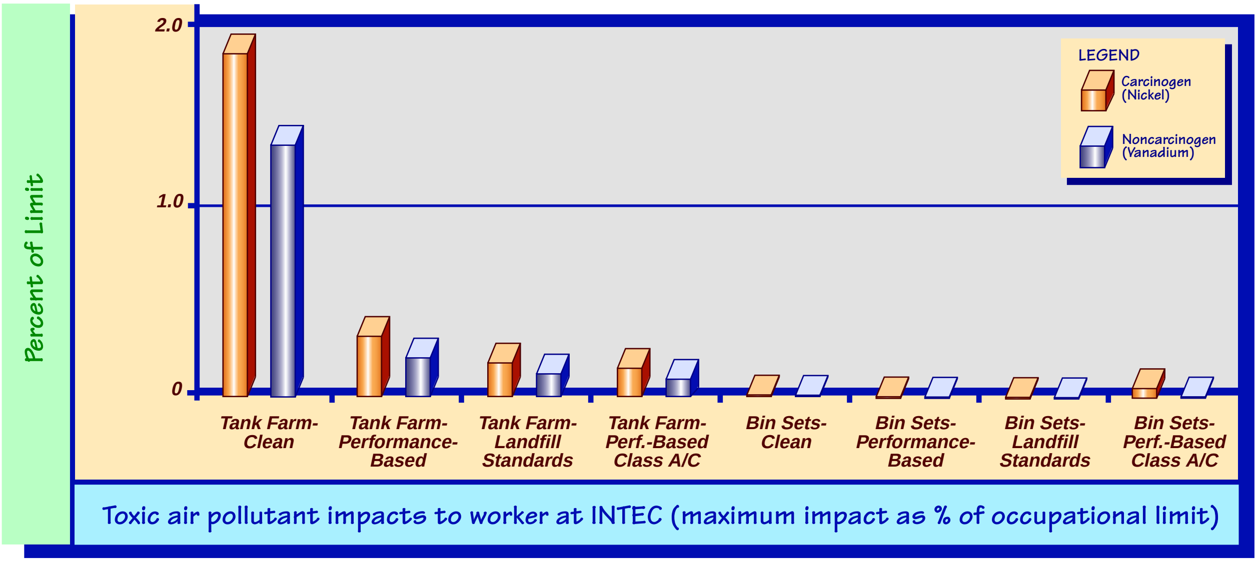


FIGURE 5.3-6.
Toxic air pollutant impacts for Tank Farm and bin set closure options.

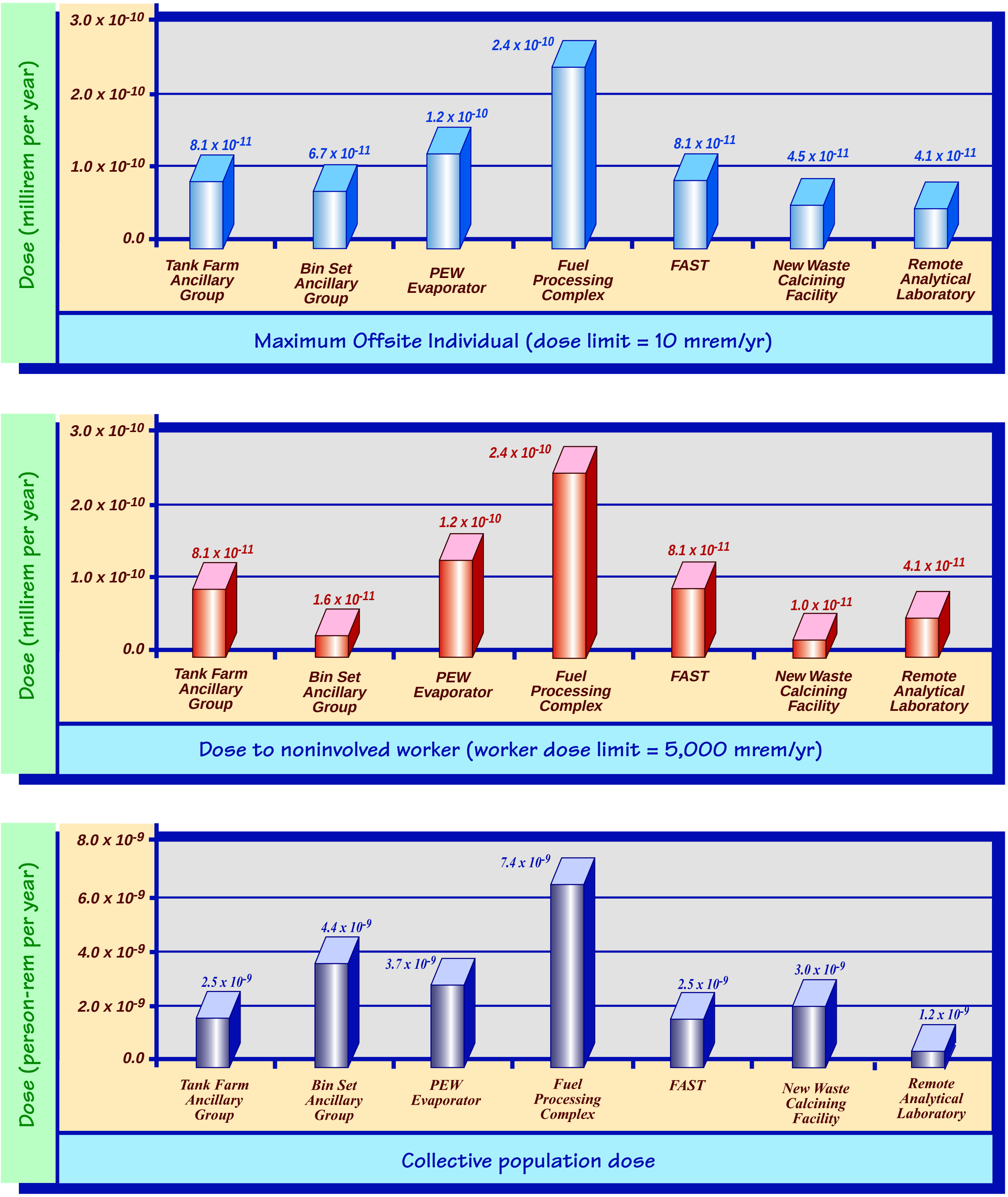
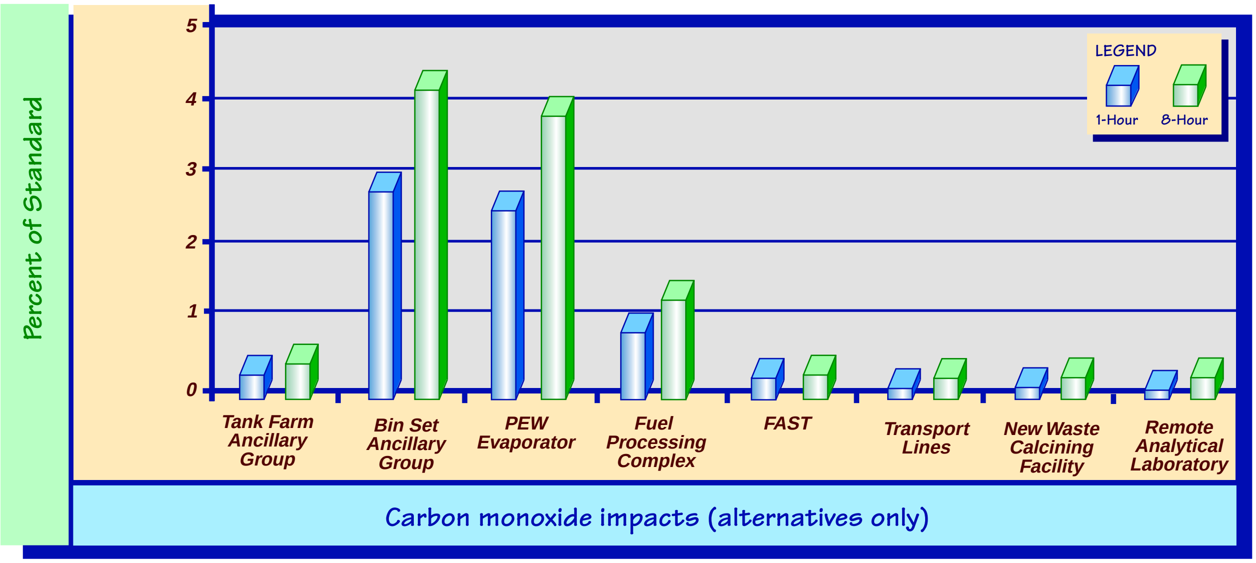


FIGURE 5.3-7.
Air pathway doses for disposition of existing INTEC facilities associated with HLW management.



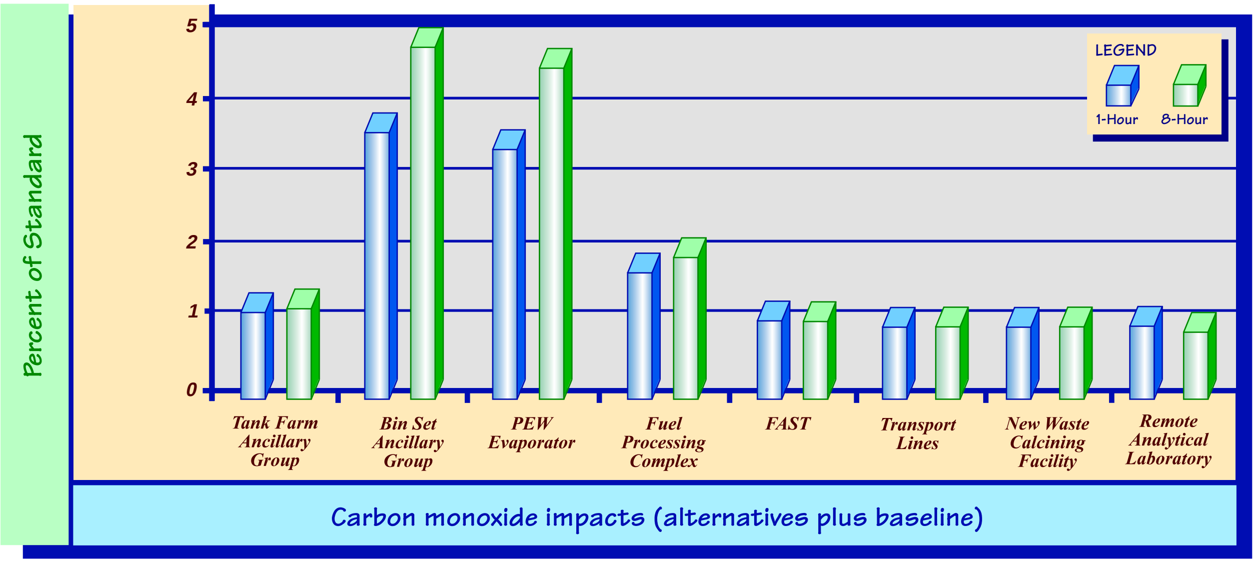
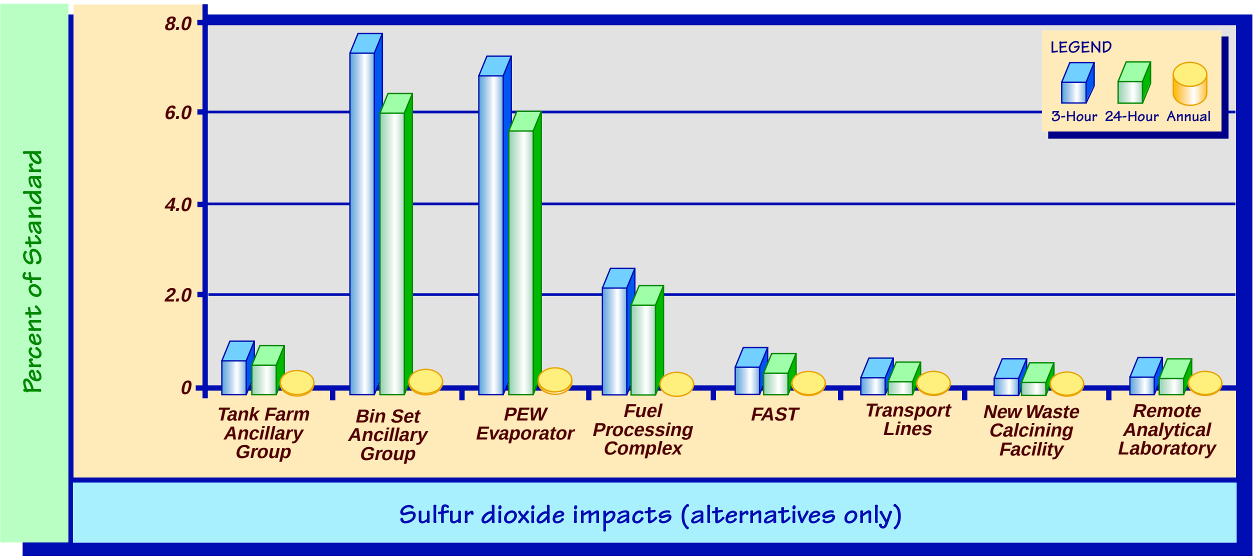


FIGURE 5.3-8. (1 of 4)
Comparison of criteria air pollutant impacts for disposition of existing INTEC facilities associated with HLW management.



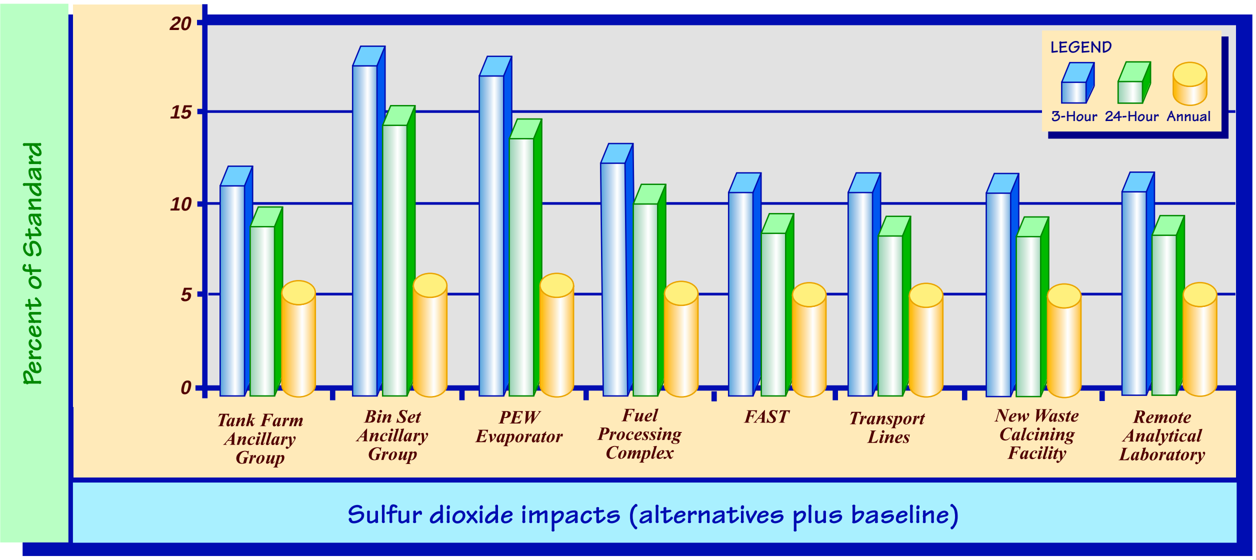
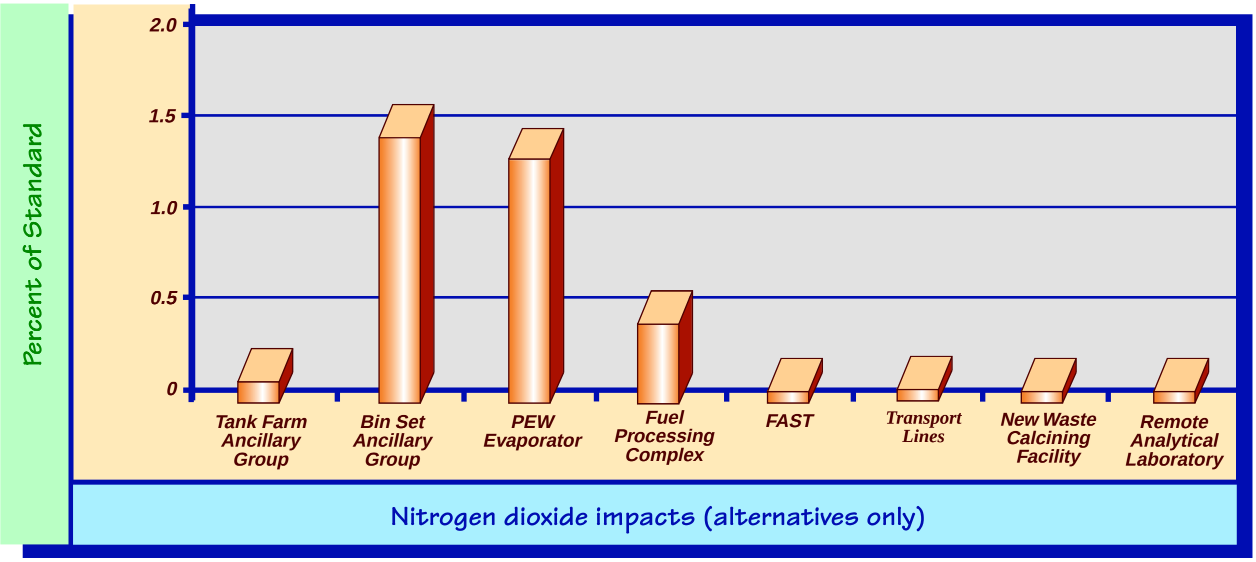


FIGURE 5.3-8. (2 of 4)
Comparison of criteria air pollutant impacts for disposition of existing INTEC facilities associated with HLW management.



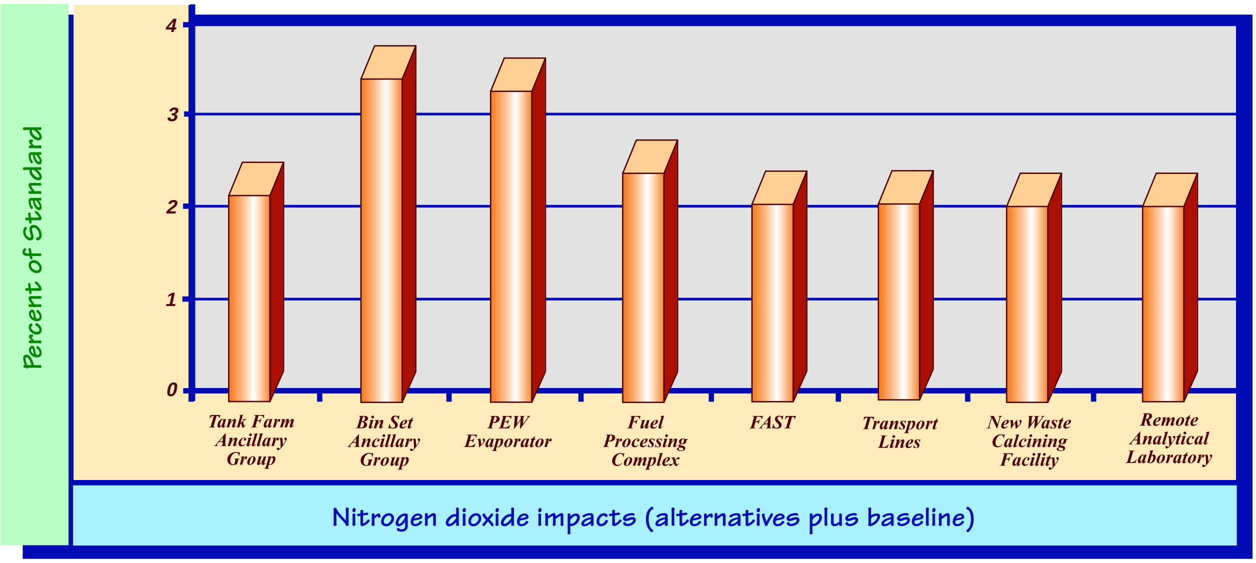
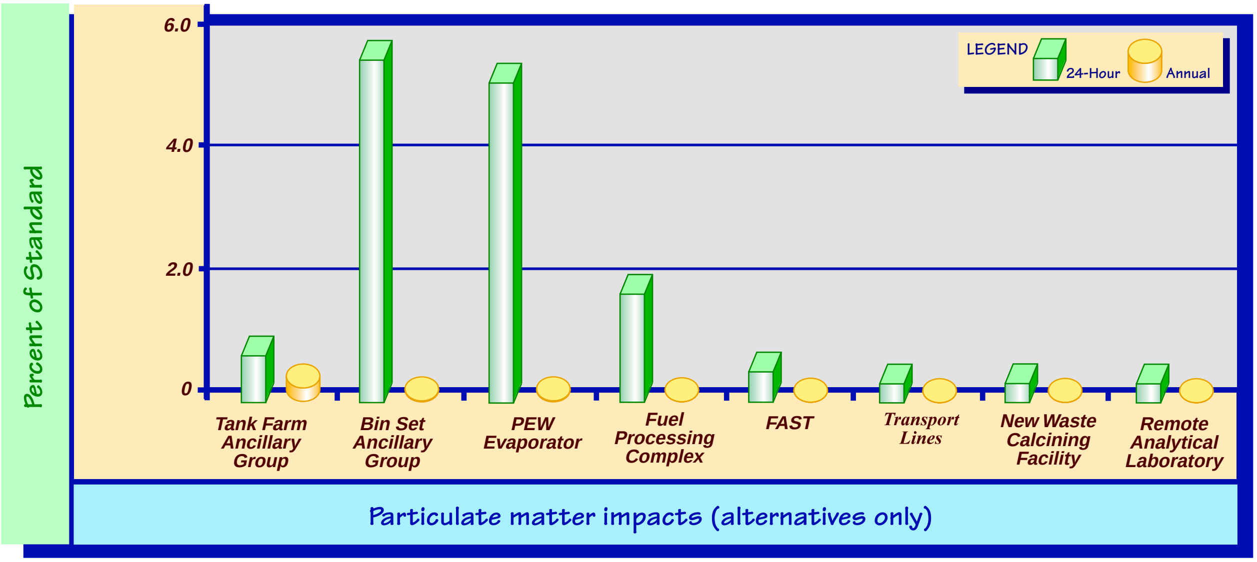
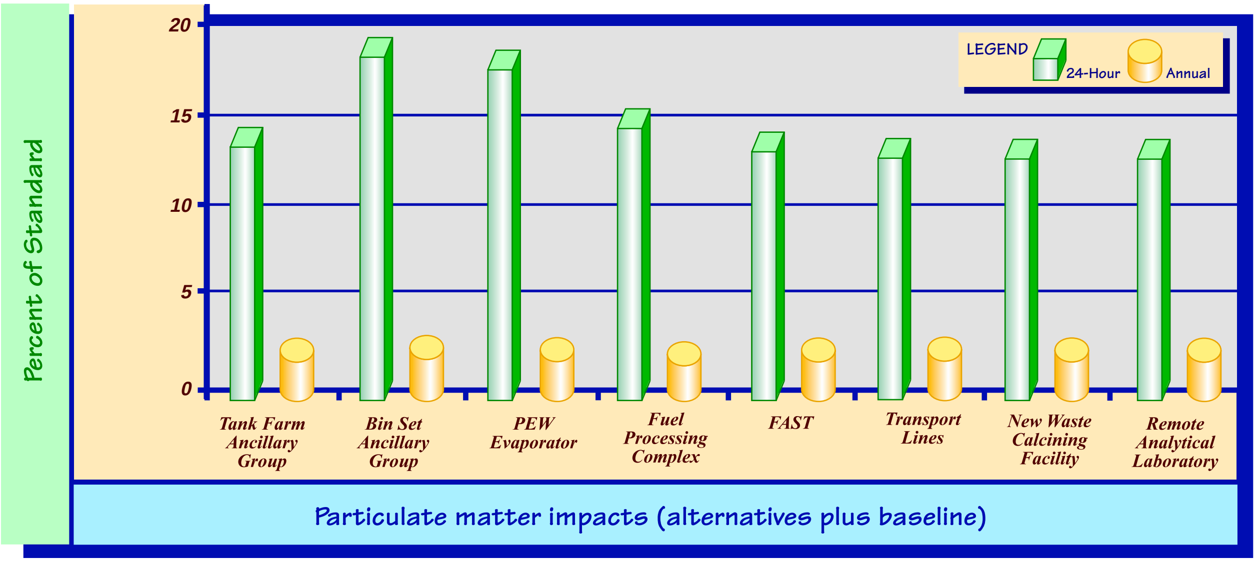


FIGURE 5.3-8. (3 of 4)
Comparison of criteria air pollutant impacts for disposition of existing INTEC facilities associated with HLW management.

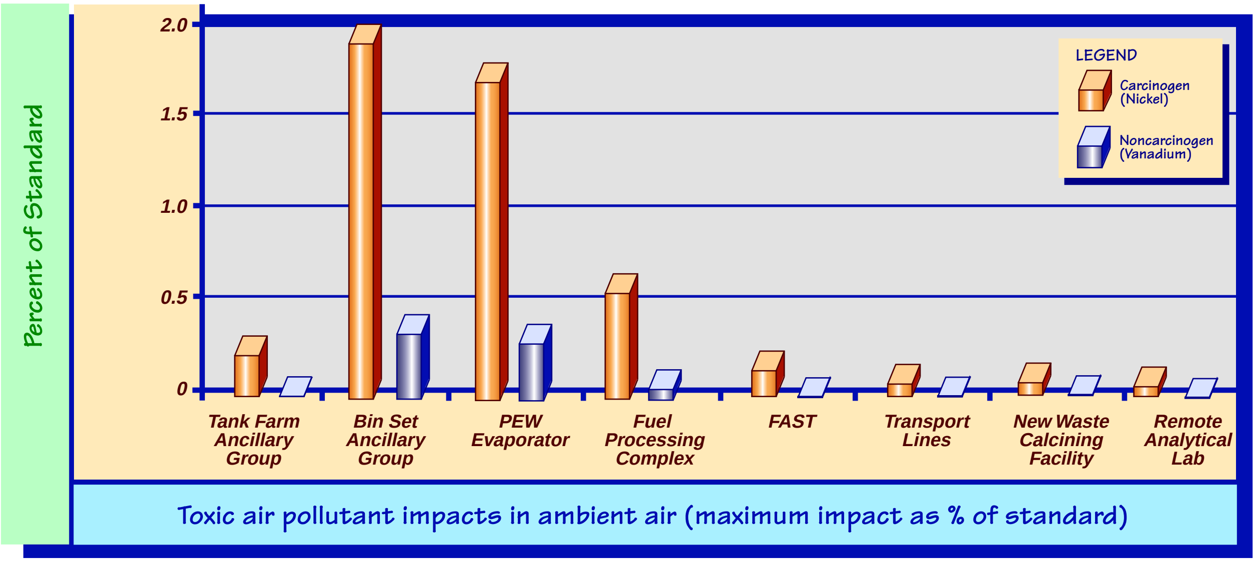


Particulate matter impacts (alternatives only)



Particulate matter impacts (alternatives plus baseline)

FIGURE 5.3-8. (4 of 4)
Comparison of criteria air pollutant impacts for disposition of existing INTEC facilities associated with HLW management.



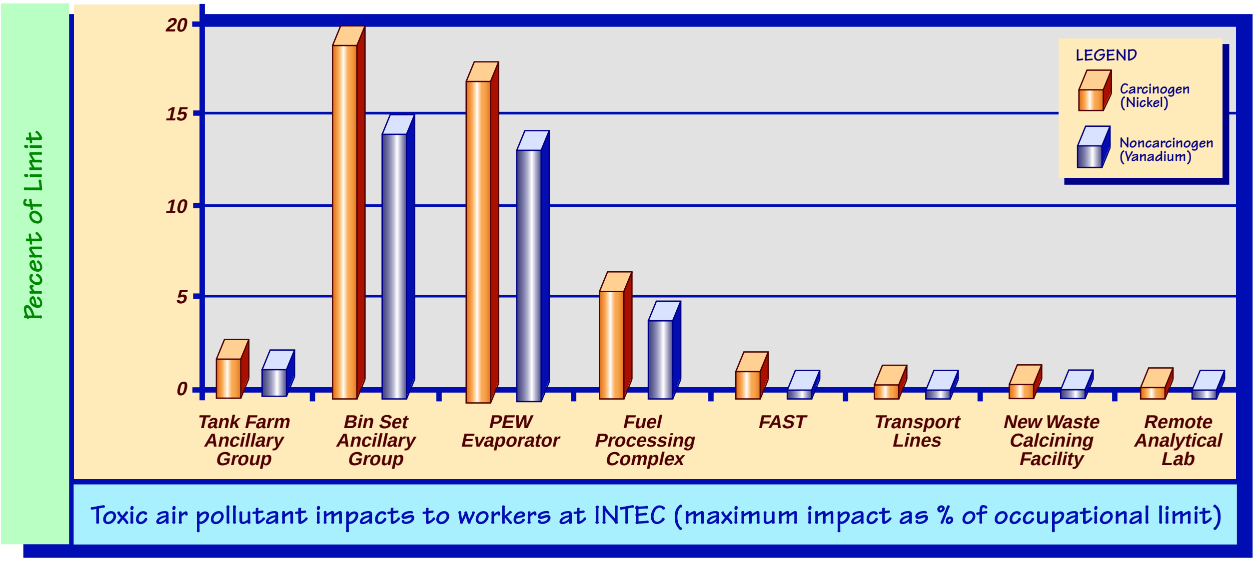


FIGURE 5.3-9.
Comparison of toxic air impacts for disposition of existing INTEC facilities.

5.3.5 WATER RESOURCES

5.3.5.1 Short-Term Impacts

Facility disposition activities would be carried out after HLW ***management*** facilities are no longer operational. HLW ***management*** 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).

All newly constructed facilities necessary to implement the waste processing alternatives would be designed and constructed consistent with measures that facilitate clean closure. 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. 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 ***from the disposition of new facilities***.

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 to the environment. An engineered cap would be placed over vaults and tanks to minimize the intrusion of water that could leach waste residues to 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 ***the Snake River Plain Aquifer*** near the facilities.

No additional long-term impacts would be expected from implementing any of the waste processing alternatives because all newly constructed facilities would be designed and constructed consistent with measures that facilitate clean closure.

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 ***hypothetical*** individual who drinks the water.

Table 5.3-***8*** presents 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 shows, there are a few instances where the peak groundwater concentration could exceed the respective maximum contaminant level. With the exception of technetium-99 in the bin sets - No Action scenario, all radionuclide concentrations are well below their MCLs. ***With the exception of cadmium, all nonradionuclide concentrations are within currently specified limits. Cadmium concentrations could exceed the maximum contaminant level under the bin sets - No Action scenario and the scenarios involving disposal of Class A or C-type grout in a Low-Activity Waste Disposal Facility. Additional details regarding methodology and results of the long-term facility disposition modeling are presented in Appendix C.9.***

5.3.6 ECOLOGICAL RESOURCES

Facility disposition includes a number of activities that would occur after HLW ***management*** facilities are no longer operational. After waste management operations are completed, HLW treatment and storage facilities at INTEC would be deactivated. ***The INEEL Comprehensive Land Use Plan*** (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 ***management*** facilities would be decontaminated to the extent practicable, then, depending on the

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 ***the Snake River Plain Aquifer*** near the facilities.

No additional long-term impacts would be expected from implementing any of the waste processing alternatives because all newly constructed facilities would be designed and constructed consistent with measures that facilitate clean closure.

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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 ***hypothetical*** individual who drinks the water.

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5.3.6 ECOLOGICAL RESOURCES

Facility disposition includes a number of activities that would occur after HLW ***management*** facilities are no longer operational. After waste management operations are completed, HLW treatment and storage facilities at INTEC would be deactivated. ***The INEEL Comprehensive Land Use Plan*** (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 ***management*** facilities would be decontaminated to the extent practicable, then, depending on the

Table 5.3-8. Projected long-term peak groundwater concentrations for contaminants associated with the facility disposition scenarios.

	Contaminant concentration (picocuries per liter or milligrams per liter)			
Contaminant	Calculated peak groundwater concentration	Reference maximum contaminant level (MCL)[a]	Concentration as a percent of MCL	Time (years after closure) of peak concentration
Tank Farm - No Action				
Technetium-99	440	900	49	600
Iodine-129	0.19	1.0	19	700
Cadmium	5.2×10^{-4}	5.0×10^{-3}	10	3,200
Fluoride	1.2×10^{-4}	4.0	< 1	2,800
Nitrate	0.62	44 [b]	1.4	600
Bin Sets - No Action				
Technetium-99	2.6×10^{3}	900	290	600
Iodine-129	0.51	1.0	51	800
Cadmium	0.011	5.0×10^{-3}	210	6,500
Fluoride	5.1×10^{-3}	4.0	< 1	10,000
Nitrate	0.048	44	< 1	600
Tank Farm - Performance-Based Closure or Closure to Landfill Standards				
Technetium-99	15	900	1.7	700
Iodine-129	0.13	1.0	13	600
Cadmium	6.8×10^{-5}	5.0×10^{-3}	1.4	3,000
Fluoride	8.1×10^{-7}	4.0	< 1	3,000
Nitrate	2.6×10^{-3}	44	< 1	600
Bin Sets - Performance-Based Closure or Closure to Landfill Standards				
Technetium-99	7.1	900	0.79	900
Iodine-129	2.8×10^{-3}	1.0	0.28	700
Cadmium	7.9×10^{-5}	5.0×10^{-3}	1.6	4,700
Fluoride	4.3×10^{-5}	4.0	< 1	5,000
Nitrate	7.4×10^{-4}	44	< 1	600
New Waste Calcining Facility - Performance-Based Closure or Closure to Landfill Standards				
Technetium-99	0.18	900	< 1	900
Iodine-129	-[c]	1.0	-	-
Cadmium	-	5.0×10^{-3}	-	-
Fluoride	2.8×10^{-6}	4.0	< 1	5,400
Nitrate	1.2×10^{-5}	44	< 1	700
Process Equipment Waste Evaporator - Performance-Based Closure or Closure to Landfill Standards				
Technetium-99	0.19	900	< 1	900
Iodine-129	-	1.0	-	-
Cadmium	-	5.0×10^{-3}	-	-
Fluoride	8.1×10^{-6}	4.0	< 1	1,400
Nitrate	1.2×10^{-5}	44	< 1	700

Table 5.3-8. Projected long-term peak groundwater concentrations for contaminants associated with the facility disposition scenarios (continued).

	Contaminant concentration (picocuries per liter or milligrams per liter)			
Contaminant	Calculated peak groundwater concentration	Reference maximum contaminant level (MCL)[a]	Concentration as a percent of MCL	Time (years after closure) of peak concentration
Tank Farm - Performance-Based Closure with Class A Grout Disposal				
Technetium-99	15	900	< 1	700
Iodine-129	0.18	1.0	24	700
Cadmium	1.1×10^{-3}	5.0×10^{-3}	22	6,300
Fluoride	5.2×10^{-4}	4.0	< 1	10,000
Nitrate	0.092	44	< 1	600
Bin Sets - Performance-Based Closure with Class A Grout Disposal				
Technetium-99	7.2	900	< 1	800
Iodine-129	0.071	1.0	7.1	1,200
Cadmium	1.5×10^{-3}	5.0×10^{-3}	30	10,000
Fluoride	7.4×10^{-4}	4.0	< 1	10,000
Nitrate	0.47	44	1.1	600
Tank Farm - Performance-Based Closure with Class C Grout Disposal				
Technetium-99	15	900	< 1	700
Iodine-129	0.14	1.0	14	700
Cadmium	5.2×10^{-4}	5.0×10^{-3}	90	3,200
Fluoride	2.8×10^{-4}	4.0	< 1	3,500
Nitrate	0.013	44	< 1	600
Bin Sets - Performance-Based Closure with Class C Grout Disposal				
Technetium-99	7.7	900	< 1	800
Iodine-129	0.053	1.0	5.3	1,200
Cadmium	1.8×10^{-3}	5.0×10^{-3}	36	10,000
Fluoride	9.0×10^{-4}	4.0	< 1	10,000
Nitrate	0.37	44	< 1	600
Disposal of Class A Grout in a New Low-Activity Waste Disposal Facility[d]				
Technetium-99	0.90	900	< 1	1,000
Iodine-129	0.55	1.0	55	900
Cadmium	0.012	5.0×10^{-3}	250	6,500
Fluoride	6.5×10^{-3}	4.0	< 1	9,300
Nitrate	0.13	44	< 1	700
Disposal of Class C Grout in a New Low-Activity Waste Disposal Facility[d]				
Technetium-99	5.7	900	< 1	1,000
Iodine-129	0.39	1.0	39	900
Cadmium	0.014	5.0×10^{-3}	280	6,000
Fluoride	7.9×10^{-3}	4.0	< 1	8,000
Nitrate	0.037	44	< 1	700

a. Maximum contaminant levels are drinking water standards specified in 40 CFR 141.

b. The MCL for nitrate in 40 CFR 141 is 10 milligrams per liter for the nitrogen component, which equates to approximately 44 milligrams per liter of nitrate.

c. A dashed line indicates that there is no significant release.

d. The onsite Low-Activity Waste Disposal Facility is described in Section 3.1.3.1.

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 ***management*** facilities.

After closure, and during the institutional control period, ***until*** 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. 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

All newly constructed facilities necessary to implement the waste processing alternatives would be designed and constructed consistent with measures that facilitate clean closure. 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 the 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 the 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 disposition activities for both new and existing facilities.

Employment levels for facility disposition 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 ***management*** 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.

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

All newly constructed facilities necessary to implement the waste processing alternatives would be designed and constructed consistent with measures that facilitate clean closure. 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 the 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 the 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 disposition activities for both new and existing facilities.

Employment levels for facility disposition 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 ***management*** 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 ***management*** facilities. The first involves disposition of new facilities required to support the waste processing alternatives. The second category involves the existing HLW ***management*** facilities as grouped in Table 3-***3*** in Chapter 3. The sections below provide DOE's estimates of radiological and nonradiological health and safety impacts for these facilities.

Impacts from Disposition of New Facilities Associated with Waste Processing Alternatives

Tables 5.3-***9*** through 5.3-1***1*** present potential health and safety impacts to involved workers from radiological and nonradiological sources by facility or group of facilities for new facilities associated with the waste processing alternatives.

Table 5.3-***9*** presents radiological impacts in terms of collective dose to workers and the resultant estimated number of latent cancer fatalities for the entire period of disposition. DOE bases dose estimates on the projected number of workers for each option and historic INEEL operations dose-per-worker data. No disposition activities would be associated with the No Action Alternative. ***The highest average collective dose would occur for the Hot Isostatic Pressed Waste Option and the Vitrification with Calcine Separations Option with 290 person-rem and would result in 0.12 latent cancer fatality under this option.***

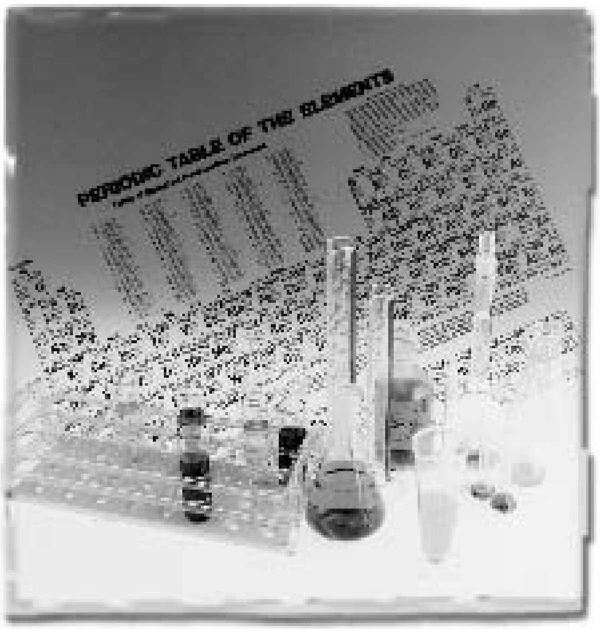

Table 5.3-***10*** provides a summary of annual radiation dose and health impacts associated with airborne radionuclide emissions. These values are based on the doses for closing each new facility presented in Section 5.3.4. Dose impacts are presented for the maximally exposed offsite and onsite individuals and the population within 50 miles of ***INTEC***. The estimated increase in the number of latent cancer fatalities is presented for the collective population. ***The annual radiation doses to the maximally exposed individuals, noninvolved worker as well as to the population for all of the options are at very low levels. The maximum number of latent cancer fatalities is associated with the Vitrification with Calcine Separations Option and is much less than one*** **(*1.1×10^{-11}*)*.***

Table 5.3-1***1*** provides estimates of occupational safety impacts for workers involved with disposition activities. Impacts are presented in terms of the number of lost workdays and total recordable cases on an annual and total disposition 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 ***1996*** to ***2000*** (***DOE 2001***).

Table 5.3-9. Estimated radiological impacts to involved workers during disposition activities for new facilities.[a,b,c]

Project Number	Description	***Radiation*** workers/ year	***Disposition*** time (years)	Total workers	***Collective*** dose (person-rem)	Estimated increase in latent cancer fatalities
Continued Current Operations Alternative						
P1A	Calcine SBW including NWCF Upgrades[d]	37	2	74	19	***7.4×10^{-3}***
P1A	Calcine SBW including NWCF Upgrades[e]	31	2	62	16	***6.2×10^{-3}***
P1B	NGLW and Tank Farm Heel Waste Management	36	1	36	9	***3.6×10^{-3}***
Totals				***170***	***43***	***0.017***
Full Separations Option						
P9A	Full Separations	100	3	***310***	77	***0.031***
P9B	Vitrification Plant	45	3	140	34	***0.014***
P9C	Class A Grout Plant	74	***2.5***	***190***	***46***	***0.019***
P18	New Analytical Laboratory	30	2	60	15	***6.0×10^{-3}***
P24	***Vitrified Product Interim Storage***	***3***	***1.8***	***5.4***	***1.4***	***5.4×10^{-4}***
P27	Class A Grout Disposal in a New Low-Activity Waste Disposal Facility	88	2	180	44	***0.018***
P35D	Class A Grout Packaging and Shipping to a New Low-Activity Waste Disposal Facility	20	2	40	10	***4.0×10^{-3}***
P59A	Calcine Retrieval and Transport	100	***1***	100	26	0.010
P118	Separations Organic Incinerator	2	2	4	1.0	***4.0×10^{-4}***
P133	***Waste Treatment Pilot Plant***	***25***	***2***	***50***	***13***	***5.0×10^{-3}***
Totals				***1.1×10^{3}***	***270***	***0.11***
Planning Basis Option						
P1A	Calcine SBW including NWCF Upgrades[d]	37	2	74	19	***7.4×10^{-3}***
P1A	Calcine SBW including NWCF Upgrades[e]	31	2	62	16	***6.2×10^{-3}***
P1B	NGLW and Tank Farm Heel Waste Management	36	1	36	9	***3.6×10^{-3}***
P18	New Analytical Laboratory	30	2	60	15	***6.0×10^{-3}***
P23A	Full Separations	100	3	310	77	***0.031***
P23B	Vitrification Plant	49	2.8	***140***	34	***0.014***
P23C	Class A Grout Plant	67	2.8	***190***	***47***	***0.019***
P24	***Vitrified Product Interim Storage***	***3***	***1.8***	***5.4***	***1.4***	***5.4×10^{-4}***
P35E	***Class A Grout Packaging and Shipping for Offsite Disposal***	***20***	***2***	***40***	***10***	4.0×10^{-3}
P59A	Calcine Retrieval and Transport	100	1	100	26	0.010
P118	Separations Organic Incinerator	2	2	4	1	***4.0×10^{-4}***
P133	***Waste Treatment Pilot Plant***	***25***	***2***	***50***	***13***	***5.0×10^{-3}***
Totals				***1.1×10^{3}***	***270***	***0.11***

Table 5.3-9. Estimated radiological impacts to involved workers during disposition activities for new facilities[a,b,c] (continued).

Project Number	Descrition	***Radiation*** workers/ year	***Disposition*** time (years)	Total workers	***Collective*** dose (person-rem)	Estimated increase in latent cancer fatalities
Transuranic Separations Option						
P18	New Analytical Laboratory	30	2	60	15	***6.0×10^{-3}***
P27	Class A Grout Disposal in a New Low-Activity Waste Disposal Facility	***49***	2	***98***	***25***	***9.8×10^{-3}***
P49A	Transuranic/Class C Separations	81	3	240	61	***0.024***
P49C	Class C Grout Plant	64	2	130	32	***0.013***
P49D	Class C Grout Packaging and Shipping to a New Low-Activity Waste Disposal Facility	41	2	82	21	***8.2×10^{-3}***
P59A	Calcine Retrieval and Transport	100	1	100	26	0.010
P118	Separations Organic Incinerator	2	2	4	1	4.0×10^{-4}
P133	***Waste Treatment Pilot Plant***	***25***	***2***	***50***	***13***	***5.0×10^{-3}***
Totals				***770***	***190***	***0.077***
Hot Isostatic Pressed Waste Option						
P1A	Calcine SBW including NWCF Upgrades[d]	37	2	74	*19*	***7.4×10^{-3}***
P1A	Calcine SBW including NWCF Upgrades[e]	31	2	62	*16*	***6.2×10^{-3}***
P1B	NGLW and Tank Farm Heel Waste Management	36	1	36	9	***3.6×10^{-3}***
P18	New Analytical Laboratory	30	2	60	15	***6.0×10^{-3}***
P59A	Calcine Retrieval and Transport	100	1	100	26	0.010
P71	Mixing and Hot Isostatic Pressing	150	5	730	***180***	***0.073***
P72	Interim Storage of Hot Isostatic Pressed Waste	16	3	48	12	***4.8×10^{-3}***
P133	***Waste Treatment Pilot Plant***	***25***	***2***	***50***	***13***	***5.0×10^{-3}***
Totals				***1.2×10^{3}***	***290***	***0.12***
Direct Cement Waste Option						
P1A	Calcine SBW including NWCF Upgrades[d]	37	2	74	19	***7.4×10^{-3}***
P1A	Calcine SBW including NWCF Upgrades[e]	31	2	62	16	***6.2×10^{-3}***
P1B	NGLW and Tank Farm Heel Waste Management	36	1	36	9	***3.6×10^{-3}***
P18	New Analytical Laboratory	30	2	60	15	***6.0×10^{-3}***
P59A	Calcine Retrieval and Transport	100	1	100	26	0.010
P80	Direct Cement Process	120	3	360	91	0.036
P81	Unseparated Cementitious HLW Interim Storage	***88***	***1***	***88***	***22***	***8.8×10^{-3}***
P133	***Waste Treatment Pilot Plant***	***25***	***2***	***50***	***13***	***5.0×10^{-3}***
Totals				***840***	***210***	***0.084***

Table 5.3-9. Estimated radiological impacts to involved workers during disposition activities for new facilities [a,b,c] (continued).

Project Number	Descrition	***Radiation*** workers/ year	***Disposition*** time (years)	Total workers	***Collective*** dose (person-rem)	Estimated increase in latent cancer fatalities
			Early Vitrification Option			
P18	New Analytical Laboratory	30	2	60	15	***6.0×10^{-3}***
P59A	Calcine Retrieval and Transport	100	1	100	26	0.010
P61	***Vitrified Product Interim Storage***	25	***3***	***75***	19	***7.5×10^{-3}***
P88	Early Vitrification Facility	78	5	390	98	0.039
P133	***Waste Treatment Pilot Plant***	***25***	***2***	***50***	13	***5.0×10^{-3}***
Totals				***680***	***170***	0.068
			Steam Reforming Option			
P13	***New Storage Tanks***	***19***	***2***	***38***	***10***	***3.8×10^{-3}***
P35E	***Class A Grout Packaging and Loading for Offsite Disposal***	***20***	***2***	***40***	***10***	***4.0×10^{-3}***
P59A	***Calcine Retrieval and Transport***	***100***	***1***	***100***	***26***	***0.010***
P117A	***Calcine Packaging and Loading***	***33***	***3***	***99***	***25***	***9.9×10^{-3}***
P2001	***NGLW Grout Facility***	***9***	***1***	***9***	***2***	***9.0×10^{-4}***
P2002A	***Steam Reforming Facility***	***45***	***1***	***45***	***11***	***4.5×10^{-3}***
Totals				***330***	***83***	***0.033***
			Minimum INEEL Processing Alternative			
P18	New Analytical Laboratory	30	2	60	15	***6.0×10^{-3}***
P24	Vitrified Product Interim Storage	3	***1.8***	***5.4***	***1.4***	***5.4×10^{-4}***
P27	Class A Grout Disposal in a New Low-Activity Waste Disposal Facility	88	2	180	44	0.018
P59A	Calcine Retrieval and Transport	100	1	100	26	0.010
P111	SBW & NGLW Treatment with CsIX to CH TRU Grout & LLW Grout	59	1	59	15	***5.9×10^{-3}***
P117A	Calcine Packaging and Loading	33	3	99	25	***9.9×10^{-3}***
P133	***Waste Treatment Pilot Plant***	***25***	***2***	***50***	***13***	***5.0×10^{-3}***
Totals				***550***	***140***	***0.055***
			Vitrification without Calcine Separations Option			
P13	***New Storage Tanks***	***15***	***2***	***30***	***7.5***	***3.0×10^{-3}***
P18	***New Analytical laboratory***	***30***	***2***	***60***	***15***	***6.0×10^{-3}***
P59A	***Calcine Retrieval and Transport***	***100***	***1***	***100***	***26***	***0.010***
P61	***Vitrified Product Interim Storage***	***25***	***3***	***75***	***19***	***7.5×10^{-3}***
P88	***Vitrification with MACT***	***78***	***5***	***390***	***98***	***0.039***
P133	***Waste Treatment Pilot Plant***	***25***	***2***	***50***	***13***	***5.0×10^{-3}***
Totals				***710***	***180***	***0.071***

Table 5.3-9. Estimated radiological impacts to involved workers during disposition activities for new facilities[a,b,c] (continued).

Project number	Description	***Radiation*** workers/ year	***Disposition*** time (years)	Total workers	***Collective*** dose (person-rem)	Estimated increase in latent cancer fatalities
	Vitrification with Calcine Separations Option					
P9A	***Full Separations***	***100***	***3***	***310***	***77***	***0.031***
P9C	***Grout Plant***	***74***	***2.5***	***190***	***46***	***0.019***
P13	***New Storage Tanks***	***15***	***2***	***30***	***7.5***	3.0×10^{-3}
P18	***New Analytical Laboratory***	***30***	***2***	***60***	***15***	6.0×10^{-3}
P24	***Vitrified Product Interim Storage***	***3***	***1.8***	***5.4***	***1.4***	5.4×10^{-4}
P35E	***Grout Packaging and Loading for Offsite Disposal***	***20***	***2***	***40***	***10***	4.0×10^{-3}
P59A	***Calcine Retrieval and Transport***	***100***	***1***	***100***	***26***	***0.010***
P88	***Vitrification with MACT***	***78***	***5***	***390***	***98***	***0.039***
P133	***Waste Treatment Pilot Plant***	***25***	***2***	***50***	***13***	5.0×10^{-3}
Totals				1.2×10^3	***290***	***0.12***

a. Source: Data from Project Data Sheets in Appendix C.6.

b. Only includes projects with potential for radiation exposure during disposition.

c. ***The EIS analyzes treatment of post-2005 newly generated liquid waste as mixed transuranic waste/SBW for comparability of impacts between alternatives. The newly generated liquid waste could be treated in the same facility as the mixed transuranic waste/SBW or DOE could construct a separate facility to grout the newly generated liquid waste.***

d. For the New Waste Calcining Facility MACT Facility.

e. 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.

As shown in Table 5.3-11, the highest number of lost workdays and total recordable cases over the entire disposition period would occur under the Hot Isostatic Pressed Waste and Vitrification with Calcine Separations Options. DOE estimates 610 lost workdays and 79 total recordable cases for these options. The ***Full Separations***, ***Planning Basis***, Early Vitrification, ***and Vitrification without Calcine Separations Options*** would have a similar number of lost workdays and total recordable cases occurrences with all other options resulting in lesser impacts for the entire disposition period of activity.

Impacts from Disposition of Existing Facilities Associated with HLW Management

Tables 5.3-1***2*** through 5.3-1***5*** present potential health and safety impacts from closure of existing HLW ***management*** facilities by alternative. These facilities would be closed as specified in Table 3-***3***.

Table 5.3-1***2*** provides radiological impacts in terms of collective dose to workers and the resultant estimated number of LCFs for the entire disposition 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 ***estimated*** the annual collective and total collective worker doses to be ***70*** and ***1,900*** person-rem, respectively. The total collective worker dose for the Clean Closure alternative would result in an estimated ***0.76*** latent cancer fatality. The estimated total collective worker doses for all other Tank Farm closure options, ***as well as closure of the*** bin sets and related facilities, and other new facilities associated with HLW management are much lower and would result in less than 1 latent cancer fatality for each option.

Table 5.3-10. Summary of radiation dose impacts associated with airborne radionuclide emissions from disposition of facilities associated with waste processing alternatives.

Receptor	No Action Alternative	Continued Current Operations Alternative	Separations Alternative			Non-Separations Alternative				Minimum INEEL Processing Alternative	***Direct Vitrification Alternative***	
			Full Separations Option[a]	Planning Basis Option	Transuranic Separations Option[b]	Hot Isostatic Pressed Waste Option	Direct Cement Waste Option	Early Vitrification Option	***Steam Reforming Option***		***Vitrification without Calcine Separations Option***	***Vitrification with Calcine Separations Option***
Annual dose to maximally exposed offsite individual (millirem per year)[c]	-	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}	***2.4×10^{-10}***	***5.6×10^{-10}***	***2.1×10^{-10}***	***3.0×10^{-10}***
Integrated dose to maximally exposed offsite individual (millirem)[d]	-	***2.2×10^{-10}***	***7.7×10^{-10}***	***9.9×10^{-10}***	***9.4×10^{-10}***	***5.4×10^{-10}***	***2.2×10^{-10}***	***4.0×10^{-10}***	***3.9×10^{-10}***	***1.3×10^{-9}***	***5.4×10^{-10}***	***7.8×10^{-10}***
Estimated increase in probability of latent cancer fatality for the maximally exposed offsite individual	-	***1.1×10^{-16}***	***3.9×10^{-16}***	***5.0×10^{-16}***	***4.7×10^{-16}***	***2.7×10^{-16}***	***1.1×10^{-16}***	***2.0×10^{-16}***	***2.0×10^{-16}***	***6.5×10^{-16}***	***2.7×10^{-16}***	***3.9×10^{-16}***
Annual dose to noninvolved worker (millirem per year)[e]	-	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}	***4.3×10^{-11}***	***1.6×10^{-10}***	***4.3×10^{-11}***	***6.0×10^{-11}***
Integrated dose to noninvolved worker (millirem)[d]	-	***4.0×10^{-11}***	***1.4×10^{-10}***	***1.8×10^{-10}***	***2.8×10^{-10}***	***1.1×10^{-10}***	***3.7×10^{-11}***	***8.1×10^{-11}***	***7.0×10^{-11}***	***3.8×10^{-10}***	***1.1×10^{-10}***	***1.6×10^{-10}***
Estimated increase in probability of latent cancer fatality for the noninvolved worker	-	***1.6×10^{-17}***	***5.6×10^{-17}***	***7.2×10^{-17}***	***1.1×10^{-16}***	***4.4×10^{-17}***	***1.5×10^{-17}***	***3.2×10^{-17}***	***2.8×10^{-17}***	***1.5×10^{-16}***	***4.4×10^{-17}***	***6.4×10^{-17}***
Annual collective dose to population within 50 miles of INTEC (person-rem per year)[f]	-	***4.0×10^{-9}***	***1.2×10^{-8}***	***1.4×10^{-8}***	***1.3×10^{-8}***	***5.7×10^{-9}***	***4.5×10^{-9}***	***4.6×10^{-9}***	***8.8×10^{-9}***	***1.6×10^{-8}***	***7.0×10^{-9}***	***9.9×10^{-9}***
Integrated collective dose to population (person-rem)[d]	-	***7.9×10^{-9}***	***2.8×10^{-8}***	***3.6×10^{-8}***	***2.6×10^{-8}***	***1.7×10^{-8}***	***7.7×10^{-9}***	***1.3×10^{-8}***	***1.4×10^{-8}***	***3.6×10^{-8}***	***1.8×10^{-8}***	***2.5×10^{-8}***
Estimated increase in number of latent cancer fatalities in population	-	***4.0×10^{-12}***	***1.4×10^{-11}***	***1.8×10^{-11}***	***1.3×10^{-11}***	***8.5×10^{-12}***	***3.9×10^{-12}***	***6.5×10^{-12}***	***7.0×10^{-12}***	***1.8×10^{-11}***	***9.0×10^{-12}***	***1.3×10^{-11}***

a. 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 5.3-6.

b. 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 5.3-6.

c. Doses are maximum values over any single year in which facility disposition occurs.

d. The annual average project doses were multiplied by the project duration and summed for all projects to determine the integrated doses and health effects.

e. Location of highest onsite dose is Central Facilities Area.

f. Population dose assumes a growth rate of 6 percent per decade between 2000 and 2035.

Table 5.3-11. Estimated worker injury impacts during disposition activities of new facilities at INEEL by alternative.[a]

Project number	Description	Total number of workers per year	Disposition time (years)	Total number of workers	Total lost workdays[b]	Total recordable cases[c]
Continued Current Operations Alternative						
P1A	Calcine SBW including NWCF Upgrades[d]	58	2	120	33	4.3
P1A	Calcine SBW including NWCF Upgrades[e]	42	2	84	24	3.1
P1B	NGLW and Tank Farm Heel Waste Management	48	1	48	14	1.8
Totals				250	70	9.2
Full Separations Option						
P9A	Full Separations	220	3	670	190	25
P9B	Vitrification Plant	72	3	220	61	8.0
P9C	Class A Grout Plant	120	2.5	300	85	11
P18	New Analytical Laboratory	88	2	180	50	6.5
P24	Vitrified Product Interim Storage	31	1.8	56	16	2.1
P25A	Packaging and Loading Vitrified HLW at INTEC for Shipment to a Geologic Repository	2.1	0.25	0.53	0.15	0.019
P27	Class A Grout Disposal in a New Low-Activity Waste Disposal Facility	140	2	270	77	10
P35D	Class A Grout Packaging and Shipping to a New Low-Activity Waste Disposal Facility	30	2	60	17	2.2
P59A	Calcine Retrieval and Transport	160	1	160	45	5.9
P118	Separations Organic Incinerator	2	2	4	1.1	0.15
P133	Waste Treatment Pilot Plant	45	2	90	26	3.3
Totals				2.0×10^3	570	74
Planning Basis Option						
P1A	Calcine SBW including NWCF Upgrades[d]	58	2	120	33	4.3
P1A	Calcine SBW including NWCF Upgrades[e]	42	2	84	24	3.1
P1B	NGLW and Tank Farm Heel Waste Management	48	1	48	14	1.8
P18	New Analytical Laboratory	88	2	180	50	6.5
P23A	Full Separations	220	3	660	190	24
P23B	Vitrification Plant	72	2.8	200	57	7.5
P23C	Class A Grout Plant	120	2.8	340	95	12
P24	Vitrified Product Interim Storage	31	1.8	56	16	2.1
P25A	Packaging and Loading Vitrified HLW at INTEC for Shipment to a Geologic Repository	2.1	0.25	0.53	0.15	0.019
P35E	Class A Grout Packaging and Loading for Offsite Disposal	30	2	60	17	2.2
P59A	Calcine Retrieval and Transport	160	1	160	45	5.9
P118	Separations Organic Incinerator	2	2	4	1.1	0.15
P133	Waste Treatment Pilot Plant	45	2	90	26	3.3
Totals				2.0×10^3	570	74

Table 5.3-11. Estimated worker injury impacts during disposition activities of new facilities at INEEL by alternative [a] (continued).

Project number	Description	Total number of workers per year	Disposition time (years)	Total number of workers	Total lost workdays[b]	Total recordable cases[c]
Transuranic Separations Option						
P18	New Analytical Laboratory	88	2	180	50	6.5
P27	Class A Grout Disposal in a New Low-Activity Waste Disposal Facility	140	2	270	77	10
P39A	Packaging and Loading TRU at INTEC for Shipment to the Waste Isolation Pilot Plant	7	1.5	11	3.0	0.39
P49A	Transuranic/Class C Separations	150	3	450	130	17
P49C	Class C Grout Plant	93	2	190	53	6.9
P49D	Class C Grout Packaging and Shipping to a New Low-Activity Waste Disposal Facility	57	2	110	32	4.2
P59A	Calcine Retrieval and Transport	160	1	160	45	5.9
P118	Separations Organic Incinerator	2	2	4	1.1	0.15
P133	Waste Treatment Pilot Plant	45	2	90	26	3.3
Totals				1.5×10^3	420	54
Hot Isostatic Pressed Waste Option						
P1A	Calcine SBW including NWCF Upgrades[d]	58	2	120	33	4.3
P1A	Calcine SBW including NWCF Upgrades[e]	42	2	84	24	3.1
P1B	NGLW and Tank Farm Heel Waste Management	48	1	48	14	1.8
P18	New Analytical Laboratory	88	2	180	50	6.5
P59A	Calcine Retrieval and Transport	160	1	160	45	5.9
P71	Mixing and Hot Isostatic Pressing	200	5	1.0×10^3	280	37
P72	Interim Storage of Hot Isostatic Pressed Waste	150	3	450	130	17
P73A	Packaging and Loading Hot Isostatic Pressed Waste at INTEC for Shipment to a Geologic Repository	7	1	7	2.0	0.26
P133	Waste Treatment Pilot Plant	45	2	90	26	3.3
Totals				2.1×10^3	610	79
Direct Cement Waste Option						
P1A	Calcine SBW including NWCF Upgrades[d]	58	2	120	33	4.2
P1A	Calcine SBW including NWCF Upgrades[e]	42	2	84	24	3.1
P1B	NGLW and Tank Farm Heel Waste Management	48	1	48	14	1.8
P18	New Analytical Laboratory	88	2	180	50	6.5
P59A	Calcine Retrieval and Transport	160	1	160	45	5.9
P80	Direct Cement Process	160	3	480	140	11
P81	Unseparated Cementitious HLW Interim Storage	290	1	290	82	11
P83A	Packaging and Loading Cementitious Waste at INTEC for Shipment to a Geologic Repository	7	1	7	2.0	0.26
P133	Waste Treatment Pilot Plant	45	2	90	26	3.3
Totals				1.4×10^3	410	54

Table 5.3-11. Estimated worker injury impacts during disposition activities of new facilities at INEEL by alternative [a] (continued).

Project number	Description	Total number of workers per year	Disposition time (years)	Total number of workers	Total lost workdays[b]	Total recordable cases[c]
	Early Vitrification Option					
P18	New Analytical Laboratory	88	2	180	50	6.5
P59A	Calcine Retrieval and Transport	160	1	160	45	5.9
P61	Unseparated Vitrified Product Interim Storage	250	3	750	210	28
P62A	Packaging and Loading Vitrified HLW at INTEC for Shipment to a Geologic Repository	10	3	30	8.5	1.1
P90A	Packaging and Loading Vitrified SBW at INTEC for Shipment to Waste Isolation Pilot Plant	7	1.5	11	3.0	0.39
P88	Early Vitrification Facility	120	5	590	170	22
P133	Waste Treatment Pilot Plant	45	2	90	26	3.3
Totals				1.8×10^3	510	67
	Steam Reforming Option					
P13	New Storage Tanks	19	2	38	11	1.4
P35E	Class A Grout Packaging and Loading for Offsite Disposal	30	2	60	17	2.2
P59A	Calcine Retrieval and Transport	160	1	160	45	5.9
P117A	Calcine Packaging and Loading	52	3	160	44	5.8
P2001	NGLW Grout Facility	16	1	16	4.5	0.59
P2002A	Steam Reforming Facility	72	1	72	20	2.7
Totals				500	140	19
	Minimum INEEL Processing Alternative					
P18	New Analytical Laboratory	88	2	180	50	6.5
P24	Vitrified Product Interim Storage	31	1.8	56	16	2.1
P25A	Packaging and Loading Vitrified HLW at INTEC for Shipment to a Geologic Repository	2.1	0.25	0.53	0.15	0.19
P27	Class A Grout Disposal in a New Low-Activity Waste Disposal Facility	140	2	270	77	10
P59A	Calcine Retrieval and Transport	160	1	160	45	5.9
P111	SBW & NGLW Treatment with CsIX to CH TRU Grout & LLW Grout	100	1	100	28	3.7
P112A	Packaging and Loading Contact Handled TRU for Shipment to WIPP	7	4.5	32	8.9	1.2
P117A	Calcine Packaging and Loading	110	3	330	94	12
P133	Waste Treatment Pilot Plant	45	2	90	26	3.3
Totals				1.2×10^3	350	45

Table 5.3-11. Estimated worker injury impacts during disposition activities of new facilities at INEEL by alternative [a] (continued).

Project number	Description	Total number of workers per year	Disposition time (years)	Total number of workers	Total lost workdays[b]	Total recordable cases[c]
Vitrification without Calcine Separations Option						
P13	New Storage Tanks	19	2	38	11	1.4
P18	New Analytical Laboratory	88	2	180	50	6.5
P59A	Calcine Retrieval and Transport	160	1	160	45	5.9
P61	Vitrified HLW Interim Storage	250	3	750	210	28
P62A	Packaging and Loading Vitrified HLW at INTEC for Shipment to a Geologic Repository	10	3	30	8.5	1.1
P88	Vitrification with MACT	120	5	590	170	22
P133	Waste Treatment Pilot Plant	45	2	90	26	3.3
Totals				1.8×10^3	520	68
Vitrification with Calcine Separations Option						
P9A	Full Separations	220	3	670	190	25
P9C	Grout Plant	120	2.5	300	85	11
P13	New Storage Tanks	19	2	38	11	1.4
P18	New Analytical Laboratory	88	2	180	50	6.5
P24	Vitrified Product Interim Storage	31	1.8	56	16	2.1
P25A	Packaging and Loading Vitrified HLW for Shipment to a Geologic Repository	2.1	0.25	0.53	0.15	0.019
P35E	Grout Packaging and Loading for Offsite Disposal	30	2	60	17	2.2
P59A	Calcine Retrieval and Transport	160	1	160	45	5.9
P88	Vitrification Facility with MACT	120	5	590	170	22
P133	Waste Treatment Pilot Plant	45	2	90	26	3.3
Totals				2.1×10^3	610	79

a. The EIS analyzes treatment of post-2005 newly generated liquid waste as mixed transuranic waste/SBW for comparability of impacts between alternatives. The newly generated liquid waste could be treated in the same facility as the mixed transuranic waste/SBW or DOE could construct a separate facility to grout the newly generated liquid waste.

b. 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.

c. 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.

d. For the New Waste Calcining Facility with Maximum Achievable Control Technology upgrades.

e. For the liquid waste storage tank.

CH TRU = contact-handled transuranic waste; CsIX = cesium ion exchange; FUETAP = formed under elevated temperature and pressure; HLW = high-level waste; LLW = low-level waste; MACT = maximum achievable control technology; NGLW = newly generated liquid waste; TRU = transuranic waste; WIPP = Waste Isolation Pilot Plant.

Table 5.3-*12*. Estimated radiological health impacts from disposition activities for existing facilities (annual and total dose).[a]

Facility description	Annual average number of workers	Annual collective worker dose (person-rem)	Total collective dose for disposition period (person-rem)	Estimated LCFs from total collective dose (person-rem)
Tank Farm				
Clean Closure	280	***70***	***1,900***	***0.76***
Performance-Based Closure	***20***	***5.0***	***110***	***0.042***
Closure to Landfill Standards	***12***	***3.0***	***51***	***0.020***
Performance-Based Closure with Class A Grout Disposal	***11***	***2.8***	***66***	***0.026***
Performance-Based Closure with Class C Grout Disposal	***11***	***2.8***	***66***	***0.026***
Tank Farm related facilities	***1***	***0.25***	***1.5***	***6.0×10^{-4}***
Bin Sets				
Clean Closure	58	***15***	***380***	***0.15***
Performance-Based Closure	***55***	***14***	***290***	***0.12***
Closure to Landfill Standards	27	***6.8***	***140***	***0.057***
Performance-Based Closure with Class A Grout Disposal	***47***	***12***	***200***	***0.080***
Performance-Based Closure with Class C Grout Disposal	***47***	***12***	***200***	***0.080***
Bin Sets related facilities	***<1***	***<0.25***	***<1.5***	***$<6.0\times10^{-4}$***
PEWE and related facilities	***39***	***9.8***	***54***	***0.021***
Fuel Processing Building and related facilities				
Performance-Based Closure	25	6.3	63	0.025
Closure to Landfill Standards	20	5.0	50	0.020
FAST/FAST Stack	34	***8.5***	***51***	0.020
Transport Lines Group	***1***	***0.25***	***0. 25***	***1.0×10^{-4}***
New Waste Calcining Facility				
Performance-Based Closure	35	8.8	***26***	***0.011***
Closure to Landfill Standards	32	8.0	***24***	***9.6×10^{-3}***
Remote Analytical Laboratory	***4***	***1.0***	***3.0***	***1.2×10^{-3}***

a. 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 5.3-1***3*** 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 ***INTEC***. 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 ***6.1×10^{-8}*** person-rem for the Bin Set Closure to Landfill Standards Alternative results in an increase in the number of latent cancer fatalities of ***3.1×10^{-11}***. All other radiation dose impacts are lower.

Table 5.3-1***4*** provides a summary of annual radiation dose and health impacts from radionuclide emissions from the ***disposition of*** other existing facilities associated with HLW ***management***. Dose impacts are presented for the maximally exposed offsite and onsite individuals and the population within 50 miles of ***INTEC***. 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.

Table 5.3-*13*. Summary of radiation dose impacts associated with airborne radionuclide emissions from disposition of the Tank Farm and bin sets under alternative closure scenarios.

		Maximum annual radiation dose[a]			
Case	Applicable standard	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}	***1.5×10^{-10}***	***1.1×10^{-9}***	1.5×10^{-10}
Estimated annual increase in probability of LCF to the maximally exposed offsite individual	NA[d]	6.0×10^{-16}	***7.5×10^{-17}***	***5.5×10^{-16}***	7.5×10^{-17}
Dose to noninvolved worker (millirem per year)[e]	5.0×10^{3}[f]	1.2×10^{-9}	***1.5×10^{-10}***	***1.1×10^{-9}***	1.5×10^{-10}
Estimated annual increase in probability of LCF to the noninvolved work	NA	4.8×10^{-16}	***6.0×10^{-17}***	***4.4×10^{-16}***	6.0×10^{-17}
Collective dose to population within 50 miles of INTEC (person-rem per year)[g]	NA	***3.7×10^{-8}***	***4.6×10^{-9}***	***3.4×10^{-8}***	***4.7×10^{-9}***
Estimated annual increase in number of latent cancer fatalities to population	NA	***1.9×10^{-11}***	***2.3×10^{-12}***	***1.7×10^{-11}***	***2.4×10^{-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)[e]	5.0×10^{3}[f]	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)[g]	NA	***6.6×10^{-9}***	***8.6×10^{-9}***	***6.1×10^{-8}***	***8.6×10^{-9}***
Estimated annual increase in number of latent cancer fatalities to population	NA	***3.3×10^{-12}***	***4.3×10^{-12}***	***3.1×10^{-11}***	***4.3×10^{-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. NA = not applicable.

e. Location of highest onsite dose is Central Facilities Area.

f. Occupational dose limit per 10 CFR 835.202; applies to sum of doses from all exposure pathways.

g. Applies to future projected population of about ***242,000*** people.

Table 5.3-14. Summary of radiation dose impacts associated with airborne radionuclide emissions from disposition of 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]	***8.1×10^{-11}***	***6.7×10^{-11}***	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[c]	***4.1×10^{-17}***	***3.4×10^{-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)[d]	5.0×10^{3}[e]	***8.1×10^{-11}***	***1.6×10^{-11}***	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	***3.2×10^{-17}***	***6.4×10^{-18}***	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)[f]	NA[f]	***2.5×10^{-9}***	***4.4×10^{-9}***	***3.7×10^{-9}***	***7.4×10^{-9}***	***2.5×10^{-9}***	***3.0×10^{-9}***	***1.2×10^{-9}***
Estimated annual increase in number of LCFs to population	NA	***1.3×10^{-12}***	***2.2×10^{-12}***	***1.9×10^{-12}***	***3.7×10^{-12}***	***1.3×10^{-12}***	***1.5×10^{-12}***	***6.0×10^{-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. NA = not applicable.

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 ***242,000*** people.

FAST = Fluorinel and Storage Facility.

Source: Data from Project Data Sheets in Appendix C.6.

Table 5.3-1***5*** provides estimates of occupational safety impacts for 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 ***and operations*** data from ***1996*** to ***2000*** (***DOE 2001***).

As shown in Table 5.3-1***5***, 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 option. DOE ***estimated*** the annual and total lost workdays to be ***80*** days and ***2,100*** days, respectively. The annual and total recordable cases are ***estimated*** to be ***10*** cases and ***280*** cases, respectively. As shown in Table 5.3-1***5***, worker occupational health and safety impacts for all other alternatives would be much lower.

Table 5.3-*15*. Estimated worker injury impacts from disposition 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	***80***	***10***	***2.1×10^3***	***280***
Performance-Based Closure	***20***	***5.7***	***0.74***	***120***	***16***
Closure to Landfill Standards	***12***	***3.4***	***0.44***	***58***	***7.5***
Performance-Based Closure with Class A Grout Disposal	***11***	***3.1***	***0.41***	***75***	***9.8***
Performance-Based Closure with Class C Grout Disposal	***11***	***3.1***	***0.41***	***75***	***9.8***
Tank Farm related facilities	***1***	***0.28***	***0.037***	***1.7***	***0.22***
Bin Sets					
Clean Closure	58	***16***	***2.1***	***430***	***56***
Performance-Based Closure	55	***16***	2.0	***330***	***43***
Closure to Landfill Standards	27	***7.7***	1.0	***160***	***21***
Performance-Based Closure with Class A Grout Disposal	***47***	***13***	***1.7***	***230***	***30***
Performance-Based Closure with Class C Grout Disposal	***47***	***13***	***1.7***	***230***	***30***
Bin Sets related Facilities	***<1***	***<0. 28***	***<0.037***	***<1.7***	***<0.22***
PEWE and related facilities	***51***	***14***	***1.9***	***87***	***11***
Fuel Processing Building and related Facilities					
Performance-Based Closure	40	***11***	***1.5***	***110***	15
Closure to Landfill Standards	32	***9.1***	***1.2***	***91***	12
FAST/FAST Stack	54	***15***	2.0	***92***	12
Transport Lines Group	***3***	***0.85***	***0.11***	***0.85***	***0.11***
New Waste Calcining Facility					
Performance-Based Closure	47	***13***	***1.7***	***40***	***5.2***
Closure to Landfill Standards	44	***12***	***1.6***	***37***	***4.9***
Remote Analytical Laboratory	7	2.0	***0.26***	***6.0***	***0.78***

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.

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 surrounding the facilities and eventually into ***the*** aquifer near the facilities.

DOE evaluated the potential for other ***dispersion mechanisms*** 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 ***weathering or*** access by burrowing animals.

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 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 ***as well as calculating radiation dose to individuals who could be in proximity to radioactivity in closed HLW management facilities.***

For radiological constituents, DOE calculated the radiation dose and estimated the corresponding number of latent cancer fatalities 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 disposition scenario in Table 5.3-1***6. The results represent doses over the entire period of exposure for each receptor that would occur during peak years of exposure (peak groundwater concentration or highest external dose rates, depending on receptor).***

Doses to the maximally exposed resident are highest under the bin set - No Action scenario. For this receptor, doses from the groundwater pathway are primarily due to iodine-129 and technetium-99 intake via groundwater and food product ingestion. Intruder and ***future industrial*** worker doses 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-type grout in the Tank Farm, while for ***the future industrial*** worker it would be very low in all cases but highest under the ***bin set -*** No Action scenario. The magnitude of these external dose estimates is highly influenced by the proximity to the Tank Farm. Under the conditions assumed here, the maximum intruder dose is estimated at about ***2.5×10^5*** millirem ***under the Tank Farm - Performance-based Closure with Class C Grout Disposal scenario.***

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. For all receptors and scenarios, cancer risk from cadmium exposure is very low (less than one in a trillion).

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 one 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. Noncancer risk would be higher for some receptors and scenarios. ***The highest values result from cadmium intake by the maximally exposed resident under the bin sets - No Action scenario and the scenarios involving disposal of Class A or C-type***

Table 5.3-16. Lifetime radiation dose (millirem) by receptor and facility disposition scenario.

Facility	*Maximally exposed resident*	*Future industrial worker*	*Intruder*	*Recreational user*
No Action				
Tank Farm	***84***	***4.4***	5.1×10^{4}	***0.64***
Bin sets	***490***	***25***	2.3×10^{-4}	***3.7***
Performance-Based Closure or Closure to Landfill Standards				
Tank Farm	***4.4***	***0.36***	1.9×10^{4}	***0.057***
Bin sets	***1.3***	***0.070***	6.6×10^{-9}	***0.010***
New Waste Calcining Facility	***0.034***	1.7×10^{-3}	9.1×10^{-11}[a]	2.4×10^{-4}
Process Equipment Waste Evaporator	***0.036***	1.8×10^{-3}	9.6×10^{-11}[a]	2.6×10^{-4}
Performance-Based Closure with Class A Grout Disposal				
Tank Farm[b]	***5.0***	***0.44***	2.0×10^{4}	***0.070***
Bin sets[b]	***2.2***	***0.19***	6.7×10^{-9}	***0.030***
Performance-Based Closure with Class C Grout Disposal				
Tank Farm[c]	***4.6***	***0.38***	2.5×10^{5}	***0.061***
Bin sets[c]	***2.1***	***0.16***	2.4×10^{-7}	***0.025***
Class A or C Grout Disposal in a New Low-Activity Waste Disposal Facility				
Class A disposal facility	***6.9***	***0.95***	2.8×10^{-6}	***0.16***
Class C disposal facility	***5.8***	***0.72***	4.4×10^{-3}	***0.12***

a. Direct radiation dose to intruder from exposure to residual activity in closed New Waste Calcining Facility and Process Equipment Waste Evaporator was not assessed. Doses shown for these facilities are from groundwater pathway.

b. Includes residual contamination plus Class A-type grout.

c. Includes residual contamination plus Class C-type grout.

grout in a Low-Activity Waste Disposal Facility. The health hazard quotient is slightly below one for the bin sets - No Action and Class A Grout Disposal in a new Low-Activity Waste Disposal Facility scenarios (0.81 and 0.96, respectively), and slightly above one (1.1) for the Class C Grout Disposal in a new Low-Activity Waste Disposal Facility scenario. 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 5.3-17 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

Table 5.3-16. Lifetime radiation dose (millirem) by receptor and facility disposition scenario.

Facility	*Maximally exposed resident*	*Future industrial worker*	*Intruder*	*Recreational user*
		No Action		
Tank Farm	***84***	***4.4***	***5.1×10^{4}***	***0.64***
Bin sets	***490***	***25***	***2.3×10^{-4}***	***3.7***
		Performance-Based Closure or Closure to Landfill Standards		
Tank Farm	***4.4***	***0.36***	***1.9×10^{4}***	***0.057***
Bin sets	***1.3***	***0.070***	***6.6×10^{-9}***	***0.010***
New Waste Calcining Facility	***0.034***	***1.7×10^{-3}***	***9.1×10^{-11}[a]***	***2.4×10^{-4}***
Process Equipment Waste Evaporator	***0.036***	***1.8×10^{-3}***	***9.6×10^{-11}[a]***	***2.6×10^{-4}***
		Performance-Based Closure with Class A Grout Disposal		
Tank Farm[b]	***5.0***	***0.44***	***2.0×10^{4}***	***0.070***
Bin sets[b]	***2.2***	***0.19***	***6.7×10^{-9}***	***0.030***
		Performance-Based Closure with Class C Grout Disposal		
Tank Farm[c]	***4.6***	***0.38***	***2.5×10^{5}***	***0.061***
Bin sets[c]	***2.1***	***0.16***	***2.4×10^{-7}***	***0.025***
		Class A or C Grout Disposal in a New Low-Activity Waste Disposal Facility		
Class A disposal facility	***6.9***	***0.95***	***2.8×10^{-6}***	***0.16***
Class C disposal facility	***5.8***	***0.72***	***4.4×10^{-3}***	***0.12***

a. Direct radiation dose to intruder from exposure to residual activity in closed New Waste Calcining Facility and Process Equipment Waste Evaporator was not assessed. Doses shown for these facilities are from groundwater pathway.

b. Includes residual contamination plus Class A-type grout.

c. Includes residual contamination plus Class C-type grout.

grout in a Low-Activity Waste Disposal Facility. The health hazard quotient is slightly below one for the bin sets - No Action and Class A Grout Disposal in a new Low-Activity Waste Disposal Facility scenarios (0.81 and 0.96, respectively), and slightly above one (1.1) for the Class C Grout Disposal in a new Low-Activity Waste Disposal Facility scenario. 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 5.3-17 presents a summary of noncancer hazard quotients for intakes of fluoride, nitrate, and cadmium.

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Table 5.3-17. Noncarcinogenic health hazard quotients.

Contaminant	Cadmium			Fluoride			Nitrate		
Facility	Maximally exposed resident	Future industrial worker	Recreational user	Maximally exposed resident	Future industrial worker	Recreational user	Maximally exposed resident	Future industrial worker	Recreational user
No Action									
Tank Farm	0.040	8.5×10^{-3}	9.7×10^{-4}	1.6×10^{-4}	1.9×10^{-5}	3.8×10^{-6}	0.047	3.8×10^{-3}	6.5×10^{-4}
Bin sets	0.81	0.17	0.020	7.1×10^{-3}	8.3×10^{-4}	1.7×10^{-4}	3.6×10^{-3}	2.9×10^{-4}	5.0×10^{-5}
Performance-Based Closure or Closure to Landfill Standards									
Tank Farm	5.3×10^{-3}	1.0×10^{-3}	1.2×10^{-4}	1.1×10^{-6}	1.3×10^{-7}	2.7×10^{-8}	1.7×10^{-4}	1.4×10^{-5}	2.4×10^{-6}
Bin sets	6.1×10^{-3}	1.3×10^{-3}	2.8×10^{-3}	6.0×10^{-5}	7.1×10^{-6}	1.4×10^{-6}	5.6×10^{-5}	4.6×10^{-6}	7.8×10^{-7}
NWCF	- [a]	-	-	3.8×10^{-6}	4.5×10^{-7}	9.2×10^{-8}	8.9×10^{-7}	7.2×10^{-8}	1.2×10^{-8}
PEW Evaporator	-	-	-	1.1×10^{-5}	1.3×10^{-6}	2.7×10^{-7}	9.2×10^{-7}	7.5×10^{-8}	1.3×10^{-8}
Performance-Based Closure with Class A Grout Disposal									
Tank Farm[b]	0.088	0.019	2.1×10^{-3}	7.2×10^{-4}	8.5×10^{-5}	1.7×10^{-5}	6.9×10^{-3}	5.6×10^{-4}	9.6×10^{-5}
Bin sets[b]	0.12	0.026	5.5×10^{-3}	1.0×10^{-3}	1.2×10^{-4}	2.5×10^{-5}	0.035	2.9×10^{-3}	4.9×10^{-4}
Performance-Based Closure with Class C Grout Disposal									
Tank Farm[c]	0.040	8.4×10^{-3}	9.6×10^{-4}	3.8×10^{-4}	4.5×10^{-5}	9.3×10^{-6}	9.1×10^{-4}	7.5×10^{-5}	1.3×10^{-5}
Bin sets[c]	0.14	0.031	6.1×10^{-3}	1.2×10^{-3}	1.5×10^{-4}	3.0×10^{-5}	0.028	2.3×10^{-3}	1.4×10^{-4}
Class A or C Grout Disposal In a New Low-Activity Waste Disposal Facility									
Class A disposal facility	0.96	0.20	0.023	9.1×10^{-3}	1.1×10^{-3}	2.2×10^{-4}	9.8×10^{-3}	8.0×10^{-4}	1.4×10^{-4}
Class C disposal facility	1.1	0.23	0.026	0.011	1.3×10^{-3}	2.6×10^{-4}	2.8×10^{-3}	2.3×10^{-4}	3.9×10^{-5}

a. A dash indicates that there is no quantifiable exposure to this toxicant.

b. Includes residual contamination plus Class A-type grout.

c. Includes residual contamination plus Class C-type grout.

NWCF = New Waste Calcining Facility; PEW = Process Equipment Waste.

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 disposition of 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 within 50 miles of INTEC (***1.6×10^{-8}*** person-rem per year) would be associated with disposition of new facilities under the Minimum INEEL Processing Alternative. This collective dose would be associated with a very small increase (***1.8×10^{-11}***) in latent cancer fatalities in the population.

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 existing waste management facilities would also be very small. The highest collective dose to the population with 50 miles of INTEC (***6.1×10^{-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 (***3.1×10^{-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 diproportionately 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 the INEEL) or southwest (into the sparsely-populated area south and west of the 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 4-2***0***). The Fort Hall Indian Reservation is also some 40 miles southeast of INTEC (see Figure 4-2***1***). 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. Disposition activities would result in the consumption of electricity, water, and fossil fuels, and the generation of wastewater.

Table 5.3-1***8*** presents the utility and energy requirements for disposition of new facilities that would be built to support the waste processing alternatives. These facilities would be clean-closed in accordance with applicable permits or regulations.

Table 5.3-1***9*** presents impacts for disposition of the Tank Farm and bin sets by closure alternative. Disposition of 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 ***would*** not ***be*** long-term compared to the Tank Farm and bin sets.

Table 5.3-***20*** presents impacts for disposition of other existing facilities associated with HLW management.

5.3.11 WASTE AND MATERIALS

Waste would be produced as a result of disposition of new waste processing facilities. Table 5.3-2***1*** 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, waste volumes have been conservatively estimated. 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.

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 5.3-2***2*** 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 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

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Table 5.3-2***2*** 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 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

Table 5.3-*18*. Utility and energy requirements for disposition of new facilities.[a,b]

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	***2.8***	160	***0.032***	0.17	0	0.17
P25A	Packaging & Loading Vitrified HLW at INTEC for Shipment to NGR	***0.25***	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	***1***	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-*18*. Utility and energy requirements for disposition of new facilities [a,b] (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	***3***	160	0.23	1.3	0.60	1.3
P23B	Vitrification Plant	***2.8***	160	0.12	***0.43***	0.60	0.44
P23C	Class A Grout Plant	***2.8***	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	***2.8***	160	***0.032***	0.17	0	0.17
P25A	Packaging & Loading Vitrified HLW at INTEC for Shipment to NGR	***0.25***	***39***	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	***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			1.8×10^{3}	1.0	5.6	3.1	5.6

Table 5.3-*18*. Utility and energy requirements for disposition of new facilities [a,b] (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	***3***	160	***0.071***	0.86	0	0.86
P73A	Packaging and Loading HIP Waste at INTEC for Shipment to NGR	***2.5***	140	***0.054***	***0.039***	0.080	***0.039***
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 5.3-18. Utility and energy requirements for disposition of new facilities [a,b] (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	***3***	160	0.12	1.6	0	1.6
P83A	Packaging & Loading Cementitious Waste at INTEC for Ship. to NGR	***3.5***	140	***0.054***	***0.039***	0.080	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	***3***	160	0.10	1.4	0	1.4
P62A	Packaging/Loading Vitrified HLW at INTEC for Shipment to NGR	***3***	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-*18*. Utility and energy requirements for disposition of new facilities [a,b] (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)
			Steam Reforming Option				
P13	***New Storage Tanks***	***2***	***140***	$\boldsymbol{7.6\times10^{-3}}$	***0.11***	***0.11***	***0.11***
P35E	***Grout Packaging and Loading for Offsite Disposal***	***2***	***160***	***0.021***	***0.17***	***0.050***	***0.17***
P59A	***Calcine Retrieval and Transport***	***1***	***160***	***0.11***	***0.90***	***0.20***	***0.90***
P117A	***Calcine Packaging and Loading to Hanford***	***3***	***160***	$\boldsymbol{9.3\times10^{-3}}$	***0.29***	***0.80***	***0.29***
P2001	***NGLW Grout Facility***	***1***	***180***	***0.036***	***0.090***	***0.23***	***0.090***
P2002A	***Steam Reforming***	***1***	***96***	***0.12***	***0.41***	***0.18***	***0.41***
Total			***890***	***0.30***	***2.0***	***1.6***	***2.0***
			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	***2.8***	160	***0.032***	0.17	0	0.17
P25A	Packaging & Loading Vitrified HLW and INTEC for Shipment to NGR	***0.25***	39	0	3.0×10^{-3}	0	3.0×10^{-3}
P27	Class A Grout Disposal in New INEEL Disposal Facility	***2***	1	0.060	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	$\boldsymbol{9.3\times10^{-3}}$	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

Table 5.3-18. Utility and energy requirements for disposition of new facilities [a,b] (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)
Vitrification without Calcine Separations Option							
P13	***New Storage Tanks***	***2***	***140***	7.6×10^{-3}	***0.11***	***0.11***	***0.11***
P18	***New Analytical Lab***	***2***	***160***	***0.16***	***0.99***	***0.23***	***0.99***
P59A	***Calcine Retrieval and Transport***	***1***	***160***	***0.11***	***0.90***	***0.20***	***0.90***
P61	***Vitrified HLW Interim Storage***	***3***	***160***	***0.10***	***1.4***	***0***	***1.4***
P62A	***Packaging/Loading Vitrified HLW at INTEC for Shipment to NGR***	***3***	***140***	***0.054***	***0.052***	***0.080***	***0.052***
P88	***Vitrification with MACT Upgrades***	***5***	***180***	***0.20***	***0.66***	***0.70***	***0.66***
P133	***Waste Treatment Pilot Plant***	***2***	***160***	***0.059***	***0.26***	***0.045***	***0.26***
Total			1.1×10^{3}	***0.69***	***4.4***	***1.4***	***4.4***
Vitrification with Calcine Separations Option							
P9A	***Full Separations***	***3***	***160***	***0.23***	***1.3***	***0.60***	***1.3***
P9C	***Grout Plant***	***2.5***	***160***	***0.12***	***0.67***	***0.60***	***0.67***
P13	***New Storage Tanks***	***2***	***140***	7.6×10^{-3}	***0.11***	***0.11***	***0.11***
P18	***New Analytical Lab***	***2***	***160***	***0.16***	***0.99***	***0.23***	***0.99***
P24	***Vitrified Product Interim Storage***	***2.8***	***160***	***0.032***	***0.17***	***0***	***0.17***
P25A	***Packaging & Loading Vitrified HLW at INTEC for Shipment to NGR***	***0.25***	***39***	***0***	3.0×10^{-3}	***0***	3.0×10^{-3}
P35E	***Grout Packaging and Loading for Offsite Disposal***	***2***	***160***	***0.021***	***0.17***	***0.050***	***0.17***
P59A	***Calcine Retrieval and Transport***	***1***	***160***	***0.11***	***0.90***	***0.20***	***0.90***
P88	***Vitrification with MACT Upgrades***	***5***	***180***	***0.20***	***0.66***	***0.70***	***0.66***
P133	***Waste Treatment Pilot Plant***	***2***	***160***	***0.059***	***0.26***	***0.045***	***0.26***
Total			1.5×10^{3}	***0.93***	***5.2***	***2.5***	***5.2***

a. Source: Data from Project Data Sheets in Appendix C.6.

b. The EIS analyzes treatment of post-2005 newly generated liquid waste as mixed transuranic waste/SBW for comparability of impacts between alternatives. The newly generated liquid waste could be treated in the same facility as the mixed transuranic waste/SBW or DOE could construct a separate facility to grout the newly generated liquid waste.

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 5.3-19. Summary of annual resource impacts from disposition of 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

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a. NA = not applicable.

Table 5.3-20. Summary of resource impacts from disposition of 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 5.3-21. Summary of waste generated from the disposition of new waste processing facilities.[a,b]

			Total waste generation per waste type (in cubic meters)			
Project Number	Project description	Duration of activity (years)	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
Total			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	***2.8***	9.4×10^3	0	0	2
P25A	Packaging and Loading Vitrified HLW at INTEC for Shipment to a Geologic Repository	***0.25***	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
Total	Base case – New INEEL disposal of Class A grout					
	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 5.3-21. Summary of waste generated from the disposition of new waste processing facilities [a,b] (continued).

Project 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	***3***	2.3×10^4	3.1×10^4	320	15
P23B	Vitrification Plant	***2.8***	1.4×10^4	1.8×10^4	8	6
P23C	Class A Grout Plant	***2.8***	6.0×10^3	7.9×10^3	12	3
P24	Vitrified Product Interim Storage	***2.8***	9.4×10^3	0	0	2
P25A	Packaging and Loading Vitrified HLW at INTEC for Shipment to a Geologic Repository	***0.25***	12	0	0	3
P59A	Calcine Retrieval and Transport	*1*	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
Total			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 Offisite Disposal	2	1.1×10^3	0	0	0
Total	Base case – New INEEL disposal of Class C grout		4.1×10^4	4.4×10^4	350	30
	Tank Farm and bin set disposal of Class C grout		4.4×10^4	4.4×10^4	710	50
	Offsite disposal of Class C grout		4.1×10^4	4.4×10^4	350	30

Table 5.3-21. Summary of waste generated from the disposition of new waste processing facilities [a,b] (continued).

Project 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	*1*	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	*1*	5.1×10^4	0	0	24
P83	Packaging and Loading of Cementitious Waste at INTEC for Shipment to a Geologic Repository	*1*	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 5.3-21. Summary of waste generated from the disposition of new waste processing facilities [a,b] (continued).

Project 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
		Steam Reforming Option				
P13	***New Storage Tanks***	***2***	***450***	***0.2***	***47***	***0***
P35E	***Grout Packaging and Loading for Offsite Disposal***	***2***	***670***	***0***	***0***	***1.3***
P59A	***Calcine Retrieval and Transport***	***1***	3.6×10^3	***0***	***0***	***0***
P117A	***Calcine Packaging and Loading***	***3***	***140***	***110***	***8***	***46***
P2001	***NGLW Grout Facility***	***1***	1.9×10^3	***0.2***	***14***	2.5×10^3
P2002A	***Steam Reforming***	***1***	1.1×10^4	1.5×10^4	***0***	***6.0***
Total			1.8×10^4	1.5×10^4	***69***	2.5×10^3
		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	***2.8***	9.4×10^3	0	0	2
P25A	Packaging and Loading of Vitrified HLW at INTEC for Shipment to a Geologic Repository	***0.25***	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

Table 5.3-21. Summary of waste generated from the disposition of new waste processing facilities [a,b] (continued).

Project 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
	Vitrification without Calcine Separations Option					
P13	***New Storage Tanks***	*2*	*450*	*0.20*	*47*	*0*
P18	***New Analytical Laboratory***	*2*	4.6×10^3	3.1×10^3	*97*	*4.9*
P59A	***Calcine Retrieval and Transport***	*1*	3.6×10^3	*0*	*0*	*0*
P61	***Vitrified HLW Interim Storage***	*3*	4.3×10^4	*0*	*0*	*32*
P62A	***Packaging and Loading Vitrified HLW at INTEC for Shipment to a Geologic Repository***	*3*	*430*	*0*	*0*	*110*
P88	***Vitrification with Maximum Achievable Control Technology***	*5*	2.3×10^4	3.1×10^4	*360*	*43*
P133	***Waste Treatment Pilot Plant***	*2*	5.4×10^3	6.7×10^3	*22*	*8.0*
Total			8.1×10^4	4.1×10^4	*530*	*200*
	Vitrification with Calcine Separations Option					
P9A	***Full Separations***	*3*	2.4×10^4	3.1×10^4	*350*	*32*
P9C	***Grout Plant***	*2.5*	6.0×10^3	7.9×10^3	*18*	*13*
P13	***New Storage Tanks***	*2*	*450*	*0.20*	*47*	*0*
P18	***New Analytical Laboratory***	*2*	4.6×10^3	3.1×10^3	*97*	*4.9*
P24	***Vitrified Product Interim Storage***	*2.8*	9.4×10^3	*0*	*0*	*4.9*
P25A	***Packaging and Loading Vitrified HLW at INTEC for Shipment to a Geologic Repository***	*0.25*	*12*	*0*	*0*	*3.4*
P35E	***Grout Packaging and Loading for Offsite Disposal***	*2*	*670*	*0*	*0*	*1.3*
P59A	***Calcine Retrieval and Transport***	*1*	3.6×10^3	*0*	*0*	*0*
P88	***Vitrification Facility with Maximum Achievable Control Technology***	*5*	2.3×10^4	3.1×10^4	*360*	*43*
P133	***Waste Treatment Pilot Plant***	*2*	5.4×10^3	6.7×10^3	*22*	*8.0*
Total			7.7×10^4	8.0×10^4	*900*	*110*

a. Source: Project Data Sheets in Appendix C.6.

b. ***The EIS analyzes treatment of post-2005 newly generated liquid waste as mixed transuranic waste/SBW for comparability of impacts between alternatives. The newly generated liquid waste could be treated in the same facility as the mixed transuranic waste/SBW or DOE could construct a separate facility to grout the newly generated liquid waste.***

Table 5.3-22. Waste generated for existing HLW *management* facilities by facility and disposition alternative. [a]

	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	1.6×10^{5}	1.1×10^{3}	1.1×10^{4}	0
Performance-Based Closure	1.9×10^{3}	0	120	79
Closure to Landfill Standards	1.7×10^{3}	0	480	0
Performance-Based Closure with Class A Grout Disposal	1.5×10^{3}	0	120	27
Performance-Based Closure with Class C Grout Disposal	1.5×10^{3}	0	120	27
Tank Farm Related Facilities	56	100	0	1
Bin Sets				
Clean Closure	2.4×10^{4}	4.6×10^{3}	180	130
Performance-Based Closure	3.6×10^{3}	150	85	100
Closure to Landfill Standards	3.6×10^{3}	150	33	100
Performance-Based Closure with Class A Grout Disposal	1.5×10^{4}	0	540	28
Performance-Based Closure with Class C Grout Disposal	1.5×10^{4}	0	540	28
Bin Set Related Facilities	0	10	0	0.2
Process Equipment Waste Evaporator and Related Facilities[c]	870	2.5×10^{3}	0	13
Fuel Processing Building and Related Facilities	0	920	0	18
FAST and Related Facilities	0	1.5×10^{3}	0	33
Remote Analytical Laboratory	0	100	0	2
New Waste Calcining Facility	0	2.4×10^{3}	460	250
Transport Line Group	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. Source of data for Process Waste Equipment Evaporator, CPP-604, (combined with related facilities here): Haley (1998).

the five disposition alternatives. Other existing waste processing facilities are generally only being considered for a single disposition alternative as shown in Table 3-***3***. The ***exceptions*** to this ***are*** the facility groupings 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 5.3-2***2*** 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 2.5×10^{5} 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 8.5×10^{4} 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 8.5×10^{4} 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 1.1×10^4 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 5.3-2*2* 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 ***risk of*** 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 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 ***disposition of*** each HLW ***management*** facility. The facility disposition alternatives are evaluated below in the respective facility accident analyses.

Approach

The approach adopted by DOE is illustrated in Figure 5.3-1*0*. 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

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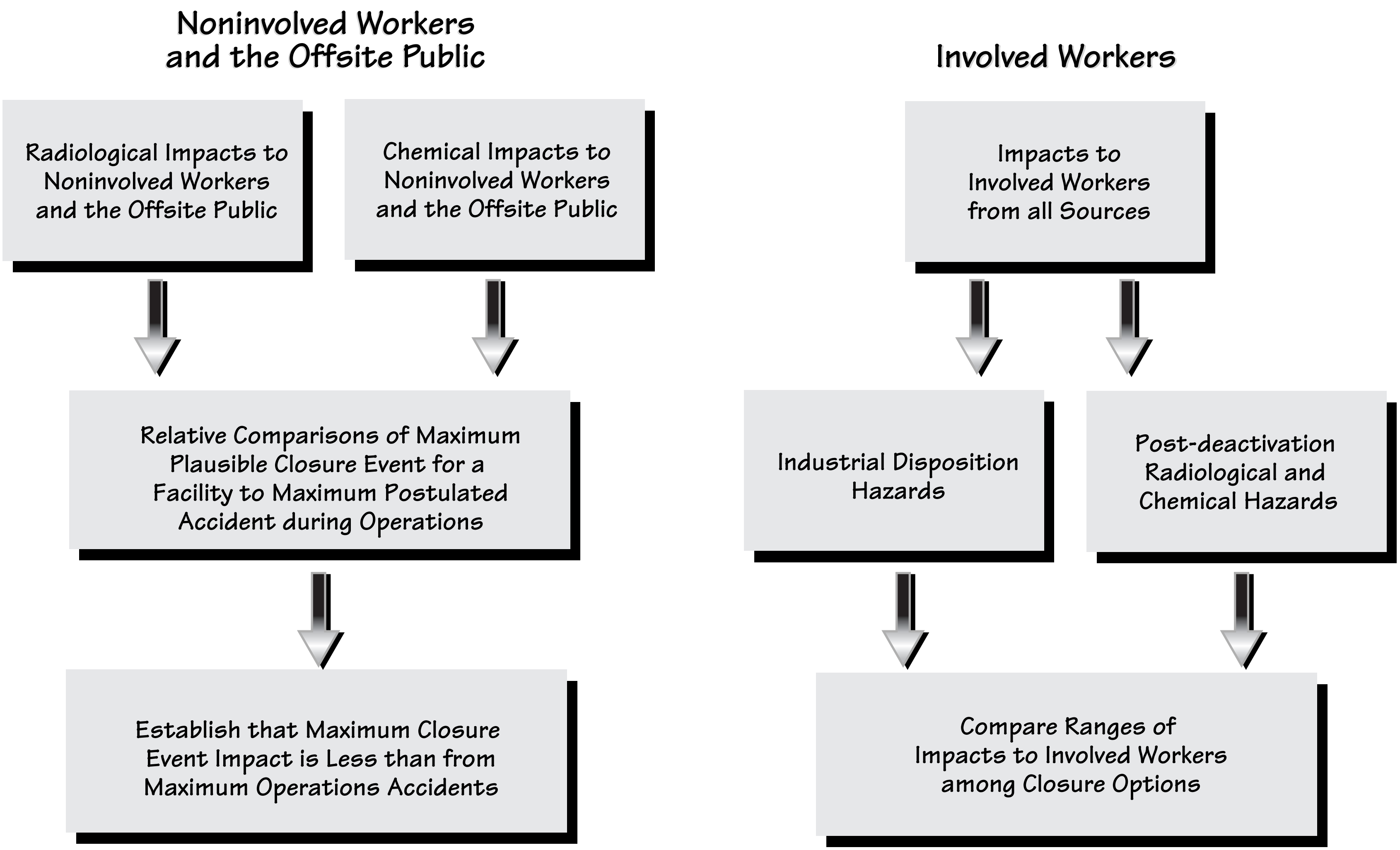

FIGURE 5.3-10.
Impact assessment methodology for hypothetical disposition accidents in INTEC facilities.

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 ***a facility disposition*** 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 release these inventories. DOE standards (DOE 1998) indicate 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 5.3-1***0*** 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-***3***. Table 5.3-2***3*** is derived from Table 3-***3*** 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 hazardous 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 5.3-2***3***.

For purposes of this facility disposition accident analysis, HLW ***management*** 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 ***because*** 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 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 ***under*** "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. 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.

Table 5.3-*23*. 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-***3*** and Rodriguez et al. (1997).

5.3.12.2 Facility Disposition Alternatives

The three facility disposition alternatives considered by DOE ***are clean closure, performance-based closure, and closure to landfill standards.***

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 disposition 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 ***management*** 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 ***management*** 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 5.3-2***4***.

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 ***management*** 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 was considered for the remaining INTEC facilities, except for the Fuel Processing Complex 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 ***management*** 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.

Table 5.3-24. Summary of facility disposition accidents potentially impacting noninvolved workers or the offsite public.

Facility number	Facility title	Clean closure	Performance - ***based***	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	***An external event causing a release of radioactivity***
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	***An external event causing a release of radioactivity***
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	***An external event causing a release of radioactivity***
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

Table 5.3-24. Summary of facility disposition accidents potentially impacting noninvolved workers or the offsite public (continued).

Facility number	Facility title	Clean closure	Performance *- based*	Landfill Stds	Material at risk at closure	Contaminant mobility at closure	Energy for accident at closure	Maximum plausible accident	Bounding operations accident
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
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

Table 5.3-24. Summary of facility disposition accidents potentially impacting noninvolved workers or the offsite public (continued).

Facility number	Facility title	Clean closure	Performance *-based*	Landfill Stds	Material at risk at closure	Contaminant mobility at closure	Energy for accident at closure	Maximum plausible accident	Bounding operations accident
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	***An external event causing a release of radioactivity***
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

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 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 ***or*** hazardous materials were inadvertently "left behind" in areas that ***were*** 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 ***management*** 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" to confirm that a "bounding 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 5.3-2***4*** 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 5.3-2***4*** 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 5.3-2***4*** 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 5.3-2***5*** 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 5.3-2***5***, 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

Table 5.3-25. **Industrial hazards impacts during disposition of existing HLW *management* 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	***770***	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	***1,100***	2.4	280	0.64	210	0.48

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 5.3-2***5 identifies*** 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 ***presents risk*** 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.

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 federal or nonfederal ***agency or entity*** 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 ***actions undertaken*** within the spatial and temporal boundaries of the actions considered in this EIS.

5.4.1 METHODOLOGY

This analysis considers ***direct and indirect*** impacts that could occur ***from*** 2000 to 2095 ***as well as the residual effects that may cause impacts over an indefinite period of time such as potential groundwater contamination***. The ***2000-2095*** period ***is the timeframe established*** for completion of activities evaluated in this EIS ***and the*** assumed period of institutional control, ***although DOE has no plans to ever relinquish institutional control of INEEL facilities or lands.*** The methodology used to analyze the potential for ***cumulative*** impacts from alternatives evaluated in this EIS involved the following process:

1. ***The*** Region of Influence for impacts associated with projects analyzed in this EIS was defined.

2. The affected environment ***and*** baseline conditions were identified.

3. Past, present, and reasonably foreseeable actions and the effects of those actions were identified.

4. Aggregate ***(additive)*** effects of past, present, and reasonably foreseeable actions were assessed.

The Idaho HLW & FD EIS ***tiers*** 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 ***also*** previously analyzed in the SNF & INEL EIS. The Record of Decision for that EIS provided the ***general*** scope and ***timeframe*** for spent nuclear fuel management and environmental restoration activities to be included in the cumulative impact analysis of this EIS. ***In*** addition, actions undertaken or proposed subsequent to the issuance of that Record of Decision were identified and included in the cumulative impact analysis of this EIS.

Data ***used to establish the cumulative impacts baseline*** 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, ***and*** was updated to reflect projects included in the SNF & INEL EIS Record of Decision and other projects that occurred subsequent to ***that*** EIS (Jason 1998). In ***the cumulative impacts*** analysis ***for this EIS***, 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 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.*7*).

Section 5.4.2 identifies past, present, and reasonably foreseeable actions included in the cumulative impact analysis. Actions 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 ***or pathway***.

Table 5.4-1. Projects included in the environmental baseline for analyses of cumulative impacts.

- Borrow Source Silt Clay
- Calcine Transfer Project
- Central Liquid Waste Processing Facility D&D
- Dry Fuels Storage Facility
- EA Determination for CPP-627
- EBR-II Blanket Treatment
- EBR-II Plant Closure
- ECF Dry Cell Project
- Engineering Test Reactor D&D
- Fuel Processing Complex (CPP-601) D&D
- Fuel Receiving, Canning, Characterization & Shipping
- Gravel Pit Expansions (New Borrow Source)
- GTCC Dedicated Storage
- Headend Processing Plant (CPP-640) D&D
- Health Physics Instrument Lab
- High Level Tank Farm Replacement (upgrade phase)
- Increased Rack Capacity for CPP-666
- Industrial/Commercial Landfill Expansion
- Material Test Reactor D&D
- Mixed/LLW Disposal Facility
- Non Incinerable Mixed Waste Treatment
- Partnership Natural Disaster Reduction Test Station
- Pit 9 Retrieval
- Private Sector Alpha-MLLW Treatment
- Radioactive Scrap/Waste Facility
- Remediation of Groundwater Facilities
- Remote Mixed Waste Treatment Facility
- RESL Replacement
- RWMC Modifications for Private Sector Treatment of Alpha-MLLW
- Sodium Processing Plant
- TAN Pool Fuel Transfer
- Tank Farm Heel Removal Project
- Treatment of Alpha-MLLW
- TSA Enclosure and Storage Project
- Vadose Zone Remediation
- Waste Calcine Facility (CPP-633) D&D
- Waste Characterization Facility
- Waste Handling Facility
- Waste Immobilization Facility
- WERF Incineration

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 cumulative impacts were identified by reviewing DOE proposed and anticipated future actions on the INEEL and by contacting other Federal and state agencies. Actions determined to have environmental impacts that would ***add to or*** 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 ***or through a particular pathway*** within the Region of Influence. Past, present, and reasonably foreseeable onsite actions 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, ***and*** remedial activities at INTEC Waste Area Group 3 (WAG 3), ***including construction and operation of the INEEL CERCLA Disposal Facility***, excavation of silt/clay borrow sources, deactivation of obsolete nuclear facilities, and replacement of INTEC percolation ponds. Impacts associated with the 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 the INEEL, including INTEC, which are included in the analysis ***in*** this EIS. Excavation of silt ***and*** clay for use in INEEL operations and remedial activities was evaluated in this ***analysis*** because these materials may be required to support facility disposition activities at INTEC. 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

Table 5.4-2. Onsite actions included in the assessment of cumulative impacts.

Project	Description
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-***5***.
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 1999***c***).
EIS for the Treatment and Management of Sodium-Bonded Spent Nuclear Fuel (DOE/EIS-0306)	This 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.

a. Included in the baseline conditions identified in the SNF & INEL EIS.

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.

A potential future project identified but not considered in the cumulative impact analysis because of its speculative nature involves the INTEC coal fired steam heating plant. The plant could potentially be converted to a small commercial power generating facility. The potential for such a conversion is being considered by the Eastern Idaho Community Reuse Organization.

Since the Draft EIS was issued, updated information concerning the treatment of sodium-bonded fuel and irradiation of neptunium-237 targets at the Advanced Test Reactor (ATR) has been evaluated. Impacts associated with the treatment of sodium-bonded spent nuclear fuel have been analyzed in detail and are presented in the U.S. Department of Energy Final Environmental Impact Statement for the Treatment and Management of Sodium-Bonded Spent Nuclear Fuel (DOE 2000a).

Impacts from irradiation of neptunium-237 targets at ATR as well as ATR operations were evaluated in the Final Programmatic Environmental Impact Statement for Accomplishing Expanded Civilian Nuclear Energy Research and Development and Isotope Production Missions in the United States (Nuclear Infrastructure PEIS) (DOE 2000b).

Table 5.4-3 presents waste processing impacts for each Idaho HLW & FD EIS alternative. The maximum impact from the Idaho HLW & FD EIS waste processing and facility disposition alternatives, and other past, present, and reasonably foreseeable projects evaluated in this EIS are presented in Table 5.4-4. Although potential incremental impacts of actions analyzed in the Nuclear Infrastructure PEIS were considered in the cumulative analysis, they were small in every instance and would not contribute substantially to cumulative impacts. For this reason, they were not included in Table 5.4-4. Table 5.4-5 lists INTEC facilities unrelated to Idaho HLW alternatives planned for closure over approximately the same timeframe as the waste processing and facility disposition activities ***analyzed*** in this EIS. The impacts from these unrelated facility closures are included in the cumulative evaluation in Table 5.4-4.

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 WAG 3 (DOE 1999b). As a result, these facilities were not included in the cumulative impact analysis ***because they possess no additive value***.

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 RESOURCES ***AND PATHWAYS*** INCLUDED IN THE CUMULATIVE IMPACT ANALYSIS

Implementation of alternatives evaluated in this EIS would contribute to cumulative impacts on lands, ***including ecology, cultural resources, and borrow materials,*** air, water, ***socioeconomics***, 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 ***Based Impacts Including Ecology, Cultural Resources, and Geology and Soils***

Land Use - Existing industrial development at the INEEL occupies approximately 11,400 acres of the total INEEL area (569,600 acres) (DOE 1995). Cumulatively, implementation of all ***anticipated*** activities ***sitewide*** would lead to converting ***an additional 1,600*** acres of land to industrial use, ***which would increase*** the total disturbance to approximately 13,000 acres, less than 3 percent of the total INEEL land area.

A majority of the potential land disturbance 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 previously disturbed ***areas*** contiguous with or adjacent to existing industrial facilities. 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.

Land disturbance associated with the facility disposition alternatives analyzed in this EIS, including closure of those identified in Table 5.4-5, would occur within the previously disturbed industrial area of INTEC. Certain land uses (such as residential or future industrial development) within this area would be precluded indefinitely into the future.

Ecology - Cumulative impacts to the ecology of the INEEL from habitat loss as a result of any alternative analyzed in this EIS would be small. Radionuclides released from treatment operations could be deposited on vegetation surrounding INTEC. Exposure of individual plants and animals to radionuclides in areas adjacent to INTEC could increase slightly due to waste processing operations. Residual radionuclides and hazardous constituents in soils surrounding INTEC could be absorbed by plants and consumed by animals. Although exposure to these materials may affect 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 alternatives analyzed in this EIS. Additional deposition resulting from any of the alternatives analyzed in this EIS would not be expected 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 to the ecology of the INEEL or plant or animal populations as a result of any alternative analyzed in this EIS.

Cultural and Historic Resources - As stated above, the majority of reasonably foreseeable INEEL actions and waste processing activities would occur within previously disturbed areas contained within or adjacent to INTEC facility areas. The likelihood that these areas contain cultural materials in-tact or in their original context, is small. Nevertheless, there is the potential to unearth or expose cultural materials during excavation. Standard measures to avoid or minimize the impacts to cultural materials discovered during site development are in place. Cultural resource surveys would be conducted prior to construction or surface disturbance outside the INTEC fence and appropriate standard 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.

The types of cumulative impacts on historic resources are the same for each alternative analyzed in this EIS. All undertakings within developed facility areas on the INEEL have the potential to impact properties eligible for nomination to the National Register of Historic Places. Appropriate standard measures, including archival documentation of historic structures, would 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.

Geology and Soils -Disposition of facilities and remediation of contaminated sites at INTEC and other INEEL facility areas would require the use of borrow materials such as gravel, silt and clay. Anticipated requirements for these materials in support of remediation of contaminated sites at the INEEL were identified in the SNF & INEL EIS and in an environmental assessment (EA) addressing impacts of developing new sources of silt and clay to support INEEL actions (DOE 1997a). The EA identified a need for 2,300,000 cubic yards of silt/clay material over a period of 10 years. To account for compaction, reject material not suitable for construction, and other uncertainties associated with construction activities, the volume of material analyzed in the EA was doubled to 4,600,000 cubic yards. Silt and 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 sources analyzed in the EA. Sources of sand, gravel, aggregate, etc. in support of remedial activities and INEEL operations were evaluated in the SNF & INEL EIS. The estimated need for gravel is estimated to be 1,772,000 cubic yards (DOE 1995). The development or expansion of borrow material sources would be within the boundaries of the

Table 5.4-3. Waste processing impacts from each Idaho HLW & FD EIS alternative.

			Separations Alternative		
Resource area	No Action Alternative	Continued Current Operations	Full Separations Option	Planning Basis Option	Transuranic Separations Options
Land resources	None	None	Conversion of 22 acres to industrial use	None	Conversion of 22 acres to industrial use
Cultural resources	None	***Minimal visual degradation through 2016***	Minimal visual degradation through 2035	Minimal visual degradation through 2035	Minimal visual degradation through 2035
Air resources	39 percent	***39*** percent	***39*** percent	***40*** percent	***39*** percent
Maximum consumption of PSD increment					
Water resources[a]					
Construction	***0.16***	***0.88***	***7.0***	7.2	4.9
Operations	15	65	9.0	75	56
Ecological resources	None	None	Loss of 22 acres of habitat	None	Loss of 22 acres of habitat
Waste management[b]					
Industrial					
Construction	1.4×10^3	6.8×10^3	5.5×10^4	6.0×10^4	3.9×10^4
Operations	1.4×10^4	1.9×10^4	5.3×10^4	5.2×10^4	4.3×10^4
Hazardous					
Construction	0	30	790	880	280
Operations	0	0	1.6×10^3	1.2×10^3	960
Mixed low-level waste					
Construction	220	240	1.1×10^3	1.1×10^3	1.1×10^3
Operations	1.3×10^3	3.2×10^3	5.9×10^3	7.9×10^3	5.3×10^3
Low-level waste					
Construction	0	20	330	210	210
Operations	190	9.5×10^3	1.2×10^3	1.0×10^4	960
Socioeconomics[c]					
Construction					
Direct	20	90	850	870	680
Indirect	20	90	***830***	***840***	***650***
Year of peak	2005	2008	2013	2013	2012
Operations					
Direct	***73***	280	440	480	320
Indirect	***140***	***550***	***870***	***950***	***630***
Year of peak	***2007***	2015	2018	***2020***	2015

a. Million gallons per year.

b. Total waste volumes in cubic meters.

c. Peak employment.

Table 5.4-3. Waste processing impacts from each Idaho HLW & FD EIS alternative (continued).

Non-Separations Alternative					***Direct Vitrification Alternative***	
Hot Isostatic Pressed Waste Option	Direct Cement Waste Option	Early Vitrification Option	***Steam Reforming Option***	Minimal INEEL Processing at INEEL	***Vitrification Without Calcine Separations Option***	***Vitrification With Calcine Separations Option***
None	None	None	***None***	Conversion of 22 acres to industrial use	***None***	***None***
Minimal visual degradation ***through 2035***	***Minimal*** visual degradation ***through 2035***	***Minimal*** visual degradation ***through 2035***	***Minimal visual degradation through 2035***	***Minimal*** visual degradation ***through 2035***	***Minimal visual degradation through 2035***	***Minimal visual degradation through 2035***
39 percent	***39*** percent	***39*** percent	***39 percent***	39 percent	***39 percent***	***39 percent***
3.3	3.7	2.8	***4.3***	3.2	***2.7***	***5.0***
93	67	9.2	***8.1***	9.1	***9.1***	***15***
None	None	None	***None***	Loss of 22 acres of habitat	***None***	***None***
2.6×10^4	3.0×10^4	2.3×10^4	***2.4×10^4***	2.6×10^4	***2.3×10^4***	***4.3×10^4***
4.3×10^4	5.0×10^4	4.2×10^4	***2.5×10^4***	3.5×10^4	***3.0×10^4***	***4.2×10^4***
790	560	640	***200***	340	***570***	***840***
4	4	4	***58***	40	***4.0***	***1.4×10^3***
1.1×10^3	1.1×10^3	1.1×10^3	***1.1×10^3***	1.1×10^3	***1.1×10^3***	***1.1×10^3***
6.4×10^3	8.6×10^3	6.0×10^3	***4.1×10^3***	5.7×10^3	***6.0×10^3***	***7.5×10^3***
260	340	310	***0***	110	***1.6×10^3***	***1.7×10^3***
1.0×10^4	1.0×10^4	750	***560***	700	***700***	***1.3×10^3***
360	400	330	***550***	200	***350***	***670***
350	***390***	***320***	***530***	***190***	***340***	***650***
2008	2008	2008	***2010***	2008	***2011***	***2019***
460	530	330	***170***	330	***310***	***440***
910	***1,000***	***650***	***340***	***650***	***600***	***880***
2015	2015	2015	***2012***	2018	***2015***	***2023***

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		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
	Waste Processing	Facility Disposition				
Land resources/acres disturbed	22 acres	None	1,346 acres[a]	21 acres and 24 acres per year[b]	None	***17*** acres
Socioeconomics	Direct employment of 870 during construction and 530 during operations	Direct peak year employment of ***790***	Overall decrease in employment	None/use of existing workforce	Small numbers of workers drawn from existing labor pool	None/use of existing workforce
Air resources	Consumption of up to ***40*** 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
Water resources groundwater withdrawal and contamination	93 million gallons per year; negligible latent cancer fatality risk	Increase of ***11*** million gallons per year; latent cancer fatality risk of $\boldsymbol{2.9\times10^{-4}}$[c] from facility disposition.	Increase of 83 million gallons per year[d]; latent cancer fatality risk of 5×10^{-5}	Negligible	Within existing water use; latent cancer fatality risk of 2×10^{-6} from closure of CPP-633	Relocation of ponds reduces potential for contaminant migration
Ecological resources/ acreage loss	22 acres	None	1,346 acres[a]	21 acres and 24 acres per year[b]	None	***6.2*** acres
Geology and soils	Negligible (use of existing onsite sources)	Negligible (use of existing onsite sources)	1,772,000 ***yd***^{3}	4,600,000 ***yd***^{3} as a silt/clay source	Materials obtained from existing INEEL sources	Soil disturbance on ***17*** acres
Cultural resources	Negligible	Potential for loss of historic data on nuclear facilities	70 structures and 23 sites impacted[e]	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

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a. SNF & INEL EIS involves 1,339 acres, plus 7 acres impacted as a result of AMWTP.

b. Represents temporary disturbance; rehabilitation of disturbed acres will occur annually.

c. Represents the total for all existing HLW management facilities.

d. SNF & INEL EIS activities use 79 million gallons per year and AMWTP involves use of 4.2 million gallons per year.

e. SNF & INEL EIS impacts plus 1 additional site impacted from AMWTP.

AMWTP = Advanced Mixed Waste Treatment Project; PSD = Prevention of Significant Deterioration.

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		

INEEL, the acreage used would be small and subject to standard cultural resources protection measures and site restoration including revegetation with native plant species. Therefore, cumulative impacts to lands based resources including site geology and soils are anticipated to be small.

5.4.3.2 Socioeconomics

Table 5.4-4 presents employment impacts for each project evaluated in this EIS. Over the timeframe ***analyzed in this EIS***, 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. Facility disposition activities would require direct employment of up to ***790*** workers. DOE anticipates these workers would be drawn from the existing workforce through retraining and reassignment. DOE anticipates total employment would decline and the net change in jobs associated with alternatives ***analyzed in this EIS*** 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 ***2001*** 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.

5.4.3.3 Air Resources

Cumulative impacts of radiological and nonradiological air emissions have been assessed for each alternative in this EIS. Since issuance of the Draft EIS, DOE has updated estimated impacts to the noninvolved worker resulting from baseline conditions. 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 less than 1.8×10^{-3} ***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. This dose, which is predominantly caused by baseline sources, is 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 and manmade sources. Cumulative doses to noninvolved INEEL workers and the total population within 50 miles of INTEC would also be very low under each of the waste processing alternatives, and would be due mainly to baseline emissions.***

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. ***Toxic air pollutant incremental impacts at offsite and onsite locations are well below applicable standards in all cases. The highest offsite impact from any waste processing alternative would be for nickel, which could reach about 10 percent of the standard under the Planning Basis***

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	***0.35***	***1.1***
Idaho HLW & FD EIS[b]	***1.8×10^{-3}***	1.0×10^{-4}[c]	***0.11***
Total	0.16	***0.35***	***1.2***
Standard	10[d]	5,000	NA[e]

a. Includes contributions from foreseeable sources including Advanced Mixed Waste Treatment Project (see Table C.2-8).

b. Maximum dose for any alternative.

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.

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	***24,000***	155,000	183,100	***8.2***
Nitrogen dioxide	3,000,000	25,000	***85,000***	220,000	338,000	11
Particulate matter[d]	900,000	290	***5,400***	180,000	186,000	21
Sulfur dioxide	1,700,000	700	***170,000***	120,000	380,700	***17***
Lead components	68	1.9×10^{-5}	***3.6***	1.5	5.6	***7.5***
VOCs	not specified	480	***2,700***	16,000	19,000	-

a. Source: DOE (1995).

b. Source: DOE (1999a).

c. Source: DOE (1997b).

d. Particle size of particulate matter emissions is assumed to be in the respirable range (less than 10 microns).

VOCs = volatile organic compounds.

Option at, or just beyond, the INEEL boundary. The highest onsite nickel concentrations are not expected to exceed one percent of the occupational exposure limit for that substance.

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 ***40*** percent of increment at Craters of the Moon ***Wilderness Area*** (Class I area) and ***38*** 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 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 ***Snake River Plain*** Aquifer each year (DOE 1997c). Total water consumption from reasonably foreseeable activities, including waste processing activities ***analyzed*** in this EIS, could account for an additional ***187*** million gallons per year, of which ***104*** million gallons would be associated with activities from ***this*** EIS (see Table 5.4-4). This 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).

Groundwater - Past waste disposal practices have ***contaminated groundwater***, 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 ***groundwater*** near INTEC. Some contaminant plumes, most notably tritium, strontium-90, and iodine-129, have concentrations in excess of EPA drinking water standards. Previous modeling of the vadose zone and saturated contaminant transport predicted no contaminants would migrate past the present 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 ***boundary*** at a concentration near the drinking water standard (Rodriquez et al. 1997).

Relocation of the percolation ponds used for disposal of service waste to a location 10,200 feet southwest of INTEC would move the region of influence of the ponds far enough that infiltration of water discharged to the ponds (which in the past has exceeded drinking water standards) ***would*** not hydrologically interact with contaminated perched water bodies beneath INTEC ***(DOE 1999c)***. Contaminant ***plumes*** 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 ***these*** plumes ***is not well understood*** at this time. However, the concentration of contaminants is greatest close to the INEEL facilities that are, ***or were,*** 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.***6***.

5.4.3.5 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.

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 ***is*** summarized in Section 5.2.9, Traffic and Transportation. 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 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

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
Rail (100 percent)	20	***8.0×10^{-3}***	29	***0.015***
Spent Nuclear Fuel Shipments				
Truck (100 percent)	***350***	***0.14***	***810***	***0.41***
Rail (100 percent)	***67***	***0.027***	***100***	***0.050***
Maximum Waste Processing Alternative				
Direct Cement Waste Option (Truck)	***520***	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
Rail	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	1.5×10^{3}	0.75
Rail	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] ***and Spent Nuclear Fuel Shipments***				
Truck (100 percent)	***1.2×10^{3}***	***0.49***	***1.3×10^{3}***	***0.64***
Rail (100 percent)	***87***	***0.04***	***130***	***0.07***
Maximum Waste Processing Alternative	***520***	0.21	2.9×10^{3}	1.4
Reasonably Foreseeable Actions				
Truck (100 percent)	1.1×10^{4}	4.2	5.0×10^{4}	25
Rail (100 percent)	1.0×10^{3}	0.37	1.8×10^{3}	0.87
General Transportation (1953 - 2037)	2.7×10^{5}	110	2.3×10^{5}	120
Total collective dose[c]	2.8×10^{5}	110	2.8×10^{5}	140
Percent of total collective dose from Maximum Waste Processing Alternative	***0.19***	***0.19***	***1.0***	***1.0***

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.

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 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 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 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 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, 1990s, ***and 2000s***. For example, there were more than ***553,000*** cancer fatalities in ***2001*** (American Cancer Society ***2001***).

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 there would be approximately ***25*** vehicular accidents, which would be expected to result in approximately one (***0.98***) 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).

5.4.3.6 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, air is the principal exposure pathway. Radiation doses ***and nonradiological impacts*** to public receptors in the vicinity of INEEL 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 ***such as*** animals and vegetation also exist, ***including*** 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. 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 ***contaminant*** plumes within the aquifer migrated off the INEEL or to a point outside the institutionally controlled area. ***Since the Draft EIS, DOE has updated health and safety information specific to the long-term groundwater impacts (see Appendix C.9).***

Occupational Health - Activities to be performed by workers under each of the alternatives ***analyzed*** in this EIS are similar to activities 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, 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 2,000. 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 ***1,100*** person-rem. The combined additional radiation dose to workers from this option would result in less than one (***0.43***) 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 ***0.91*** latent cancer fatality. 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 - Air is the principal pathway through which radioactive materials released on the INEEL can reach offsite members of the public. The project-specific analysis of the potential radiation dose to the public in the vicinity of the INEEL indicates 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 ***and manmade sources*** averages approximately 360 millirem per year (ESRF 1997).

Waste processing options would add a maximum of ***0.11*** 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 ***0.24*** person-rem. Using the standard risk factors for estimating fatal ***cancers*** from a given calculated exposure, a ***maximum*** value of ***0.001*** fatal cancers would be obtained as a result of the cumulative radiation dose received by the population within 50 miles of the INEEL from existing INEEL operations, treatment of HLW, and other reasonably foreseeable actions at the 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 the 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 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 ***under*** any alternative ***or option***, although emissions of ***nickel*** at the Maximum Achievable Control Technology limit, which is much higher than actual emissions are likely to be, could potentially reach ***10*** 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 ***cumulative*** 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 ***flowing*** 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 event storm water runoff from INTEC were to reach the Big Lost River channel, the flow would not leave the 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.

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 WAG 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 unmitigated results of the baseline risk assessment for Operable Unit 3-13 and the results from the analyses of the facility disposition alternatives in this EIS. (Note the CERCLA Record of Decision for the Operable Unit 3-13 portion of WAG 3 committed DOE to meet the drinking water standards in the Snake River Plain Aquifer outside of the INTEC security fence by 2095.) 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 ***shown in*** the WAG 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 facility 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 ***any of*** 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 WAG 3 risk assessment. ***The potential for long-term cumulative impacts is discussed in Section 5.3.8.2. Section 5.2.14.6 provides a discussion of potential impacts to the groundwater from a postulated failure of five below grade storage tanks full of mixed transuranic waste/SBW.***

Additional health risk could occur as a result of nonradiological contaminants ***through the*** groundwater and fugitive dust pathways. However, in the cases assessed here, cancer risk ***would*** result 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

Table 5.4-9. Comparison of groundwater impacts.

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)
Assessment derived from the Operable Unit 3-13 Baseline Risk Assessment ***(unmitigated)***	56[c] (beta/gamma emitting radionuclides) 250[c] (total radiation dose)	5.0×10^{-5}[d]	1.9 (beta/gamma-emitting radionuclides) 8.33 (total radiation dose)	2095
Idaho High-Level Waste and Facilities Disposition EIS				
Tank Farm	***4.4***[e]	2.2×10^{-6}[f]	***0.040***	***2800***
Bin Sets	***1.3***[e]	6.5×10^{-7}[f]	7.8×10^{-3}	***3000***
New Waste Calcining Facility	***0.034***[e]	1.7×10^{-8}[f]	1.9×10^{-4}	***3000***
Process Equipment Waste Evaporator	***0.036***[e]	1.8×10^{-8}[f]	2.0×10^{-4}	***3000***

a. The total radiation dose is presented for the duration reported in the respective documents.

b. The annual dose was estimated by dividing the total dose by the evaluation period duration.

c. 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).

d. The risk for this evaluation was calculated based on EPA methodology for risk assessment.

e. ***Values represent results for the maximally exposed resident for Performance-Based Closure.***

f. The risk for this evaluation was calculated based on National Council on Radiation Protection and Measurements and DOE guidance on risk assessment.

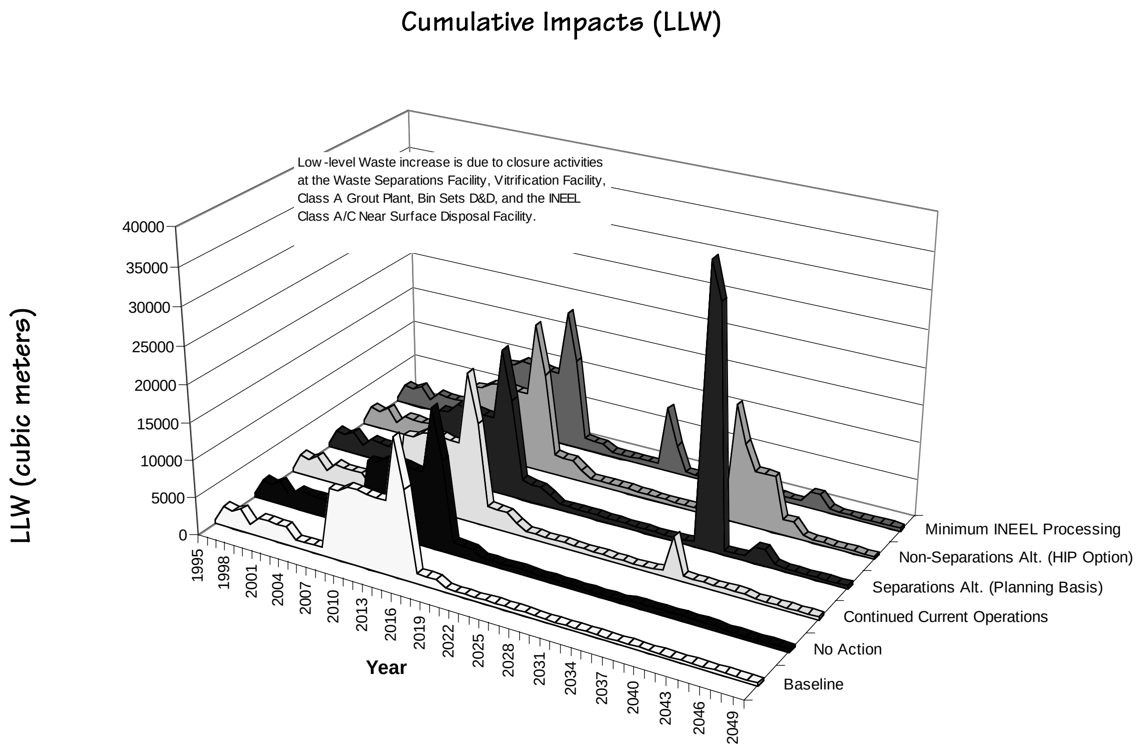
less than 1×10^{-9} and would not contribute substantially to the cumulative risk. Noncancer risk would be higher than for some receptors and scenarios, most notably those cases involving fluoride releases from onsite disposal of low-level Class A or C type grout.

5.4.3.7 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 ***disposed of*** 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 ***actions*** evaluated in this EIS.

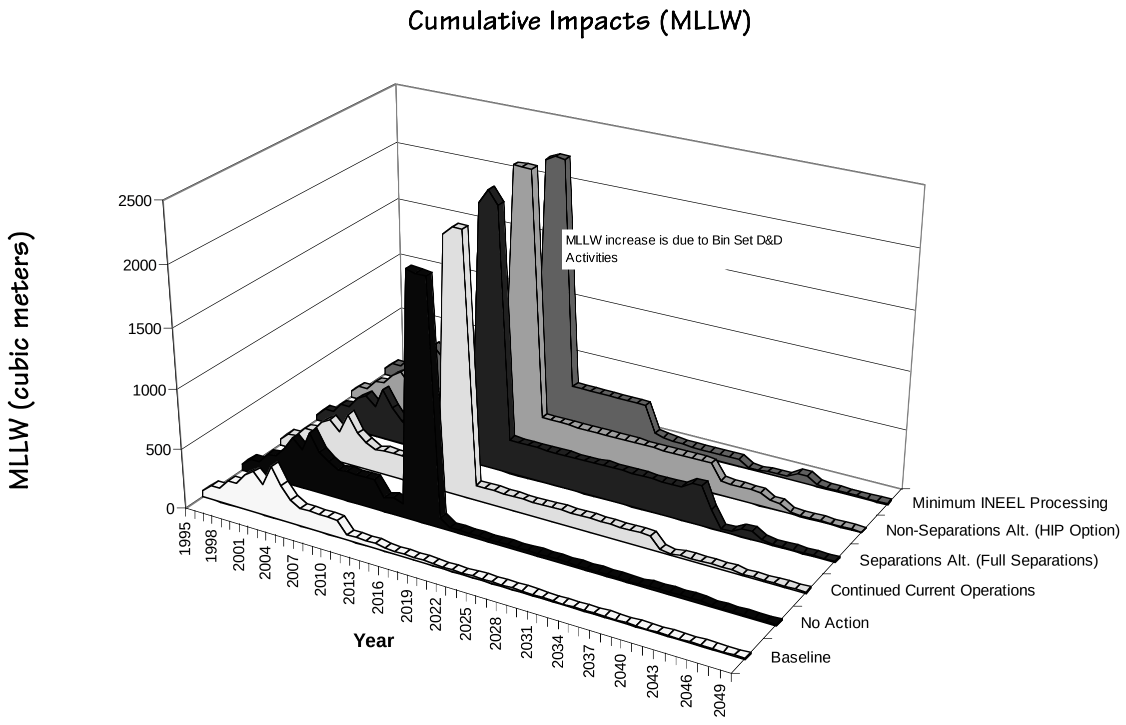
Figures depicting the cumulative volume of specific waste streams that may be generated by INEEL activities over the projected life of the Idaho HLW & FD EIS alternatives have been developed using the INEEL baseline (Jason 1998) and LMITCO Project Data Sheets. Figures 5.4-1, 5.4-2, 5.4-3, and 5.4-4 project cumulative INEEL generation of low-level waste, mixed low-level waste, hazardous waste, and industrial waste, respectively.

Since issuance of the Draft EIS, more detailed information has become available on two INEEL projects, treatment of sodium-bonded spent nuclear fuel at Argonne National Laboratory-West (ANL-W) and irradiation of neptunium-237 targets at ATR. As discussed in



Low -level Waste increase is due to closure activities at the Waste Separations Facility, Vitrification Facility, Class A Grout Plant, Bin Sets D&D, and the INEEL Class A/C Near Surface Disposal Facility.

Figure 5.4-1. Cumulative generation of low-level waste at INEEL, 1995-2050.



MLLW increase is due to Bin Set D&D Activities

Figure 5.4-2. Cumulative generation of mixed low-level waste at INEEL, 1995-2050.

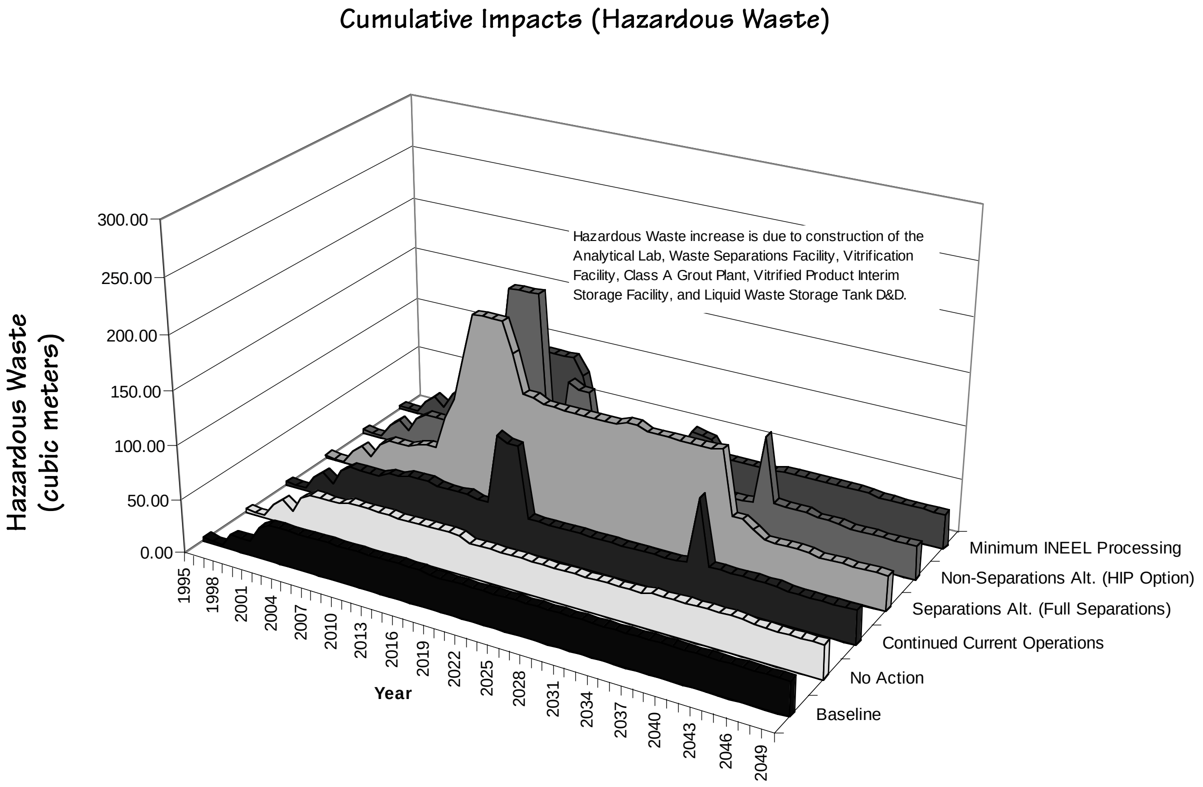


Figure 5.4-3. Cumulative generation of hazardous waste at INEEL, 1995-2050.

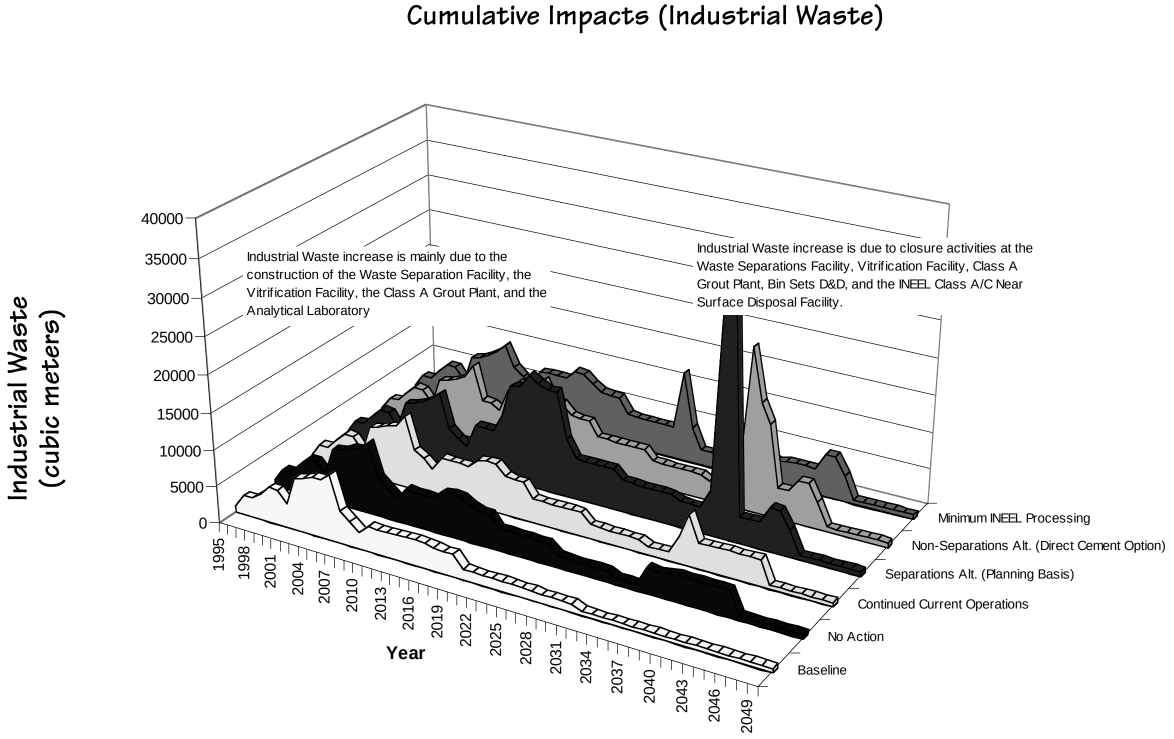


Figure 5.4-4. Cumulative generation of industrial waste at INEEL, 1995-2050.

Section 5.2.13 of this EIS, process waste volumes generated under the waste processing alternatives would be small relative to the volumes generated site-wide and complex-wide. Adding the modest volumes of process wastes likely to be produced by several other reasonably foreseeable projects listed in Table 5.4-2 would not substantially increase the volumes of waste generated at the INEEL and would not strain existing infrastructure or capacity. For example, HLW management activities are expected to generate a total of 9.7×10^3 cubic meters of mixed low-level waste over the 2000-2035 processing period (see Table 5.4-3). The electrometallurgical treatment of sodium-bonded fuel at ANL-W over the 2000-2015 timeframe would contribute another 40 cubic meters of mixed low-level waste to this total (DOE 2000a). Very small amounts of waste are expected to be generated by the irradiation of neptunium-237 targets at ATR and would not contribute to the mixed low-level waste total (DOE 2000b). DOE has plans to manage 1.4×10^5 cubic meters of mixed low-level waste over the next 20 years and is prepared to build additional treatment capacity should it be necessary.

HLW management activities are expected to generate as much as 1.0×10^4 cubic meters of low-level waste over the 2000-2035 processing period. Treatment of sodium-bonded fuel at ANL-W is expected to contribute another 850 cubic meters of low-level waste over a 15-year period, while irradiation of neptunium-237 targets at ATR is expected to produce 1 cubic meter of low-level waste. This compares to an average annual generation rate of 2.9×10^3 cubic meters for the INEEL site as a whole. DOE has plans to generate and safely manage approximately 1.5 million cubic meters of low-level waste over the next 20 years. The quantities of low-level waste that would be produced by the proposed action and other reasonably foreseeable activities are minor compared to the amount that would be produced by other DOE activities (complex-wide) and should have very little impact on the ability of existing DOE disposal facilities to manage this waste.

The waste processing alternatives would result in the generation of as much as 6.0×10^4 cubic meters per year of industrial (nonhazardous and nonradiological) waste during construction and 5.3×10^4 cubic meters per year during operations. The peak annual production of industrial waste (8.5×10^3 cubic meters, during construction) represents a 10 to 18 percent increase in the volumes currently disposed of at the INEEL Landfill Complex (in the Central Facilities Area), which in recent years have ranged between 4.6×10^4 and 8.5×10^4 cubic meters. Little or no additional industrial waste is expected to be generated by the treatment of sodium-bonded fuel at ANL-W or the irradiation of neptunium-237 targets at ATR. Although the volume of industrial waste previously disposed of in the Landfill Complex is unknown, it is estimated that the INEEL Landfill Complex would provide adequate capacity for the next 30 to 50 years, which would accommodate industrial wastes generated over the life of the projects analyzed in this EIS and other reasonably foreseeable projects.

Consistent with the Draft EIS, this discussion emphasizes process wastes, because ultimate disposition of these wastes is largely the responsibility of INEEL, whereas product wastes are generally intended for two national repositories, the Waste Isolation Pilot Plant and the national geologic repository. The potential cumulative impacts of managing product wastes result from the need to provide interim storage and ultimately transport the material to a repository for disposal.

DOE's decision (65 FR 56565; September 19, 2000) to select electrometallurgical treatment at ANL-W as the preferred alternative for treatment and management of INEEL sodium-bonded spent nuclear fuel will produce treated HLW forms in addition to those evaluated in this EIS, with potential cumulative impacts with respect to waste management and transportation. Electrometallurgical treatment of accumulated sodium-bonded fuel at the INEEL would produce approximately 80 cubic meters of high-level (ceramic and metallic) waste, the equivalent of approximately 130 HLW canisters (DOE 2000a). This added volume of treated HLW could require an expansion of interim storage facilities planned under the waste processing alternatives.

Based on the waste processing option and transportation mode selected, the waste processing alternatives would require between 650 and 18,000 truck shipments or between 130 and

3,600 rail shipments to transport treated HLW canisters from INTEC to a national geologic repository. An additional 130 truck shipments or 26 rail shipments would be needed to transport the HLW canisters produced from electrometallurgical treatment of accumulated sodium-bonded fuel at ANL-W.

5.5 Mitigation Measures

As required by the Council on Environmental Quality, ***DOE*** considered mitigation measures that could reduce or offset the potential environmental consequences of waste management activities that are not integral to the alternatives analyzed in this EIS. ***Under any of the alternatives analyzed in this EIS standard management controls, engineering, safety and health practices, cultural and biological surveys and site restoration requirements would be uniformly implemented. No impact resulting from normal operations under any of the alternatives or options analyzed in this EIS would require a specifically designed mitigation measure. If future connected actions have the potential 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.*** Appendix C.8 discusses mitigation measures that could reduce or offset potential impacts at Hanford under the Minimum INEEL Processing Alternative.

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 ***those*** that would occur after implementation of all ***standard management controls, engineering, safety and health practices, cultural and biological surveys and site restoration requirements and*** feasible mitigation measures. ***Appendix*** C.8 contains a discussion of potential unavoidable adverse impacts at Hanford associated with the Minimum INEEL Processing Alternative.

5.6.1 CULTURAL RESOURCES

Existing facilities or facilities constructed under the alternatives analyzed in this EIS as well as the institutional controls that would be necessary following facilities disposition could occupy INEC and adjacent areas for an indefinite period of time. Even after remediation, the appearance and presence of institutional controls would likely preclude the INTEC area from ever being returned to its natural cultural setting or to a condition where the effects of industrial activities were not the most evident feature of the landscape.

5.6.2 AESTHETIC AND SCENIC RESOURCES

INTEC is distant 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 ***under the alternatives analyzed in this EIS*** would change the viewscape to some degree, but those changes would ***not*** likely be noticed ***by*** the casual observer.

Emission rates for pollutants under the waste processing alternatives are not expected to exceed levels currently or previously ***emitted*** 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. 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 ***under*** the waste processing alternatives ***analyzed in this EIS*** 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,

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an important cultural resource to the Shoshone-Bannock Tribes). 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 ***during the period of waste treatment*** under ***any of the action*** alternatives ***analyzed in this EIS***.

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. An unavoidable adverse impact of all alternatives would be the risk of migration of ***residual*** 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 ***1,000,000*** gallons of mixed transuranic waste/SBW and ***4,400*** 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

The entire area ***within and adjacent to the INTEC fence line has been cleared of natural vegetation and the habitat it provides is poor compared to the surrounding sagebrush steppe. This condition would exist during the operating period under any of the alternatives analyzed in this EIS. After facility disposition most of the area would likely return to near natural conditions of habitat diversity and productivity.***

Radionuclide exposure of plant and animal species in the areas adjacent to INTEC could increase slightly due to operations ***that would occur under the action alternatives***. 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 ***implementing any alternative analyzed in this EIS***.

5.6.6 HEALTH AND SAFETY

The workforce and offsite population would be exposed to low levels of radionuclides under any of the alternatives analyzed in this EIS. Exposure would be highest under the Direct Cement Waste Option of the Non-Separations Alternative. This exposure could potentially lead to less than 1 (***0.43***) latent cancer fatality within the exposed workforce. The highest collective worker dose during disposition of new facilities associated with the waste processing alternatives ***could*** result in less than one (***0.12***) latent cancer fatality. The highest collective worker dose from disposition of existing facilities associated with HLW management would occur as a result of Clean Closure of the Tank Farm and ***could*** result in an estimated ***0.76*** 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 ***could*** 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 noncarcinogenic and carcinogenic toxic air pollutants to result in health impacts.

5.7 Short-term Use Versus Long-term Productivity of the Environment

This section compares ***the*** potential short-term ***effects*** of ***the alternatives analyzed in this EIS*** on the ***use of the*** environment ***with*** the ***potential*** effects on ***its*** long-term productivity. ***Appendix*** 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 *NO ACTION ALTERNATIVE*

Short-term use of the existing environment would not change from that described in Chapter 4 of this EIS. Long-term productivity could be impaired through the risk associated with the indefinite storage of mixed transuranic waste/SBW and calcine in the tank farm and bin sets at INTEC. The radioactivity in the mixed transuranic waste/SBW and calcine would decay over thousands of years but the potential for release to the aquifer and surrounding environment would increase as the tank farm and bin sets aged and the level of uncertainty of maintaining institutional controls increased.

5.7.2 CONTINUED CURRENT OPERATIONS ALTERNATIVE

As with the No Action Alternative, short term use of the environment would not change from that described in Chapter 4 of this EIS. There would be some small short-term worker risk and small short term impairment of air quality associated with calcining the remaining mixed transuranic waste/SBW but this would contribute to reducing long term risk and preserving the long term productivity of the environment. The long-long term productivity of the environment could be impaired through the presence and risk associated with the indefinite storage of calcine but the risk associated with the indefinite storage of mixed transuranic waste/SBW would not exist. Thus, the risk to the long term productivity of the aquifer would be less than the No Action Alternative. Radioactivity in the calcine would decay over thousands of years but the potential for release to the surrounding environment would increase as the bin sets aged and the level of uncertainty of maintaining institutional controls increased.

5.7.3 ACTION ALTERNATIVES

In the context of their affects on short-term use versus long-term productivity of the environment the action alternatives are indistinguishable. Each of the action alternatives involves a period of treating mixed transuranic waste/SBW and treating or containerizing calcine during which there would be a small temporary increase in worker risk and impairment to air quality. The short-term use of the environment would not change from that described in Chapter 4 of this EIS. Each of the action alternatives would place the mixed transuranic waste/SBW and calcine in a form suitable for disposal and place the treated waste forms in a disposal facility or repository designed to preserve the long term productivity of the environment and reduce dependence on the effectiveness of institutional controls.

5.8 Irreversible and Irretrievable Commitments of Resources

The irreversible ***or*** irretrievable commitment ***of resources is*** the permanent loss ***of a resource for future uses or alternative purposes. These kinds of*** commitments occur as a result of destruction ***or use*** of a resource (e.g., fossil fuels) that cannot be replaced ***or recovered***. Irreversible and irretrievable commitments of resources ***could*** potentially include land, groundwater, construction materials, and energy resources. Some resources and materials that would be used under each alternative could be recycled and do not represent an irreversible ***or***

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irretrievable commitment, ***for example,*** structural and stainless steel used in construction could be recovered and recycled after the completion of project related activities.

Activities at the INEEL ***and at INTEC*** have resulted in the ***chemical and radioactive contamination of*** the Snake River Plain Aquifer ***in localized areas***. ***This has resulted in an irreversible and irretrievable commitment of the groundwater that is actually contaminated.*** Services lost ***due to the contaminants*** include ***possible*** limits on the ***future*** location of wells, ***and use of water for drinking and agricultural production***. Risk of future contamination of groundwater underlying the INTEC, and hence commitment of the groundwater resource, ***would be*** highest under the No Action Alternative.

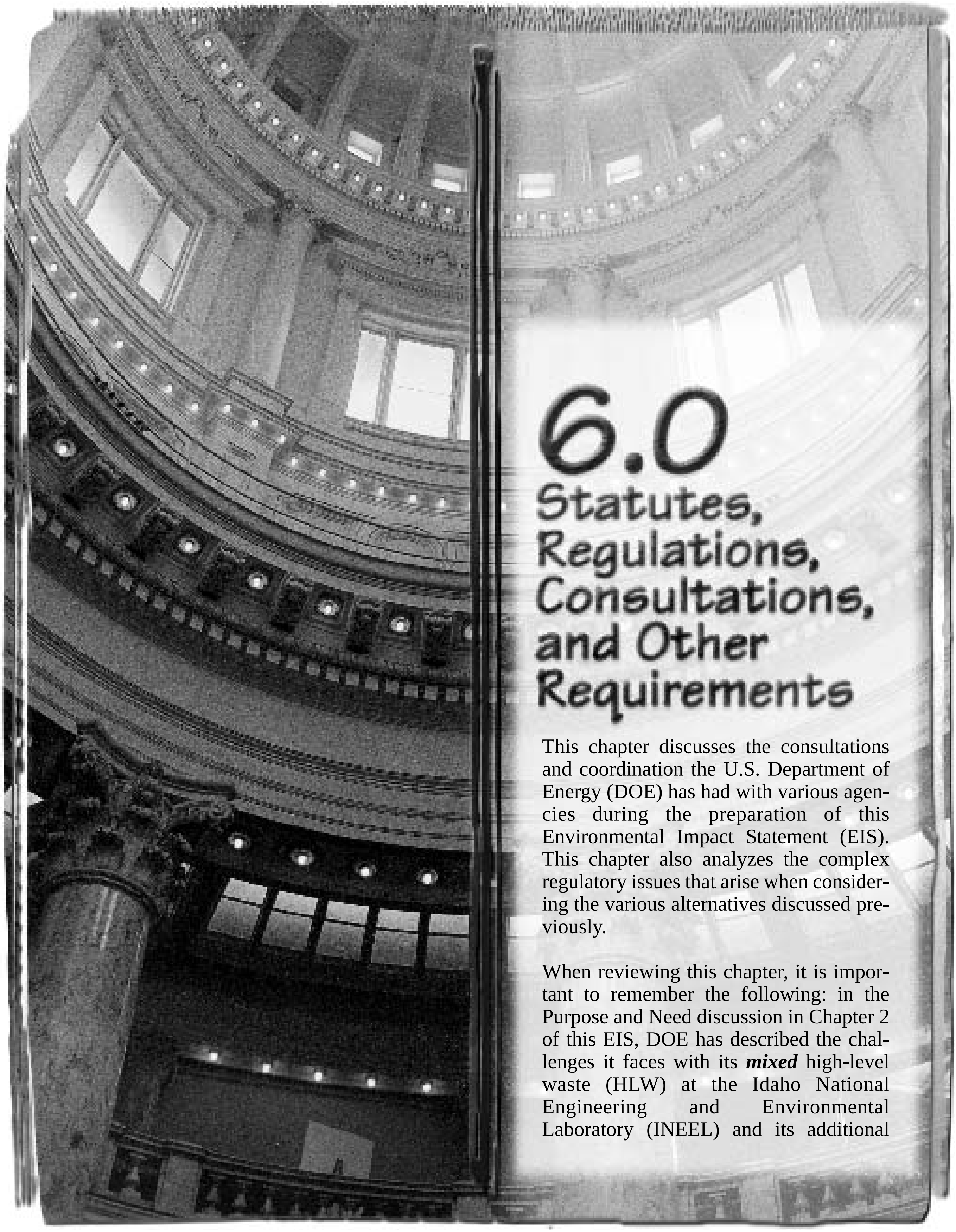
Borrow materials extracted on the INEEL would be ***used but not actually*** irreversibly and irretrievably committed ***to*** support activities associated with waste processing, facility disposition, ***and environmental restoration***. Materials ***required*** for facility construction, such as structural steel, could ultimately be recycled depending on market conditions. All of these materials are plentiful ***and their*** consumption ***under any alternative analyzed in this EIS*** would not lead to shortages in ***their*** availability. ***Chemicals and other materials, such as nitric acid and titanium or aluminum powder, would be used up or permanently converted to other forms under any of the alternatives involving waste treatment. These materials and chemicals could not be recycled in any volume but none are of strategic importance nor are any in short supply.***

Consumption of fossil fuel during the construction phase would be highest under the Vitrification with Calcine Separations Option, which would require an estimated 0.81 million gallons of fuel per year. The peak annual fossil fuel usage for operations is also highest under this option at 5.0 million gallons per year. Other options 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 Vitrification with Calcine Separations Option has the highest operations-phase energy requirement, 5.2×10^4 megawatt hours per year.*** All other alternatives would require ***less*** 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



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 Environmental Impact Statement (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 ***mixed*** high-level waste (HLW) at the Idaho National Engineering and Environmental Laboratory (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 about the treatment of mixed HLW at INEEL; however, with respect to any decision on how the waste tanks at the Idaho Nuclear Technology and Engineering Center (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.

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.

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 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 (DOE-ID) 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 respective points of view. During the scoping period, DOE received more than 900 comments representing 49 issue categories. 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. 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, 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. ***In 1999, the Council issued Alternative High-Level Waste Treatments at the Idaho National Engineering and Environmental Laboratory (NAS 1999). This report, summarized in Appendix B of this EIS, evaluated technologies for treating the mixed transuranic waste/SBW at the INEEL.***

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 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.

In a February 4, 1999, letter 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 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, DOE-ID notified the State Historic Preservation Officer that DOE would be issuing this 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.

DOE provided a variety of notifications and opportunities for the public to review and comment on the Draft EIS. Table 6-1 provides a list of these public involvement activities. In the Comment Response Document, Chapter 11, DOE and the State of Idaho summarize the comments received and provide responses to those summaries. The comment documents are provided in Appendix D.

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.

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

Table 6-1. Draft EIS public involvement activities.

Activity	Date	Location	Number of stakeholders
Public hearings			
Idaho Falls hearing	February 7, 2000	Shilo Inn	75
Pocatello hearing	February 8, 2000	Idaho State University	16
Jackson Hole hearing	February 9, 2000	Snow King Resort	103
Twin Falls hearing	February 15, 2000	College of Southern Idaho	15
Boise hearing	February 17, 2000	Doubletree Riverside	19
Portland hearing	February 22, 2000	Doubletree Lloyd Center	8
Pasco hearing	February 24, 2000	Doubletree Pasco	20
Fort Hall hearing	March 2, 2000	Tribal Business Center	22
Press releases and media advisories			
Draft EIS availability, comment period	January 21, 2000	Regional media	NA
Addition of the Fort Hall hearing	February 7, 2000	Regional media	NA
Portland and Pasco hearings	February 14, 2000	Portland & Pasco media	NA
Extension of the public comment period	February 17, 2000	Regional media	NA
Close of the public comment period	April 13, 2000	Regional media	NA
Display advertising announcing Draft EIS availability and hearings			
Willamette Weekly	February 9, 2000	Willamette Valley, Oregon	NA
Oregonian	February 6, 2000	Portland	NA
East Oregonian	February 5, 2000	Eastern Oregon	NA
Tri-City Herald	February 6, 2000	Eastern Washington	NA
Spokesman Review	February 6, 2000	Spokane	NA
Lewiston Morning Tribune	February 6, 2000	Lewiston	NA
The Post Register	January 23, 2000 February 20, 2000	Idaho Falls	NA
Teton Valley News	January 27, 2000	Driggs/Victor/Tetonia	NA
Arco Advertiser	January 27, 2000	Arco	NA
The Idaho State Journal	January 24, 2000 February 20, 2000	Pocatello	NA
Jackson Hole News	January 26, 2000 February 23, 2000	Jackson	NA
Jackson Guide	January 26, 2000 February 23, 2000	Jackson	NA
West Yellowstone News	February 3, 2000	West Yellowstone, Montana	NA
Twin Falls Times News	January 31, 2000 February 20, 2000	Twin Falls	NA
Wood River Journal	February 2, 2000 February 23, 2000	Hailey/Ketchum/Sun Valley	NA
Idaho Mountain Express	February 2, 2000	Hailey/Ketchum/Sun Valley	NA
The Idaho Statesman	February 2, 2000	Boise	NA

Table 6-1. Draft EIS public involvement activities (continued).

Activity	*Date*	*Location*	*Number of stakeholders*
Sho-Ban News	*February 24, 2000*	*Fort Hall*	*NA*
The Morning News	*February 19, 2000*	*Blackfoot*	*NA*
Missoula Independent	*January 27, 2000*	*Missoula, Montana*	*NA*
Butte Weekly	*January 26, 2000*	*Butte, Montana*	*NA*
Argus Observer	*February 6, 2000*	*Ontario, Oregon*	*NA*
Salt Lake Tribune	*January 30, 2000*	*Salt Lake City, Utah*	*NA*
Wyoming Tribune Eagle	*January 23, 2000*	*Cheyenne, Wyoming*	*NA*
Daily Rocket	*January 29, 2000*	*Rock Springs, Wyoming*	*NA*
Laramie Boomerang	*January 30, 2000*	*Laramie, Wyoming*	*NA*
Denver Rocky Mountain News	*January 30, 2000*	*Denver, Colorado*	*NA*
Las Vegas Review Journal	*January 30, 2000*	*Las Vegas, Nevada*	*NA*
Carlsbad Current Argus	*January 30, 2000*	*Carlsbad, New Mexico*	*NA*
Albuquerque Journal	*January 30, 2000*	*Albuquerque, New Mexico*	*NA*
Radio spots announcing public hearings			
KLCE-FM/KOSZ-FM	*February 4, 2000* *February 5, 2000* *February 7, 2000*	*Idaho Falls/Blackfoot/ Pocatello areas*	*NA*
KID-AM/FM	*February 4, 2000* *February 5, 2000* *February 7, 2000*	*Idaho Falls/Blackfoot/ Pocatello areas*	*NA*
La Super Caliente/KID-AM/FM	*February 5, 2000* *February 6, 2000*	*Idaho Falls/Blackfoot/ Pocatello areas*	*NA*
KECH/KSKI	*February 12, 2000* *February 14, 2000* *February 15, 2000*	*Ketchum/Sun Valley/ Twin Falls areas*	*NA*
KMTN/KSGT	*February 7, 2000* *February 8, 2000* *February 9, 2000*	*Jackson area*	*NA*
KZJH	*February 7, 2000* *February 8, 2000* *February 9, 2000*	*Jackson area*	*NA*
KUFO-FM	*February 21, 2000* *February 22, 2000*	*Portland area*	*NA*
KONA-AM/FM/KXRX/KEYW	*February 22, 2000* *February 23, 2000* *February 24, 2000*	*Richland/Tri-Cities area*	*NA*
KIDO	*February 15, 2000* *February 16, 2000* *February 17, 2000*	*Boise area*	*NA*
Postcards			
To request copies of the Draft EIS	*June 1999*	*Nationwide*	*6,144*
Toll-free Line			
Information or document requests	*January-November, 2000*	*Nationwide*	*89*

Table 6-1. Draft EIS public involvement activities (continued).

Activity	Date	Location	Number of stakeholders
Stakeholder briefings			
Daryl Siemer	January 10, 2000	Idaho Falls	1
Stan Hobson	January 11, 2000	Idaho Falls	1
Site union representative	January 13, 2000	Idaho Falls	1
Wayne Pierre, EPA	January 14, 2000	Teleconference	1
Jennifer Langston, Post Register	January 14, 2000	Idaho Falls	1
Idaho congressional staffs	January 18, 2000	Idaho Falls	6
Shoshone-Bannock Tribes	January 19, 2000	Fort Hall	14
Snake River Alliance	January 21, 2000	Pocatello	2
Wyoming congressional staffs	January 25, 2000	Jackson	4
INEEL Citizens Advisory Board	January 26, 2000	Boise	20
Representative M. Simpson's staff	January 26, 2000	Idaho Falls	1
University of Idaho class	February 1, 2000	Idaho Falls	8
INTEC employees open house	February 3, 2000	INEEL Site	88
Hanford Advisory Board subcommittee	February 3, 2000	Kennewick, Washington	6
Washington Congressional staffs	February 3, 2000	Richland, Washington	6
Mayor Linda Milam	February 7, 2000	Idaho Falls	1
Jackson Hole Alternative High School	February 9, 2000	Jackson	20
Keep Yellowstone Nuclear Free	February 10, 2000	Jackson	4
Teton County Commissioners	February 10, 2000	Jackson	5
Coalition 21	February 11, 2000	Idaho Falls	16
Senator L. Craig's staff	February 25, 2000	Washington DC	3
Distribution			
Summaries	January 2000		1971
Draft EIS (complete)	January 2000		897

NA = not applicable.

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.

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 (RCRA). 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 demonstrates 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 the U.S. Environmental Protection Agency (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 Comprehensive Environmental Response, Compensation and Liability Act (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 EPA (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). EPA ***considered the National Academy of Sciences' findings and recommendations in establishing*** its final standards at 40 CFR Part 197 ***(66FR 32074; June 13, 2001)***.

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 ***November 2001***, the Nuclear Regulatory Commission issued site-specific technical requirements and criteria (10 CFR Part 63). The Commission ***will*** use these requirements and criteria 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 RCRA 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.

10 CFR Part 63 – These regulations contain the site-specific technical criteria for the licensing and operation of the ***proposed*** repository at Yucca Mountain. The Nuclear Regulatory Commission's ***regulations at*** 10 CFR Part 63 would apply only to the repository at Yucca Mountain and the existing generic regulations at 10 CFR 60 would remain in place and would not apply to the repository at Yucca Mountain.

40 CFR Part 197 - These regulations 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 ***58***.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. ***EPA Region X has approved the Idaho Department of Environmental Quality's request for program approval and delegation of authority to implement and enforce specific National Emission Standards for Hazardous Air Pollutants as they apply to major sources in Idaho required to obtain an operating permit under Title V of the federal Clean Air Act. EPA delegated certain 40 CFR Part 61 and 63 subparts to the Idaho Department of Environmental Quality based on its ability to carry out implementation and enforcement responsibilities for Title V sources subject to these standards. EPA did not delegate all of the 40 CFR Part 61 subparts pertaining to radon or radionuclides. Additionally, EPA did not delegate the regulations that implement Clean Air Act sections 112(g) and 112(j), codified at 40 CFR Part 63, Subpart B, to the Idaho Department of Environmental Quality. This delegation was effective March 25, 2002. (67 FR 3106; January 23, 2002)***

Noise Control Act of 1972 (42 USC 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.

On November 9, 2000, President Clinton signed a Presidential Proclamation that expanded the boundaries of Craters of the Moon, a national monument (Clinton 2000). Associated with this national monument is a wilderness area, which is designated as a Class I area under the Prevention of Significant Deterioration program. The boundaries of the wilderness area (and thus the Class I area) may change as a result of the increased size of the national monument. Future applications for a permit to construct under the Prevention of Significant Deterioration program would consider any changes to the Class I area boundary. DOE does not expect the potential changes to the Class I area boundary to have significant implications for future air quality compliance. 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

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 Act 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 (IDAPA ***58***.01.02) and ***Wastewater-Land Application Permit Rules (IDAPA 58.01.17)*** 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 ***58***.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.

On December 7, 2000, EPA published revisions to the national primary drinking water regulations (40 CFR Part 141), including maximum contaminant levels for certain radionuclides (65 FR 76708). The new rule includes requirements for uranium, which was not previously regulated, and revisions to monitoring requirements. EPA decided to retain the current standards for combined radium-226 and -228 and gross alpha particle radioactivity. EPA also retained the current maximum contaminant level for beta particle and gamma radioactivity pending further review. As a regulatory policy and practice, the Safe Drinking Water Act maximum contaminant levels are also used as groundwater protection standards. The new standard for uranium will be considered with the other maximum contaminant levels for radionuclides in assessing the cumulative impacts to groundwater from the facility disposition activities under this EIS.

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 Rules for Public Drinking Water Systems (IDAPA 58.01.08) set forth maximum contaminant levels for public drinking water systems. The ***Department*** of Environmental Quality 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 (10CFR 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 Environnmental 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.

In accordance with 10 CFR 1022, DOE has prepared a floodplain assessment in Section 5.2.7.3 of this EIS based on a flood study completed by the U.S. Geological Survey in 1998. DOE used the 1998 study as an upper bound estimate of the 100-year Big Lost River flood for analysis purposes. The 1998 study indicates the 100-year flood could affect a portion of INTEC. Ongoing studies, which incorporate information from the existing geologic record, indicate that the 100-year flood elevation would be substantially less than that estimated by the 1998 study. DOE will complete further studies in coordination with the U.S. Geological Survey and Bureau of Reclamation to refine the projected 100-year and 500-year flood elevations. A final floodplain determination will be issued upon completion of these studies. At that time, DOE will consider any alternatives to locating facilities within the floodplain and identify mitigation measures to minimize potential harm to and within the floodplain. For the purposes of obtaining a RCRA permit for the several hazardous waste facilities at INTEC, DOE-ID determined, as an interim measure pending a final flood determination, to use the most conservative flood elevation for the INTEC. That elevation is 4,916 ft (24,870 cfs) and is the estimated peak water elevation from a 100-year flood coupled with the failure of Mackay Dam.

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, 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, or 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 58.01.05) 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 *Rules and Standards*, (IDAPA 58.01.06) – 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, 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 milestones ***listed in the text box on page 6-22*** related to management of calcined waste and sodium-bearing liquid high-level wastes.

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.

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."
- ***"DOE shall treat all HLW currently at the INEL so that it is ready to be moved out of Idaho for disposal by a target date of 2035."***

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 RCRA 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 ***nine*** Notices of Violation from the State of Idaho ***resulting in eight*** signed Consent Orders ***and one pending Consent Order***. ***All eight signed*** Consent Orders have been closed because DOE has taken the appropriate actions to address the violation. ***A Consent Order addresses the most recent RCRA Notice of Violation.***

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.

DOE placed the calciner in standby prior to the deadline of June 1, 2000. Shutdown activities included flushing the system. DOE submitted a two-phased, partial closure plan on August 29, 2000, for the calciner portion of the New Waste Calcining Facility consistent with the Consent Order milestone and 40 CFR 265.112(a). The closure plan describes and accommodates the EIS decision-making process and schedule. The closure plan states that if DOE decides in the Record of Decision to upgrade and permit the calciner, DOE plans to modify the closure plan accordingly through the permitting process.

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 6-2. 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 6-3 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 6-4 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 Emission 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

Table 6-2. 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.
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.

Table 6-3. Air, water, NRC, DOT, and RCRA permits, licenses, or approvals required for each alternative.

Waste Processing Alternatives											***State of Idaho's Preferred Alternative***	
			Separations Alternative			Non-Separations Alternative					***Direct Vitrification***	
Permit, License, and/or approval type	No Action	Continued Current Operations	Full Separations	Planning Basis	Transuranic Separations	Hot Isostatic Pressed Waste	Direct Cement Waste	Early Vitrification	***Steam Reforming***	Min. INEEL Processing	***Vitrification Without Calcine Separations***	***Vitrification With Calcine Separations***
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 6-4. 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	●	●	–
Steam Reforming 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.

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 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 requirements 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 1999). 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 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 ***2002***). 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 *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-0250). 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 6-5 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 6-5. Compliance status of the proposed alternatives with the INEEL HLW enforceable milestones.

Waste Processing Alternatives											***State of Idaho's Preferred Alternative***	
			Separations Alternative			Non-Separations Alternative					***Direct Vitrification***	
Milestone	No Action	Continued Current Operations	Full Separations	Planning Basis	Transuranic Separations	Hot Isostatic Pressed Waste	Direct Cement Waste	Early Vitrification	***Steam Reforming***	Min. INEEL Processing	***Vitrification Without Calcine Separations***	***Vitrification With Calcine Separations***
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 ***and are freed from RCRA post-closure requirements*** 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. ***If DOE failed to meet the performance-based closure standards, those facilities may be unavailable for the disposal of the low-level waste fraction.***

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 ***four*** options considered in the Non-Separations Alternative are (1) Hot Isostatic Pressed Waste Option, (2) Direct Cement Waste Option, (3) Early Vitrification Option, ***and (4) Steam Reforming Option***. ***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.***

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 ***four*** 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.

Steam Reforming Option

In addition to the issues identified for all four non-separations alternatives, this alternative

has one more concern related to sending non-vitrified HLW to a geologic repository. The HLW calcine does not meet the current waste acceptance criteria for the potential repository. DOE will have to demonstrate the packaged waste form meets performance requirements of the waste acceptance criteria for the potential geologic repository.

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.

6.3.3.6 Direct Vitrification Alternative - State of Idaho's Preferred Alternative

The two options considered under the Direct Vitrification alternative are: Vitrification without Calcine Separations and Vitrification with Calcine Separations. 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 Section 6.3.2.1 through 6.3.2.3.

The waste streams that must be delisted for the Direct Vitrification Alternative include the vitrified HLW and potentially the mixed low-level waste fraction produced under the Vitrification with Calcine Separations Option. In addition to delisting, DOE must determine that the low-level waste fraction can be managed as mixed low-level waste through an incidental waste determination using the process established in DOE Manual 435.1-1 (DOE 1999).

Vitrified calcine or any separated vitrified HLW fraction resulting from calcine separations would be placed in interim storage at INTEC pending transport to a geologic repository. Under current waste acceptance criteria, DOE would not accept RCRA-regulated HLW at the proposed geologic repository at Yucca Mountain. Therefore, DOE may need to obtain a delisting to exclude the treated HLW from RCRA regulation in order to implement the Direct Vitrification Alternative. 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 (which stands for "eXcellence and Leadership"), and (2) a legislative strategy that would exclude the treated HLW from regulation under RCRA.

The SBW will be placed in a road-ready form by 2035. The SBW will undergo an incidental waste determination to determine whether the treated waste form should be managed as HLW or transuranic waste. The outcome of the incidental waste determination will determine the disposal site for the treated SBW. If DOE determines that the SBW should be managed as HLW, the treated SBW would be placed in interim storage pending transport to a national geologic repository. If DOE determines that the SBW is transuranic waste, the treated SBW would be shipped to the Waste Isolation Pilot Plant for disposal. Not all types of hazardous wastes in the INEEL SBW have been identified on the Waste Isolation Pilot Plant hazardous waste permit. Additional waste codes would need to be included in the permit or DOE may need to obtain a delisting to exclude the treated SBW from RCRA regulation in order to implement the Direct Vitrification Alternative.

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. The projected inventory of commercial spent nuclear fuel, DOE-owned and managed spent nuclear fuel, and HLW exceeds the statutory limit on emplacement in the first repository. Varying amounts of HLW could be accommodated within the statutory limit of 70,000 MTHM depending on the method used to establish MTHM equivalence for HLW. DOE has not determined which HLW would be shipped to the repository, or the order of shipments. The Direct Vitrification Alternative provides for interim storage of vitri-

fied HLW, including any vitrified SBW that DOE determines should be managed as HLW, until repository capacity or an interim storage site outside of Idaho is available.

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 1999). 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 a ***waste*** incidental ***to reprocessing*** determination for the tank heels in the INTEC Tank Farm. Decisions ***regarding*** 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 the Nuclear Regulatory Commission regarding its waste incidental to reprocessing determination. The ultimate disposition of the tank heels will be determined through RCRA ***tank*** closure plans that must be negotiated with the State of Idaho.

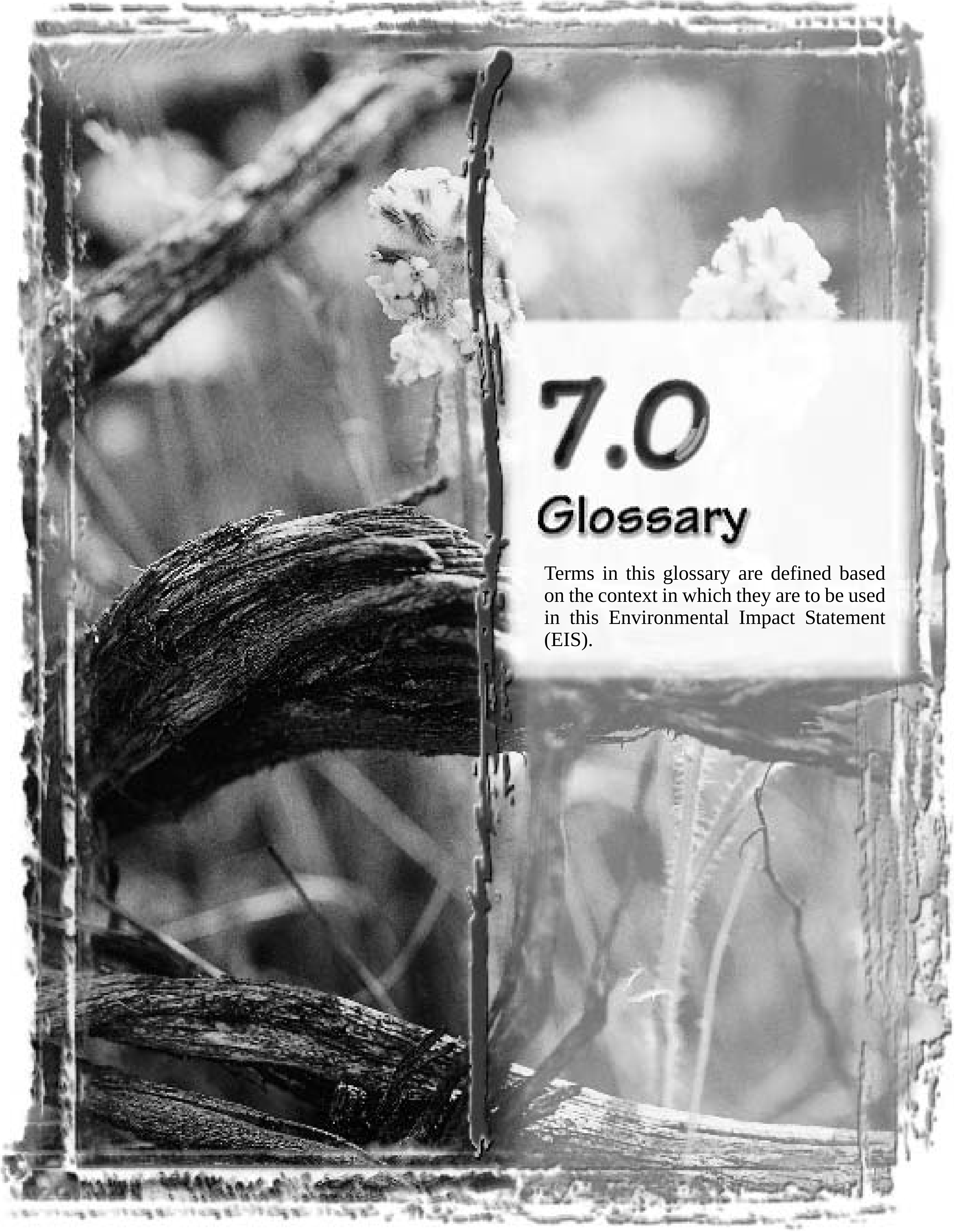
Due to the configuration of many of the buildings and facilities at INTEC, one building may have within its confines several different regulatory or programmatic drivers. For example, a facility might have one area being operated and closed in accordance with RCRA requirements, another area being closed 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.

Consistent with the objectives and requirements of DOE Order 430.1A, Life Cycle Management, and DOE Manual 435.1-1, Radioactive Waste Management Manual, all newly constructed facilities implementing any waste processing alternative would be designed and constructed consistent with measures that facilitate clean closure methods. The preferred facility disposition alternative includes the use of performance-based closure methods for existing HLW facilities. During facility disposition, residual wastes would be reduced to the extent technically and economically feasible in order to satisfy the waste incidental to reprocessing requirements. The remaining residual wastes would be immobilized by methods such as grouting, disposed in-place, and monitored in accordance with applicable requirements under RCRA and the Idaho Hazardous Waste Management Act. DOE would determine whether the residual waste satisfied the incidental waste criteria set forth in DOE Manual 435.1-1. That decision would determine the applicable standards for the preferred facility disposition alternative.

Facility disposition would be a long-term process implemented incrementally as the facilities associated with generation, treatment, and storage of HLW and associated waste reach the end of their mission life. Each individual facility action would be evaluated on a case-by-case basis by considering the impact on the allowable cumulative risk in the INTEC area resulting from residual contamination from all facilities. Facility disposition activities, CERCLA remedial activities, and any other in-place disposal actions would be performed in accordance with applicable regulations and controlled so as not to exceed the calculated cumulative risk value established to be protective of the Snake River Plain Aquifer.

7.0

Glossary



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Glossary

Terms in this glossary are defined based on the context in which they are to be used in this Environmental Impact Statement (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)

The facility 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

Low-level mixed waste containing, at the time of assay, concentrations of at least 10 but less than 100 nCi/g of waste of alpha-emitting radionuclides with an atomic number greater than 92 and half-lives greater than 20 years. The term "mixed" cannotes waste containing both radioactive and hazardous constituents as defined by the Atomic Energy Act and the Resource Conservation and Recovery Act (RCRA) respectively.

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.

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 haz-ardous 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.

newly generated liquid waste

Newly generated liquid waste refers to liquid waste from a variety of sources that has been evaporated and added to the liquid mixed HLW and mixed transuranic waste/sodium-bearing waste in the below-grade tanks at the INTEC. Sources include leachates from treating contaminated high-efficiency particulate air filters, decontamination liquids from INTEC operations that are not associated with HLW management activities, and liquid wastes from other Idaho National Engineering and Environmental Laboratory facilities. Newly generated liquid waste is used in this EIS because INTEC has historically used this term to refer to liquid waste streams (past and future) that were not part of spent fuel reprocessing.

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 non-ionizing 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 ***a*** liquid ***mixed radioactive*** waste ***produced from the second and third cycles of spent nuclear fuel reprocessing and waste calcination, liquid wastes from INTEC closure activities stored in the Tank Farm, solids in the bottom of the tanks, and trace contamination from first cycle reprocessing extraction waste.*** SBW contains large quantities of sodium and potassium nitrates. Typically, SBW is processed through an evaporator to reduce the volume, then stored in the ***Tank Farm***. 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 ***components*** and is a mixed waste. ***DOE assumes that the SBW*** is mixed transuranic waste. This EIS refers to SBW as mixed transuranic waste/SBW.

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 Farm

An installation of multiple adjacent tanks at INTEC interconnected for storage of liquid radioactive waste.

tank heel

> ***A tank heel is the amount of liquid remaining in each tank after lowering to the greatest extent possible by use of the existing transfer equipment, such as ejectors.***

tank residual

> ***The tank residual is the amount of radioactive waste remaining in each tank, the removal of which is not considered to be technically and economically practical. This could be the tank heel or the amount of radioactive waste remaining after additional removal using other methods than the existing transfer equipment.***

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

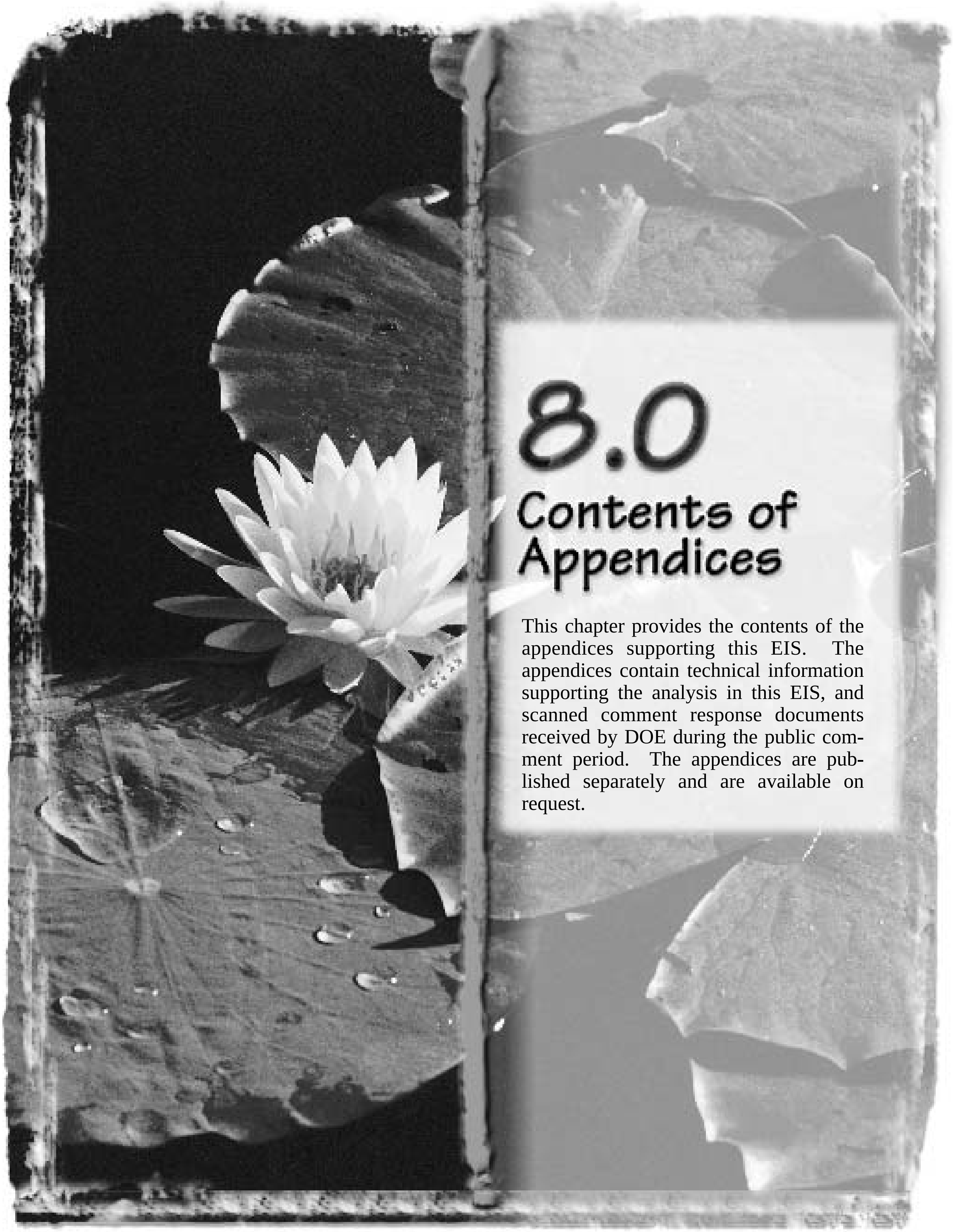
A waste or group of wastes with similar physical form, radiological properties, U.S. Environmental Protection Agency waste codes, or associated land disposal restriction treatment standards. It may be the result of one or more processes or operations.

wind rose

A diagram showing how often winds of various speeds blow from different directions. This is usually based on annual averages.

8.0

Contents of Appendices



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Contents of Appendices

This chapter provides the contents of the appendices supporting this EIS. The appendices contain technical information supporting the analysis in this EIS, and scanned comment response documents received by DOE during the public comment period. The appendices are published separately and are available on request.

- New Information -

TABLE OF CONTENTS

Section

TABLE OF CONTENTS
(continued)

9.0

References

9.0

References

Chapter 1

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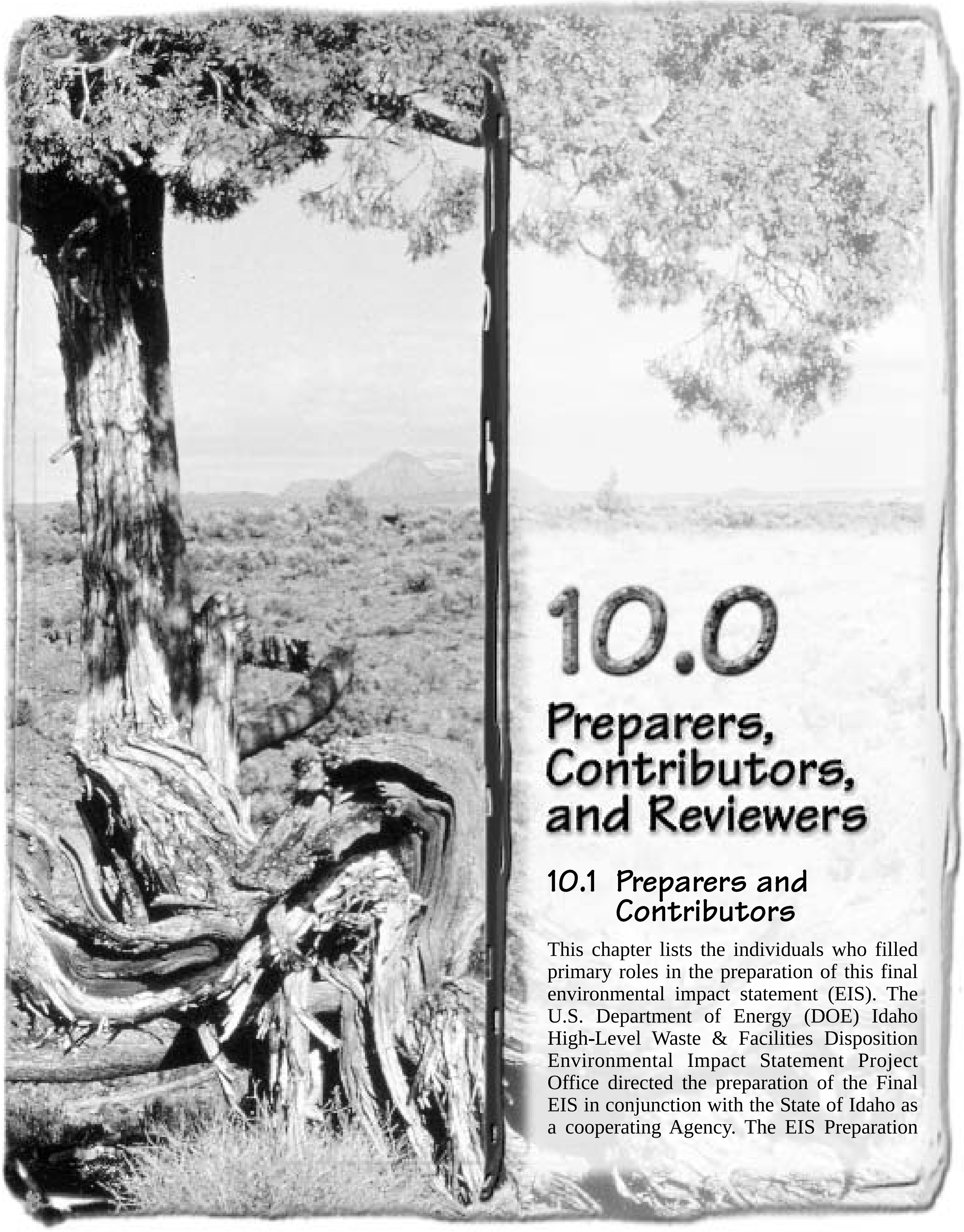
Preparers, Contributors, and Reviewers



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Preparers, Contributors, and Reviewers

10.1 Preparers and Contributors

This chapter lists the individuals who filled primary roles in the preparation of this final environmental impact statement (EIS). The U.S. Department of Energy (DOE) Idaho High-Level Waste & Facilities Disposition Environmental Impact Statement Project Office directed the preparation of the Final EIS in conjunction with the State of Idaho as a cooperating Agency. The EIS Preparation

Team, led by Tetra Tech NUS, Inc, provided primary assistance to DOE along with assistance from Jason & Associates Company, Ryan-Belanger Associates, Global Technologies Incorporated Company, Portage Environmental, Inc., ERIN Engineering & Research Inc. Company, Rogers & Associates Engineering Unit Dames & Moore, Inc., David Miller & Associates Company, Jacobs Engineering Group, and Hinman Law Offices. The EIS Preparation Team was responsible for developing the analytical methodology and alternatives, coordinating the work tasks, performing the impact analyses, and producing the document. DOE was responsible for data quality, procedural adequacy the scope and content of the EIS, issue resolution, and directing the EIS Preparation Team.

In addition, the Management and Operating Contractor at the Idaho National Engineering and Environmental Laboratory (INEEL) assisted in the preparation of supporting documentation and provided additional information for the EIS, as did the Shoshone-Bannock Tribes for cultural resources. These organizations worked closely with the EIS Preparation Team under DOE direction. The State of Idaho INEEL Oversight Program was the lead for State of Idaho cooperation on this EIS. Other State of Idaho Agencies provided assistance with supporting information and document review. DOE independently evaluated all data and supporting documentation prepared by these organizations. Further, DOE retained the responsibility for determining the appropriateness and adequacy of incorporating any data, analyses, and results of other work performed by these organizations in the EIS. The EIS Preparation Team was responsible for integrating such work into the EIS.

As required by Federal regulations (40 CFR 1506.5c), subcontractors have signed National Environmental Policy Act (NEPA) Disclosure Statements in relation to the work they performed on this EIS. These statements appear at the end of this chapter.

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Joel T. Case	*M.S., Environmental and Nuclear Engineering, 1980* *B.S., Microbiology, 1978*	*20 years experience in nuclear engineering and waste management in both the commercial and Department of Energy sectors; currently Director of DOE's INTEC Waste Program responsible for management and oversight activities for INEEL HLW*	*Programmatic and Technical Reviewer*
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Jack D. Depperschmidt	B.S., Wildlife Biology, 1985	***17 years, including 8 years regulatory compliance; 2 years natural resource management; and 7 years NEPA compliance***	Regulatory Compliance Associate Advisor; NEPA Compliance Associate Advisor; ***Analytical Lead - Land Use, Aesthetic and Scenic Resources; Irretrievable and Irreversible Impacts***
Denise M. Glore	J.D., 1985 M.S., Biology, 1980 B.A., Geography and Anthropology, 1978	19 years, including 13 years as environmental attorney; 6 years in photogrammetry, NEPA data collection and statistical analysis	Consultations, Legal and Regulatory Issues
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David Herrin	M.S., Electrical Engineering, 1992 B.S., Electrical Engineering, 1990	6 years experience in construction project management	Analytical Lead – Facility Accidents, Traffic and Transportation, Utilities and Energy
Talley Jenkins	M.S., Metallurgical Engineering, 1991 B.S., Metallurgical Engineering, 1989	7 years involvement in Environmental Restoration program dealing with risk assessment, feasibility studies, and remedial action	CERCLA and WAG-3 Coordinator; Facilities Disposition Advisor
Richard Kimmel, P.E.	B.S., Civil Engineering, 1969	32 years, including construction, engineering and project/environmental management at fossil-fueled and nuclear power plants, and DOE including public involvement and NEPA analyses	***Final*** EIS Project Manager

Name	Education	Experience	Responsibility
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Ralph W. Russell	B.S., Chemical Engineering, 1970	22 years air quality; 4 years public involvement	Analytical Lead - Air Resources (***through September 2001)***
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Name	Education	Experience	Responsibility
State of Idaho			
Rick Denning	***M.S., Environmental Science, 1998*** ***B.S., Chemistry, 1996***	***8 years experience in water and wastewater chemistry, hazardous and radioactive waste management***	***Deputy project lead for State of Idaho***
Ann Dold	B.S., Environmental Planning, 1983	15 years experience in environmental affairs	Project lead for State of Idaho ***(through June 2001)***
Jerry Downs	Ph.D., Physics, 1975	23 years experience in air quality and 3 years in transportation risk assessments	Air quality and transportation risk issues, QA/QC issues ***(through January 2002)***
David Frederick	M.S., Geology, 1990	10 years experience in geology and groundwater issues	Reviewer for geology/hydrology issues
Robert Guenzler, P.E.	M.S., Civil Engineering, 1966	30 years experience in structural analysis and earthquake engineering	Nuclear engineering and technology
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Mike Ryan	***Ph.D., Health Physics, 1982***	***25 years experience in health physics, environmental monitoring and regulatory compliance program management***	***Reviewer for geology/hydrology issues***
Doug Walker	***M.S., Health Physics, 2000*** B.S., Health Physics, 1990	10 years experience in environmental monitoring and emergency response	Accident and health risk assessment issues
Tetra Tech NUS and associated subcontractors			
Yvonne F. Abernethy	M.S., Forest Management and Economics, 1984 B.S., Forest Management, 1979	5 years preparing NEPA documents; 14 years in natural resource management and environmental planning	Quality Assurance, Data Management
Janet Bouknight	B.S., Biological Sciences, 1995 M.S., Environmental Toxicology, 1998	3 years in polymer research; 1 year in ecological risk assessment	Ecological Resources; Project Information

Name	Education	Experience	Responsibility
Bruce Bradford, P.E.	Ph.D., Civil Engineering, 1974 M.S., Civil Engineering, 1966 B.S., Civil Engineering, 1965	15 years preparing NEPA documents; 32 years in civil engineering specializing in hydrology, hydraulics, and water resources	Senior Technical Reviewer
Steven J. Connor	M.S., Physics, 1974 B.S., Physics, 1973	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	***Draft EIS*** Project Manager
William Craig	M.S., Planning, 1977 B.S., Forestry, 1972	10 years preparing NEPA documents; 20 years utility fuel planning and powerplant siting	Socioeconomics
Kent T. Cubbage	M.S. Environmental Toxicology, 1993 B.S., Environmental Biology, 1991	6 years experience in toxicology, risk assessment, and aquatic and terrestrial ecology	Ecological Resources
Sandy Enyeart, P.E.	B.S., Civil Engineering, 1974 B.A., Fine Arts, 1987	10 years preparing NEPA documents, 22 years DOE experience primarily in water resources, NEPA, and safety analysis	Geology and Soils; Water Resources
Philip Fulmer	Ph.D. Nuclear Engineering, 1993 M.S., Health Physics, 1990 B.A., Health Physics, 1989	10 years experience in radiation protection, internal radiation dosimetry, and external radiation dosimetry	Facility Disposition Modeling
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Name	Education	Experience	Responsibility
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Name	Education	Experience	Responsibility
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Diane Sinkowski	M.E., Environmental Engineering, 1994 B.S., Nuclear Engineering Sciences, 1990	4 years preparing NEPA documents; 6 years in fate and transport modeling, human health impacts, environmental compliance, and health physics	Facility closure modeling; Project Information; Traffic and Transportation and Utilities and Energy
James S. Willison, P.E., CHP	M.S., Nuclear Engineering, 1982 B.S., Nuclear Engineering, 1980	2 years preparing NEPA documents; 14 years of accident analyses at nuclear facilities; health physics and radiological engineering	Facility Accidents
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Name	Education	Experience	Responsibility
Jacobs Engineering Group			
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Dwayne Crumpler	M.S., Geology, 1989 B.S., Geology, 1985	10 years experience in environmental compliance at DOE, DOD and private sector facilities; 3 years in the preparation of NEPA documents	Hanford Impacts
Doug Evans	M.S., Geology, 1989 B.S., Geology, 1980	10 years experience in environmental compliance at DOE; 7 years in the preparation of NEPA documents	Hanford Impacts
Harry Fugate	M.S., Environmental Engineering, 1989 MBA, 1988 B.S., Civil and Environmental Engineering, 1986	10 years experience in environmental compliance at DOE; 1 year in the preparation of NEPA documents	Hanford Impacts
Greg Gavel	B.S., Nuclear Engineering, 1990	10 years experience in processing engineering for private sector clients; 1 year in the preparation of NEPA documents	Hanford Impacts
Michael Harker	B.S., Zoology, 1979	15 years experience in environmental compliance at DOE; 5 years in the preparation of NEPA documents	Hanford Impacts
Colin Henderson	M.S., Environmental Engineering, 1996 B.S., Mechanical Engineering, 1986	10 years engineering experience with industry and environmental compliance at DOE; 5 years experience in the preparation of NEPA documents	Hanford Impacts

Name	Education	Experience	Responsibility
Kathleen Moore	M.P.H. Epidemiology and Public Health, 1989 B.S., Biochemistry, 1978	10 years experience in environmental compliance at DOE and DOD; 8 years in the preparation of NEPA documents	Hanford Impacts
Dave Nichols	B.A., Political Science and Communications, 1980	15 years experience in environmental compliance for DOE, DOD, EPA and industry; 9 years experience in the preparation of NEPA documents	Hanford Impacts
Jack Sabin	B.A., Mechanical Engineering, 1973	40 years experience in engineering, project scheduling, and cost estimating for DOE and industry; 3 years experience in the preparation of NEPA documents	Hanford Impacts
Mike Worthington	B.S., Chemical Engineering, 1971	25 years experience in chemical and processing engineering for industry; 1 year experience in the preparation of NEPA documents	Hanford Impacts
	Rogers & Associates Engineering Corp.		
Vern C. Rogers	M.S., Nuclear Engineering, 1995 B.S., Physics, 1990	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	Traffic and Transportation

Name	Education	Experience	Responsibility
	Ryan Belanger Associates		
Christopher Bartolomei	***M.B.A., Business Administration, 1995*** ***B.S., Mechanical Engineering, 1988***	***7 years engineering experience (aerospace applications) and 7 years of computer system administration, both including extensive Quality Control/Assurance activities***	***Air Resources***
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Deborah Ryan	B.S., Meteorology, 1976	20 years of experience in air pollution control and air quality assessments, including over 5 years of direct involvement in NEPA projects	Air Resources
	Tetra Tech, Inc.		
Sara McQueen	B.A., Economics, 1995	More than 3 years experience conducting socioeconomic analyses and environmental justice evaluations under NEPA for DOE and DOD	Environmental Justice
	Erin Engineering Research		
Al Unione	Ph.D., Mechanics and Hydraulics, 1972 M.S., Mechanics and Hydraulics, 1970 B.S., Mechanical and Aerospace Engineering 1967	26 years of professional experience; ***including*** risk assessment, safety assessment, probabilistic risk evaluation, health impact evaluation***, and accident analyses***	Facility Accidents Lead
	Global Technologies, Inc.		
Ken Krivanek	M.S., Thermal & Environmental Engineering, 1979 M.S., Geochemistry/ Hydrology, 1976 B.S., Geology/ Mineralogy, 1972	23 years as an environmental and systems engineer; 15 years preparing NEPA documents	Facility Accidents, Technical Resource Document

Name	Education	Experience	Responsibility
Jason Associates Corporation			
William Berry	Ph.D., Entomology, 1988 M.S., Biology, 1983 B.S., Biology, 1981	10 years of experience in environmental compliance, environmental impact assessment, ecological risk assessment, and remedial investigations/feasibility studies at DOE and DOD facilities	Unavoidable Adverse Impacts; Irreversible and Irretrievable Commitments of Resources; Short-Term Use Versus Long-Term Productivity of the Environment; Cumulative Impacts
Albert Bowman	B.A., Physics and Mathematics, 1958	34 years experience in engineering and related fields including: nuclear engineering, environmental compliance; and environmental impact assessment	Senior Technical Advisor ***and facility accidents***
Carolann Cole	B.S., Experimental Psychology, 1967	22 years of experience specializing in government and industry, communications, public participation, and media planning	Public Involvement; Summary; Comment Response System
Keith Davis, P.E.	M.S., Civil and Environmental Engineering, 1976 B.S., Civil Engineering, 1973	22 years of experience in civil and environmental engineering projects and hazardous and radioactive mixed waste management	Waste and Materials
Kevin Harris	M.S., Environmental Engineering, 1997 B.S., Environmental Engineering, 1995	2 years experience in environmental engineering projects including environmental baseline modeling and environmental sampling	Waste and Materials; Consultations and Environmental Requirements
Kimberly Johnson	B.S., Biology, 1994	***6*** years of experience in environmental compliance, environmental site assessment, and environmental restoration	***Quality Assurance***

Name	Education	Experience	Responsibility
David J. Lechel	***B.S., Fisheries Biology, 1972*** ***M.S., Fisheries Biology, 1974***	***28 years experience, including extensive NEPA experience with the Department of Energy***	***Final EIS Summary***
Emily Scarborough	B.S., Biology, 1981	15 years of experience in various areas of health physics, including field operations, training, regulatory compliance, and risk assessment	Affected Environment: Health and Safety
Portage Environmental, Inc.			
Michael J. Spry	***M.S., Land Rehabilitation, 1986*** ***B.S., Environmental Studies, 1983***	***15 years of experience in environmental compliance, preparing CERCLA compliance documents, conducting RCRA facility closures and performing NEPA impact analyses***	***Affected Environment: Cultural Resources***
Hinman Law Offices			
Margaret B. Hinman	***J.D., 1986*** ***B.A., Government, 1979***	***15 years legal experience including 13 years as an environmental attorney***	***Support for Consultations, Legal and Regulatory Issues***

10.2 Reviewers

The DOE Idaho High-Level Waste & Facilities Disposition Environmental Impact Statement Project Office incorporated information from a number of other DOE offices that reviewed the document into the EIS. These included the Office of Environmental Management, the Office of Environmental, Safety, and Health, the Richland Operations Office, the Savannah River Operations Office, the Office of Civilian Radioactive Waste Management, the Yucca Mountain Site Characterization Office, and Yucca Mountain Project Office.

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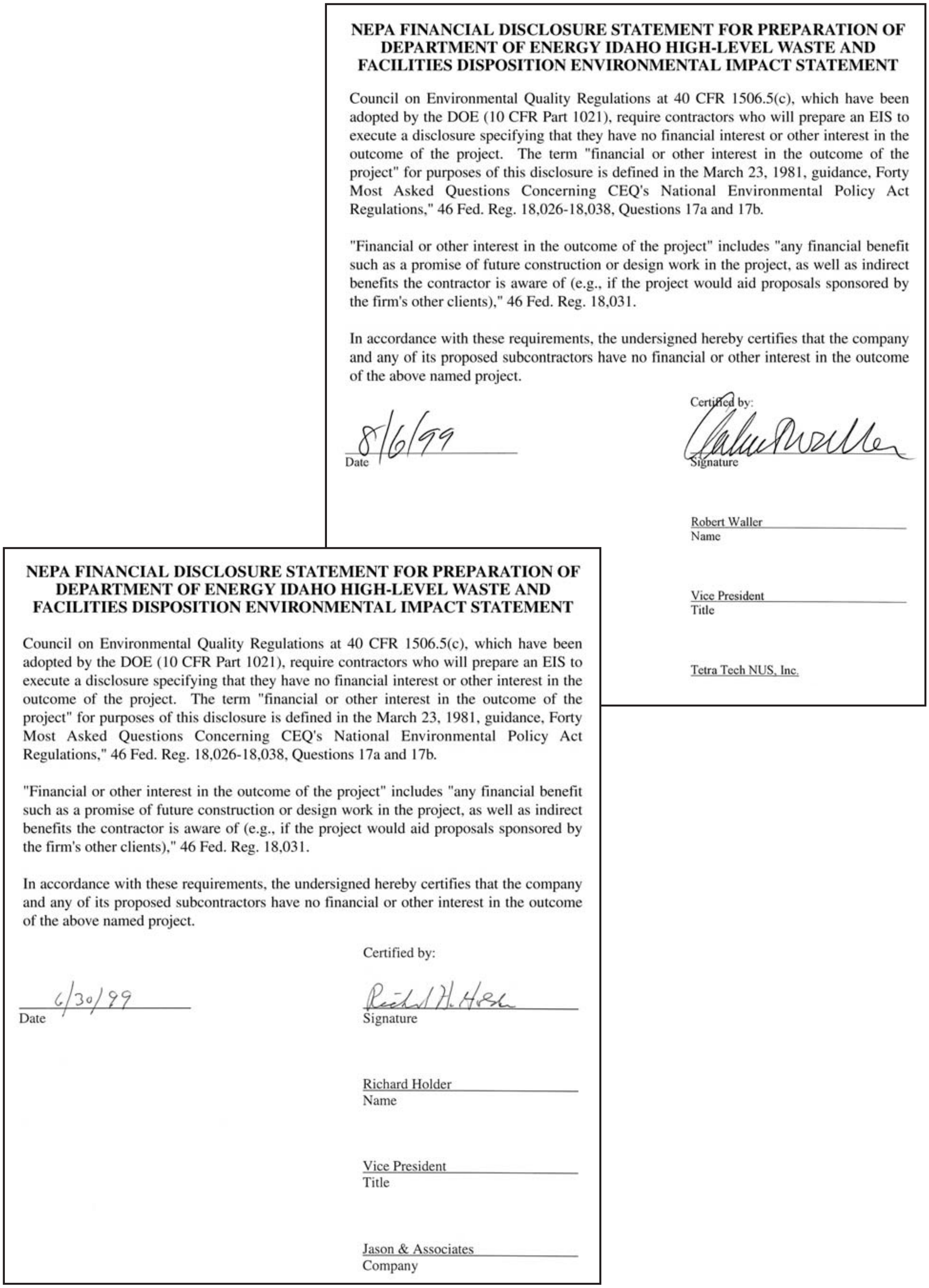

NEPA FINANCIAL DISCLOSURE STATEMENT FOR PREPARATION OF DEPARTMENT OF ENERGY IDAHO HIGH-LEVEL WASTE AND FACILITIES DISPOSITION ENVIRONMENTAL IMPACT STATEMENT

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

Robert Waller
Name

Vice President
Title

Tetra Tech NUS, Inc.

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:

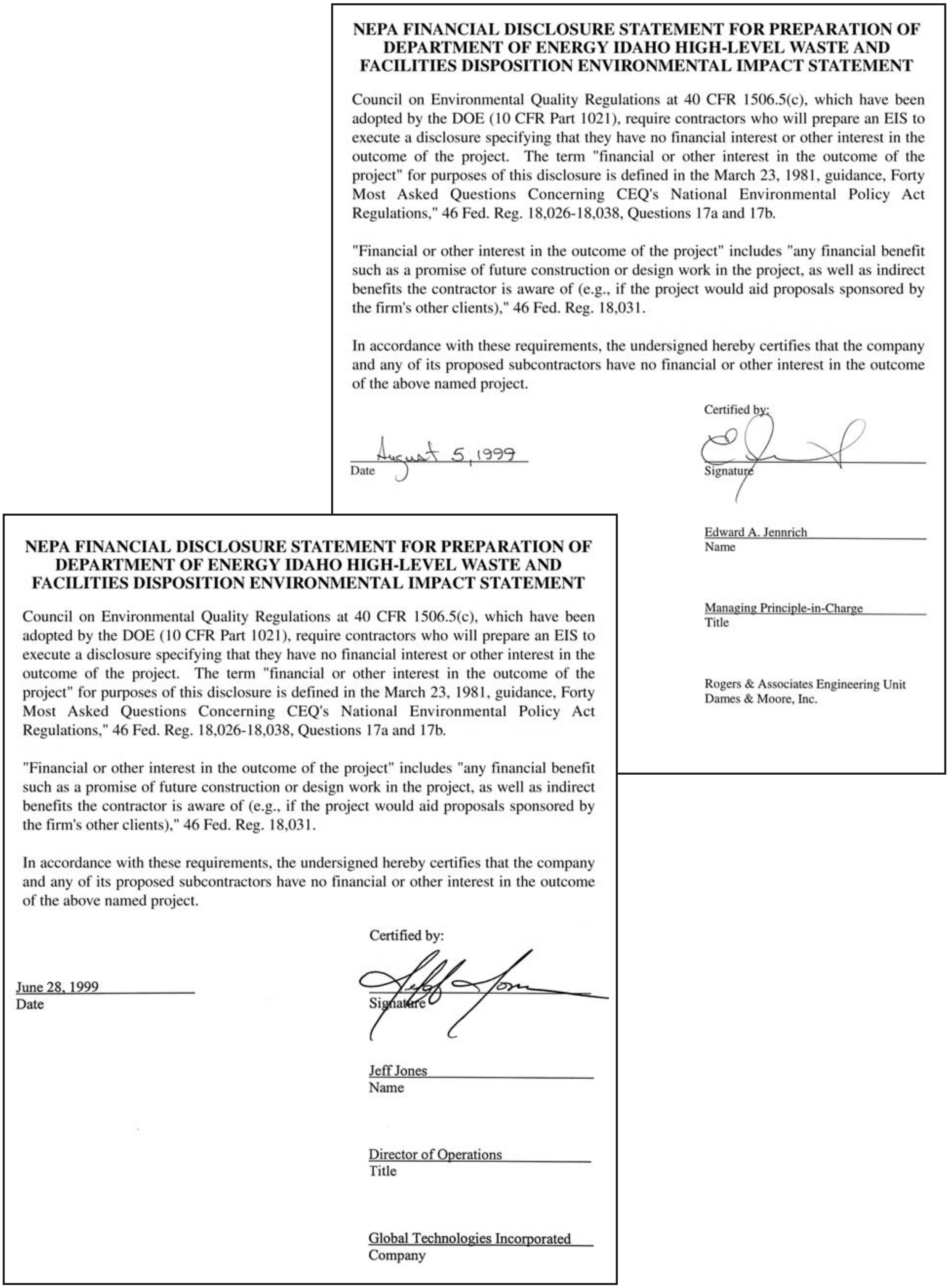
6/30/99
Date

Richard H. Holder
Signature

Richard Holder
Name

Vice President
Title

Jason & Associates
Company



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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 5, 1999
Date

Signature

Edward A. Jennrich
Name

Managing Principle-in-Charge
Title

Rogers & Associates Engineering Unit
Dames & Moore, Inc.

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:

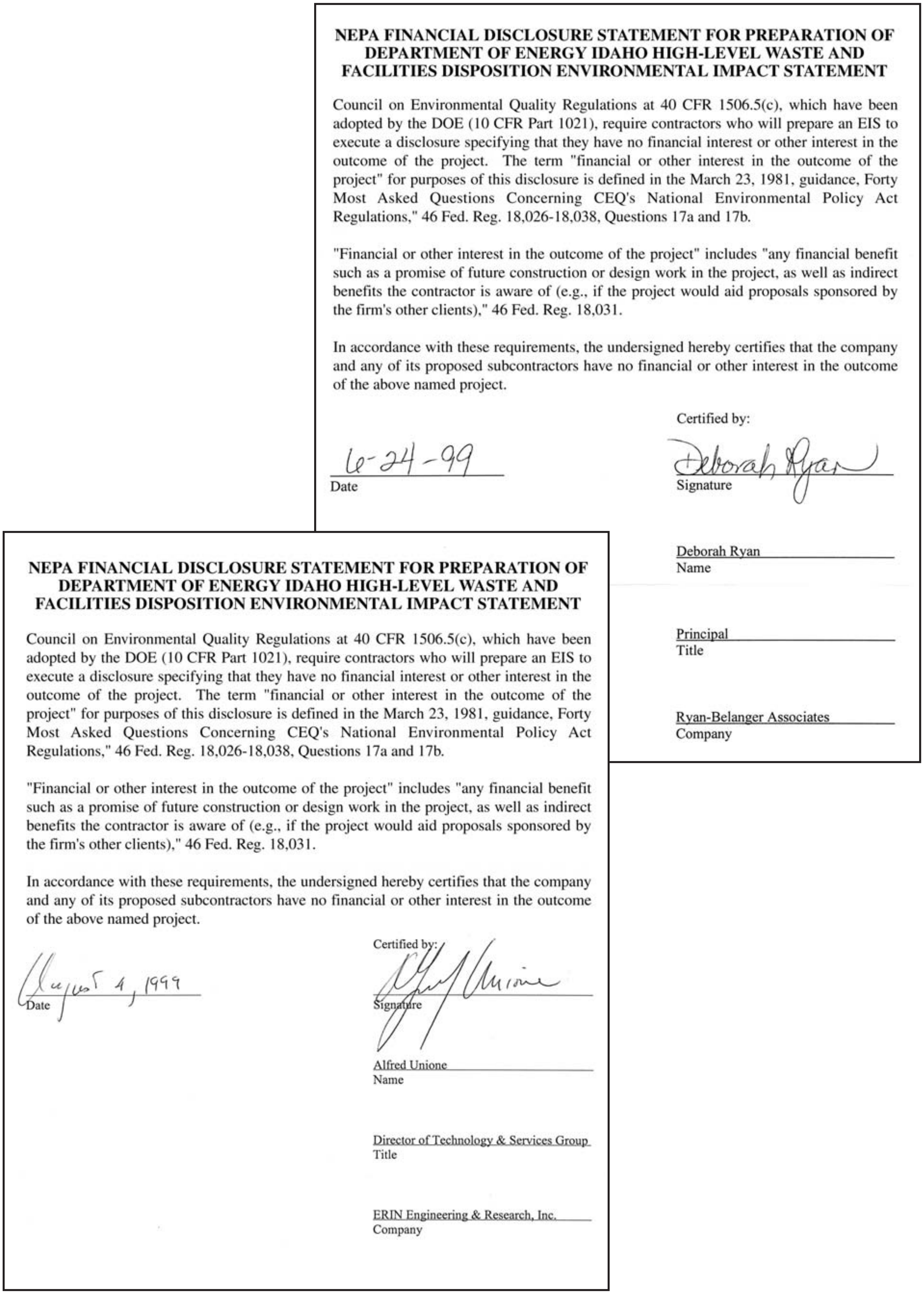
June 28, 1999
Date

Signature

Jeff Jones
Name

Director of Operations
Title

Global Technologies Incorporated
Company



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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:

6-24-99
Date

Deborah Ryan
Signature

Deborah Ryan
Name

Principal
Title

Ryan-Belanger 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:

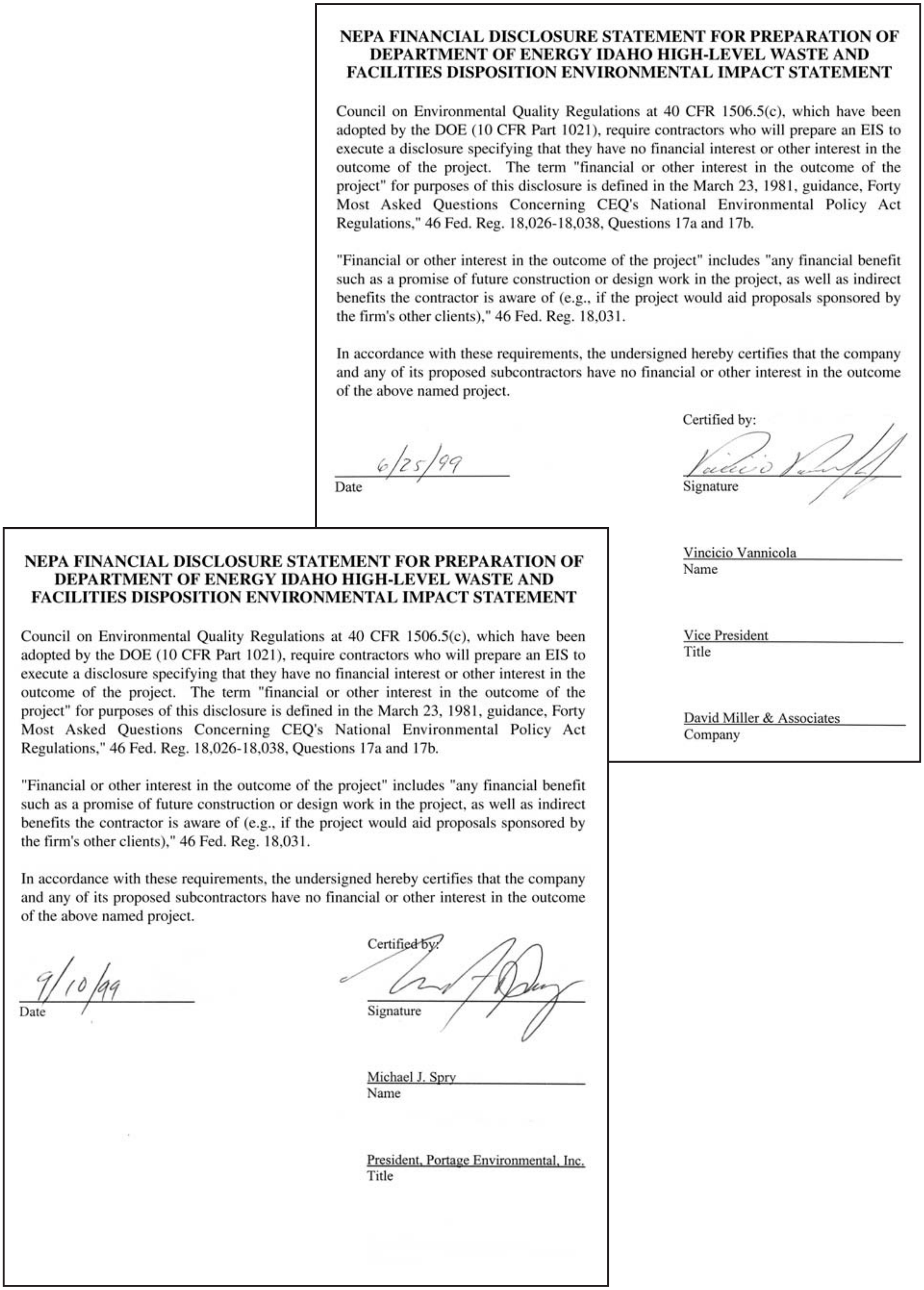
August 4, 1999
Date

Signature

Alfred Unione
Name

Director of Technology & Services Group
Title

ERIN Engineering & Research, Inc.
Company



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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:

6/25/99
Date

Signature

Vincicio Vannicola
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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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.

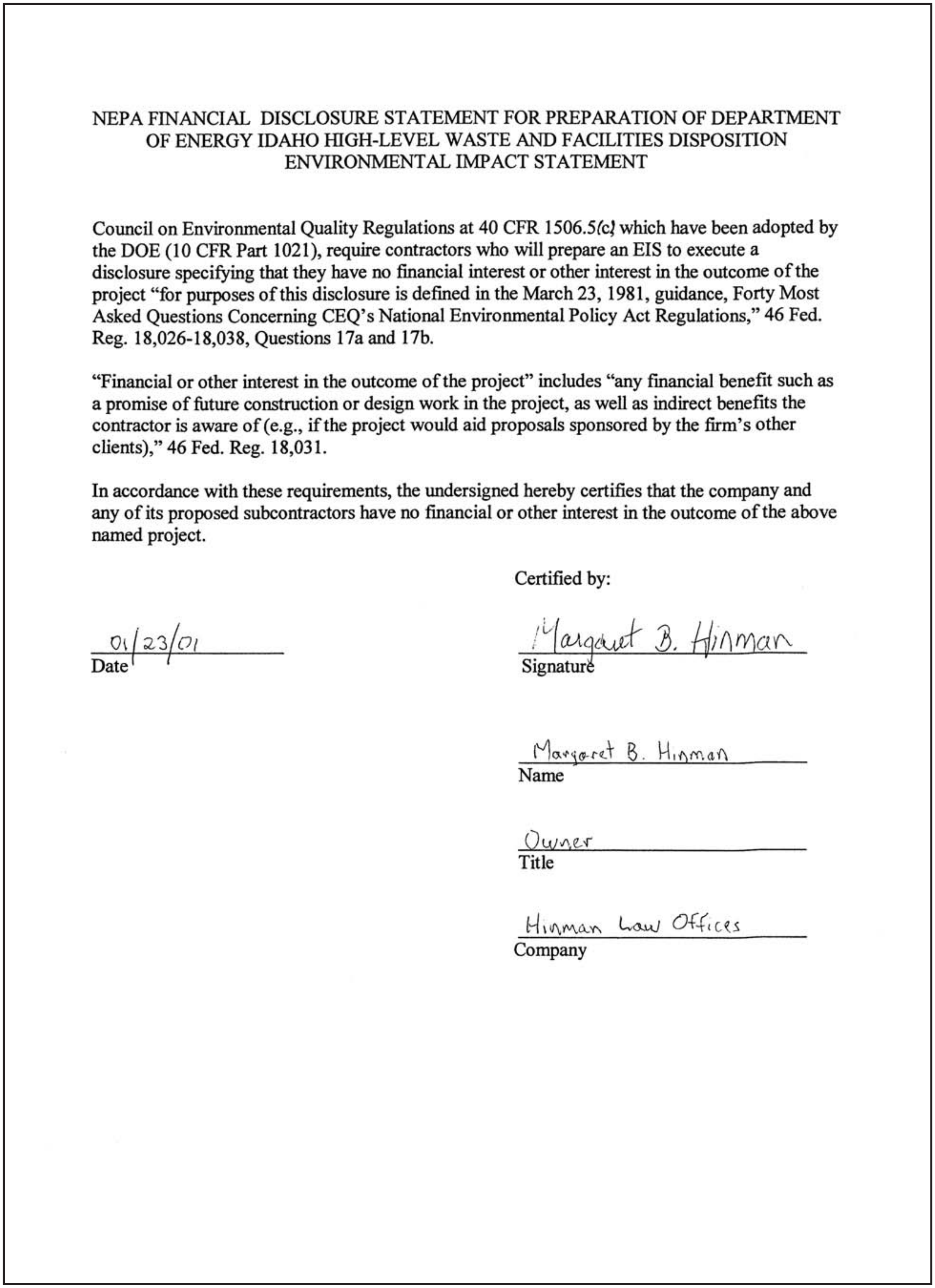
Certified by:

9/10/99
Date

Signature

Michael J. Spry
Name

President, Portage Environmental, Inc.
Title



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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:

01/23/01
Date

Margaret B. Hinman
Signature

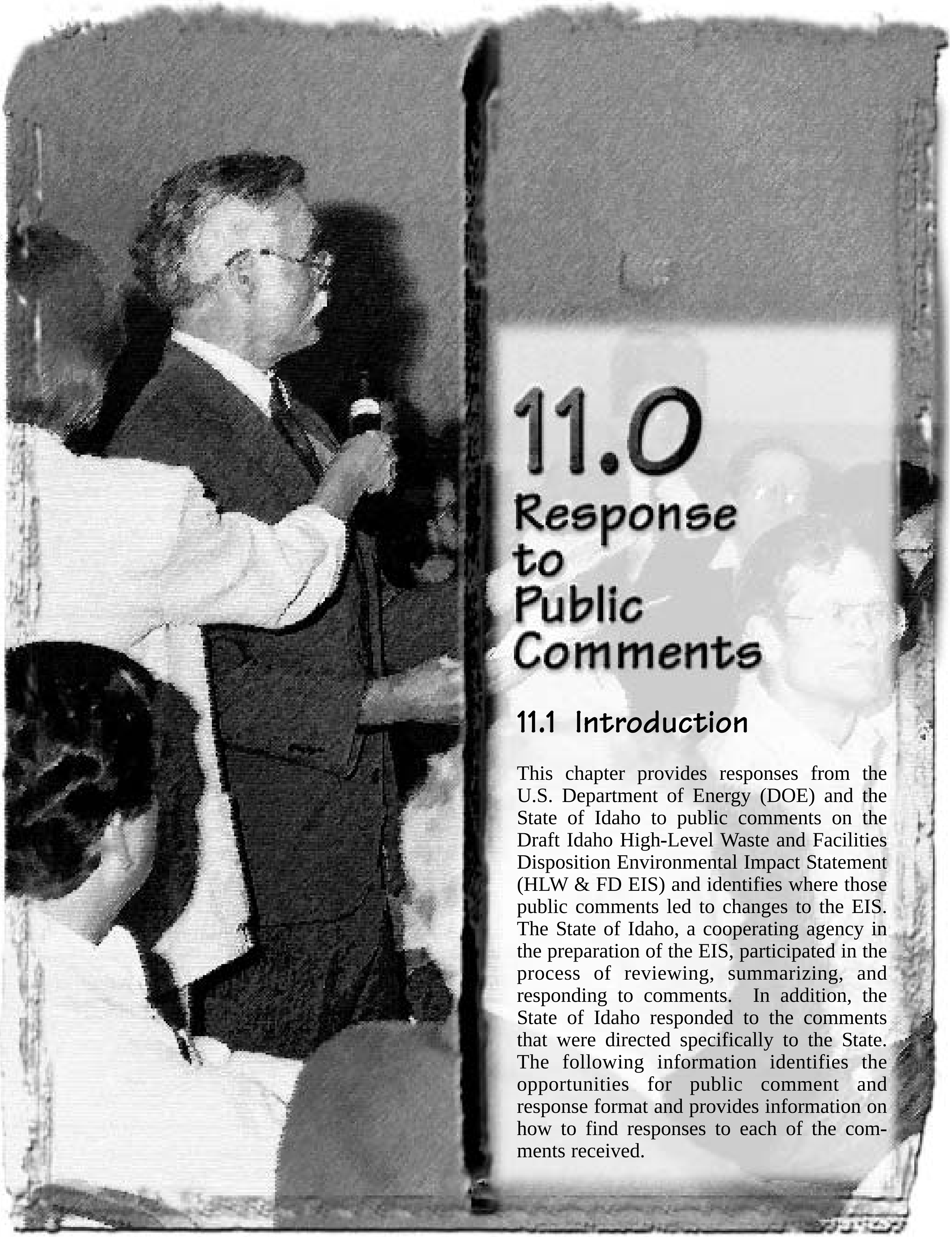
Margaret B. Hinman
Name

Owner
Title

Hinman Law Offices
Company

11.0

Response to Public Comment



11.0 Response to Public Comments

11.1 Introduction

This chapter provides responses from the U.S. Department of Energy (DOE) and the State of Idaho to public comments on the Draft Idaho High-Level Waste and Facilities Disposition Environmental Impact Statement (HLW & FD EIS) and identifies where those public comments led to changes to the EIS. The State of Idaho, a cooperating agency in the preparation of the EIS, participated in the process of reviewing, summarizing, and responding to comments. In addition, the State of Idaho responded to the comments that were directed specifically to the State. The following information identifies the opportunities for public comment and response format and provides information on how to find responses to each of the comments received.

11.2 Opportunities for Public Comment and Response Format

DOE published the Notice of Availability of the Draft EIS in the Federal Register on January 21, 2000, (65 FR 3432) and subsequently extended the public comment period from 60 to 90 days in response to public requests (65 FR 9257, February 24, 2000). The Notice of Availability provided information on how the public could obtain copies of the Draft EIS and the locations, dates, and times of the public hearings. Individuals submitted comments in writing by mail, fax, electronic mail, and by written or oral comments at public hearings in Idaho Falls, Pocatello, Twin Falls, Boise, and Fort Hall, Idaho; Jackson, Wyoming; Portland, Oregon; and Pasco, Washington.

In addition to Notice of Availability information on public hearings, DOE publicized the availability of and provided information about the Draft EIS through radio announcements in four Western states and newspaper advertisements in nine states as well as distribution of the Draft EIS to more than 1,400 individuals and organizations in 27 states and the District of Columbia. DOE held briefings with government and tribal officials, public interest groups, Idaho National Engineering and Environmental Laboratory (INEEL) employees, DOE citizens advisory boards in Idaho and Washington, state and Federal agencies, and other interested stakeholders.

DOE received comments from private citizens; businesses; local, state, and Federal officials; Native American Tribes; and public interest groups in Idaho, Wyoming, Washington, Oregon, Georgia, Nevada, Maryland, South Carolina, Wisconsin, and the District of Columbia.

In compliance with the provisions of the National Environmental Policy Act (NEPA) and Council on Environmental Quality (CEQ) regulations, DOE assessed and considered public comments both individually and collectively. Although many comments did not result in an EIS change, responses are provided to clarify information, to explain or communicate government policy or the relationship of this EIS to other related NEPA documents, to direct commentors to information in the EIS, or to answer technical questions.

11.2.1 CHANGES TO THE EIS RESULTING FROM PUBLIC COMMENTS AND AGENCY REVIEW

Consideration of public comments on the Draft EIS helped ensure the adequacy of this EIS as a decision-making tool; accordingly, this EIS incorporates enhancements, as appropriate, in response to public comments and DOE and State of Idaho internal review. These enhancements include, but are not limited to, the following:

- Identified the DOE and State of Idaho Preferred Alternatives in Chapter 3.
- Added "Other Information and Technologies Reviewed" (Chapter 2, Section 2.3.5). This new section summarizes DOE's review of information received from the National Academy of Sciences National Research Council, commentors, and others.
- Updated "Alternatives Eliminated from Detailed Analysis" (Chapter 3, Section 3.3) to clarify why some alternatives and technologies submitted in response to the Draft EIS discussion on purpose and need were not considered further by DOE.
- Modified data on transportation impacts for the Minimum INEEL Processing Alternative. Higher volumes of waste would be produced from vitrification of calcine at the Hanford Site than those analyzed for this alternative in the Draft EIS. (Chapter 5, Section 5.2.9)
- Updated waste inventory information in Appendix C.7 and made corresponding changes in long-term facility disposition modeling (Appendix C.9), facility accident analysis (Appendix C.4) and related sections.

- Updated the EIS to reflect the DOE Waste Management Programmatic EIS Record of Decision for disposal of low-level and mixed-low-level waste.

- Expanded the discussion of the waste incidental to reprocessing procedure under DOE Order 435.1 and the possible designation and disposal destination of wastes.

- Updated Chapter 4, "Affected Environment," so that the information it provides is current.

- Added a Steam Reforming Option under the Non-Separations Alternative that includes containerizing the calcine for shipment to the geologic repository.

11.2.2 HOW TO LOCATE RESPONSES TO COMMENTS

- Frequently, commentors submitted comments that addressed similar or identical topics. In such cases, DOE and the State of Idaho grouped and summarized the comments referred to as comment summaries and prepared a single response for each summary.

- Table 11-1 lists the topics with which similar comments and responses are associated (e.g. Alternatives, Section II, provides responses to comments related to the EIS alternatives such as II.B No Action). The Roman Numerals in the Chapter 11 index (Table 11-2) correspond with those in Table 11-1, which lists the page numbers of the topics identified by the Roman Numerals.

- Table 11-2 lists comment summary numbers by commentor alphabetically in four categories: Individuals, Government Agencies/Tribes, Organizations, and Public Hearings. Those interested in finding responses to comments made by specific individuals, on behalf of specific groups, or at particular public meetings may turn to the index, and find the corresponding category and comment summary number. The comment summaries and corresponding responses are in numerical order under the topics identified by the Roman Numerals. Those interested in finding comments and responses on a particular topic may find the topic and the corresponding page number in Table 11-1.

- The document number that appears opposite each name in the index corresponds to a scanned copy of the associated comment document. These Comment Documents are in Appendix D of this EIS.

11.2.3 HOW TO FIND REFERENCE DOCUMENTS

Technical references and other supporting documentation cited in this document are available from the DOE-Idaho Operations Office [(208) 526-0833]. Readers can find the document of interest on the alphabetical list provided in the DOE Reading Rooms and other information locations.

Table 11-1. Summary Comments and DOE Responses.

Table 11-1. Summary Comments and DOE Responses (continued).

Table 11-2. Index - Alphabetical List of Commentors by Name.

Table 11-2. Index - Alphabetical List of Commentors by Name (continued).

Table 11-2. Index - Alphabetical List of Commentors by Name (continued).

Commentor	Comment Summary Number(s)	Appendix D Comment Document Number
Hopkins, Steve – Snake River Alliance	II.A (5); II.D (1); II.E (2); III.D.1 (8); III.D.3 (1); III.D.3 (3); III.E (1); IX.C (2); IX.C (4); XI (7)	45
	I (1); II.A (3); III.D.1 (1); III.D.1 (8); III.D.3 (1); III.D.3 (3); III.E (1); VII.D (6); IX.A (1); IX.A (6); X (2); X (4); XI (3)	50
	III.D.1 (1); III.D.3 (1); III.D.3 (3); III.E (1); III.F.1 (2); V (9); VII.A (4); VII.A (6); VIII.C (5); IX.C (2)	67
Hormel, Jay – Snake River Alliance	II.A (5); III.D.2.c (1)	24
Jobe, Lowell – Coalition 21	III.F.2 (1); III.F.2 (2); VI (1); VII.A (1); X (2); XI (3)	2
	III.F.2 (1); III.F.2 (2); VII.A (1); VII.D (1); X (2); XI (3)	35
Joel, Jeffrey	II.A (3); III.C (6); X (2)	10
	II.A (3); II.E (7); III.C (6); X (2)	36
Kaiyou, Shirley – Shoshone-Bannock Tribes	IX.C (3); IX.C (6); IX.D (1); X (13)	42
Kenney, Richard – Coalition 21	III.C (2); III.D.3 (1); III.D.4 (3); III.D.4 (6); III.D.4 (6); III.D.4 (8); III.F.1 (3); III.F.2 (1); III.F.2 (2); III.F.2 (6); VII.D (2); VII.D (6); VIII.A (2); VIII.G (7); VIII.G (8); IX.A (4); IX.C (1); X (14); XI (1); XI (7)	83
Knight, Page	II.E (4); II.E (5); II.E (8); III.D.1 (4); III.E (1); VI (1); XI (7); IX.D (1)	38
Kruse, Stephen D.	II.B (1); VI (1); VIII.A (2); VIII.H (5); IX.A (2); IX.D (6); X (6)	84
Laybaum, Jim	II.E (8); III.C (4); III.D.2.b (6); III.D.2.c (1); III.D.3 (1); III.E (3); VIII.G (2); IX.C (2); IX.C (4); X (11); X (9); X (9)	36
Lindsay, Richard	III.B (1); VIII.G (8)	8
Linn, Benn	III.D.1 (5); VI (1); IX.C (4); IX.D (2)	36
Martin, Todd – Snake River Alliance	II.E (5); III.A (1); III.D.3 (1); III.E (1); VII.A (4)	45
	III.D.3 (1); III.E (1); VII.A (4); VII.D (6); X (13); X (6); X (9); XI (7)	50
Martiszus, Ed	III.A (1); VII.A (6); IX.C (8)	38
Maxwell, Tatiana	III.D.1 (4); III.D.2.b (5); III.D.2.c (1); IX.D (1); IX.D (2)	36
Mincher, Bruce	III.C (1); III.C (2); III.D.1 (3); III.D.4 (8); VII.D (2); VIII.I (1); IX.D (1); XI (7)	43
MsMere, Reverend	III.D.1 (6); VIII.B (2)	50
Newcomb, Anne	IV.C (1); VIII.A (10); VIII.C (4); IX.D (3); X (9); XI (7)	44
Niles, Ken – Oregon Office of Energy	II.E (1); II.E (4); II.E (5); II.E (6); II.E (8); VII.A (2); VIII.H (5); IX.C (5)	27
	II.E (1); II.E (4); II.E (5); II.E (8); IX.C (3)	38
Nissl, Jan	II.A (1); II.A (5); III.D.3 (1); VII.B (1)	19
Oldani, Cisco	XI (5)	12
Oliver, Thomas – Studsvik, Inc.	III.D.4 (4); XI (5)	57
	III.D.4 (4)	60
Ossi Jr., Anthony – U.S. Department of Transportation	IX.B (2)	29

Table 11-2. Index - Alphabetical List of Commentors by Name (continued).

Table 11-2. Index - Alphabetical List of Commentors by Name (continued).

Commentor	Comment Summary Number(s)	Appendix D Comment Document Number
Stoner, Tom	III.D.1 (7); III.E (1); III.F.2 (5); VII.B (3); VIII.A (4); IX.D (1)	16
	III.A (1); III.C (3); VI (1)	41
Stout, Kemble and Mildred	III.C (3)	47
Tanner, John	III.C (2); III.D.3 (1); III.F.2 (1); IX.C (2)	63
	III.D.1 (1); III.F.2 (1); X (7)	35
Taylor, Dean	III.F.2 (1); VIII.A (6); X (12); X (4)	76
Volpentest, Sam – Tri-Cities Industrial Development Council	II.E (2); II.E (3); II.E (4); II.E (5); II.E (6); VII.A (2); VIII.H (3); VIII.I (2)	34
Wakefield, Sophia	VII.D (1); VIII.B (2); IX.A (7); IX.D (5)	36
Ward, Kevin	III.A (1); III.D.2.c (1); IX.C (1); VIII.G (1)	75
Weaver, Roxanne	II.A (3); IX.C (2); XI (2)	36
Willison, Jim	VIII.A (11); VIII.A (6); VIII.G (3); VIII.G (5); IX.A (1); IX.A (2);	61
Wood, George – Coalition 21	VIII.A (1); VIII.A (7); VIII.B (4); VIII.C (1); VIII.G (8)	37
	Government Agencies/Tribes	
Nevada Department of Administration (Heather Elliott)	III.E (1); VIII.H (1)	40
Oregon Office of Energy (Mary Lou Blazek)	II.A (3); II.E (2); II.E (3); III.D.2.c (5); VII.A (2); VIII.C (2); VIII.C (3); VIII.C (9); VIII.D (1); IX.A (8); IX.C (3); IX.C (5)	51
Oregon Office of Energy (Ken Niles)	II.E (1); II.E (4); II.E (5); II.E (6); II.E (8); VII.A (2); VIII.H (5); IX.C (5)	27
	II.E (1); II.E (4); II.E (5); II.E (8); IX.C (3)	38
Shoshone-Bannock Tribes (Claudeo Broncho)	II.B (1); II.C (1); II.E (6); III.A (2); III.C (4); III.D.2.b (6); III.D.2.c (4); III.D.3 (1); III.E (1); III.F.2 (1); III.F.2 (2); III.F.3 (1); III.F.4 (2); IV.A (1); V (1); V (2); V (9); VII.A (2); VII.A (5); VII.D (4); VII.D (6); VII.E (1); VII.E (2); VII.E (3); VIII.C (6); VIII.C (7); VIII.H (2); IX.A (8); IX.C (4)	62
Shoshone-Bannock Tribes (Blaine Edmo)	VII.D (5); VII.E (1); VII.E (3); IX.A (2); IX.D (1)	42
Shoshone-Bannock Tribes (Shirley Kaiyou)	IX.C (3); IX.C (6); IX.D (1); X (13)	42
Teton County (WY) Commissioners Sandy Shuptrine	II.A (5); VII.A (7); VII.D (3); VIII.A (9); IX.C (4); X (1); X (3); X (9)	36
U.S. Department of Commerce (Charles Challistrom)	VIII.F (1)	32
U.S. Department of Health and Human Services (Kenneth W. Holt)	VIII.B (1); IX.B (2)	23
U.S. Department of Interior (Preston A. Sleeger)	None	48
	VIII.B (2)	82
U.S. Department of Transportation (Anthony Ossi Jr.)	IX.B (2)	29
U.S. Environmental Protection Agency – Region 10 (Christian F. Gebhardt)	IX.A (2); IX.B (2)	66

Table 11-2. Index - Alphabetical List of Commentors by Name (continued).

Commentor	Comment Summary Number(s)	Appendix D Comment Document Number
U.S. Environmental Protection Agency – Region 10 (Richard B. Parkin)	II.E (1); II.E (2); II.E (5); III.F.2 (1); III.F.4 (2); IV.C (1); IV.C (3); IV.D (1); V (12); V (8); VII.B (1); VIII.C (4); X (11); X (15); X (6)	56
U.S. House of Representatives (Mike Simpson) (Laurel Hall presenter)	IX.A (2)	5
	IX.A (2)	35
United States Senate (Larry Craig) (Georgia Dixon presenter)	IX.A (2)	6
	IX.A (2)	35
United States Senate (Michael Crapo) (Suzanne Hobbs presenter)	VII.D (6)	4
	VII.D (6)	35
	Organizations	
Coalition 21 (Lowell Jobe)	III.F.2 (1); III.F.2 (2); VI (1); VII.A (1); X (2); XI (3)	2
	III.F.2 (1); III.F.2 (2); VII.A (1); VII.D (1); X (2); XI (3)	35
Coalition 21 (Richard Kenney)	III.C (2); III.D.3 (1); III.D.4 (3); III.D.4 (6); III.D.4 (8); III.F.1 (3); III.F.2 (1); III.F.2 (2); III.F.2 (6); VII.D (2); VII.D (6); VIII.A (2); VIII.G (7); VIII.G (8); IX.A (4); IX.C (1); X (14); XI (1); XI (7)	83
Coalition 21 (George Wood)	VIII.A (1); VIII.A (7); VIII.B (4); VIII.C (1); VIII.G (8)	37
Cogema, Inc. (Rhonnie Smith)	III.D.4 (4)	58
Environmental Defense Institute (Chuck Broscious)	II.A (3); II.E (1); III.A (1); III.C (3); III.C (5); III.C (7); III.D.1 (1); III.D.2.b (5); III.D.2.c (1); III.D.2.c (2); III.D.3 (1); III.E (1); III.F.2 (2); III.F.2 (5); III.F.3 (1); IV.C (2); V (10); V (11); V (12); V (4); V (7); V (9); VII.A (8); VII.B (2); VII.C (1); VII.C (3); VII.C (4); VII.D (6); VIII.A (3); VIII.B (3); VIII.B (6); VIII.C (1); VIII.C (8); VIII.G (6); IX.D (1); IX.D (6); XI (5); XI (7); XI (9)	68
Foothills School of Arts and Sciences (Rebecca Ballenger)	III.D.2.c (1)	73
Foothills School of Arts and Sciences (Matt Dubman)	III.A (1); III.D.2.c (1)	72
Foothills School of Arts and Sciences (Foldyna, Erika and Lloyd, Kaitlin)	III.D.2.c (1); III.D.3 (1); IX.C (1)	69
Foothills School of Arts and Sciences (Goicoechea, Jake; Baehr, Jeffrey; and Madsen, Logan)	III.D.2.c (1)	78
Foothills School of Arts and Sciences (Goodenough, Ashten)	II.A (2); III.A (1)	74
Foothills School of Arts and Sciences (Porter, Chelsea and Spear, Edie)	III.D.1 (1)	77
Foothills School of Arts and Sciences (Schueren, Briana and Reardon, Katherine)	III.A (1); III.E (3); VIII.G (1); IX.C (1)	70
Foothills School of Arts and Sciences (Sipiora, Ashina and Asbury, Alexandra)	II.A (2); VII.A (6); IX.C (1)	71
Foothills School of Arts and Sciences (Kevin Ward)	III.A (1); III.D.2.c (1); VIII.G (1); IX.C (1)	75

Table 11-2. Index - Alphabetical List of Commentors by Name (continued).

Commentor	Comment Summary Number(s)	Appendix D Comment Document Number
Hanford Advisory Board (Merilyn Reeves)	II.E (2); II.E (3); II.E (5); II.E (6); II.E (9); VII.A (6)	39
	II.E (2); II.E (3); II.E (5); II.E (6); II.E (9); VII.A (6)	52
	II.A (1); II.E (3); II.E (6); III.A (1); III.B (2); III.C (4); III.D.1 (4); III.D.2.c (5); III.D.4 (5); III.F.2 (1); III.F.2 (2); III.F.2 (4); IV.C (1); IV (5); VI (1); VII.A (6); VII.C (2); VII.D (3); VII.D (6); VIII.A (2); IX.A (2); IX.A (3); IX.C (2); X (11); X (12); X (2); X (5); XI (3)	55
Keep Yellowstone Nuclear Free (Berte Herschfield)	III.A (1); III.C (4); III.D.1 (1); III.F.2 (5); V (9); VI (1); VII.A (6); VIII.G (7); IX.B (1); IX.C (2); IX.D (1)	36
Mere Peace Church (Reverend MsMere)	III.D.1 (6); VIII.B (2)	50
Snake River Alliance	III.D.1 (1); III.D.3 (1); III.D.3 (3); III.E (1); III.F.1 (2); V (9); VII.A (4); VII.A (6); VIII.C (5); IX.C (2)	65
Snake River Alliance (Pam Allister)	II.A (5); III.D.1 (4); III.D.1 (6); III.E (1); VI (1); VII.A (6); VII.B (3); IX.C (3); IX.C (4)	50
Snake River Alliance (Beatrice Brailsford)	II.A (1); II.A (3); III.D.1 (4); III.D.3 (1); V (9); VII.D (1); VIII.A (8); VIII.C (5); IX.A (4); IX.C (7); IX.D (1)	42
Snake River Alliance (Dave Hensel)	III.D.2.c (1); III.D.3 (1); III.E (3); IV.C (1); VII.B (1); VII.D (3); VIII.H (4)	36
Snake River Alliance (Steve Hopkins)	II.A (5); II.D (1); II.E (2); III.D.1 (8); III.D.3 (1); III.D.3 (3); III.E (1); XI (7); IX.C (2); IX.C (4)	45
	I (1); II.A (3); III.D.1 (1); III.D.1 (8); III.D.3 (1); III.D.3 (3); III.E (1); VII.D (6); IX.A (1); IX.A (6); X (2); X (4); XI (3)	50
	III.D.1 (1); III.D.3 (1); III.D.3 (3); III.E (1); III.F.1 (2); V (9); VII.A (4); VII.A (6); VIII.C (5); IX.C (2)	67
Snake River Alliance (Jay Hormel)	II.A (5); III.D.2.c (1)	24
Snake River Alliance (Todd Martin)	II.E (5); III.A (1); III.D.3 (1); III.E (1); VII.A (4)	45
	III.D.3 (1); III.E (1); VII.A (4); VII.D (6); X (13); X (6); X (9); XI (7)	50
Studsvik, Inc. (Thomas Oliver)	III.D.4 (4); XI (5)	57
	III.D.4 (4)	60
Tri-Cities Industrial Development Council (Harold Heacock)	II.E (2); II.E (3); II.E (4); II.E (5); II.E (6); VII.A (2); VIII.H (3); VIII.I (2)	31
	II.E (2); II.E (3); II.E (4); II.E (5); II.E (6); VII.A (2); VIII.H (3); VIII.I (2)	53
Tri-Cities Industrial Development Council (Sam Volpentest)	II.E (2); II.E (3); II.E (4); II.E (5); II.E (6); VII.A (2); VIII.H (3); VIII.I (2)	34

Table 11-2. Index - Alphabetical List of Commentors by Name (continued).

Commentor	Comment Summary Number(s)	Appendix D Comment Document Number
	Public Hearings	
Boise Public Hearing, Pamela Allister	II.A (5); III.D.1 (4); III.D.1 (6); III.E (1); VI (1); VII.A (6); VII.B (3); IX.C (3); IX.C (4)	50
Boise Public Hearing, Steve Hopkins	I (1); II.A (3); III.D.1 (1); III.D.1 (8); III.D.3 (1); III.D.3 (3); III.E (1); VII.D (6); IX.A (1); IX.A (6); X (2); X (4); XI (3)	50
Boise Public Hearing, Todd Martin	III.D.3 (1); III.E (1); VII.A (4); VII.D (6); X (13); X (6); X (9); XI (7)	50
Boise Public Hearing, Reverend MsMere	III.D.1 (6); VIII.B (2)	50
Fort Hall Public Hearing, Beatrice Brailsford	II.A (1); II.A (3); III.D.1 (4); III.D.3 (1); V (9); VII.D (1); VIII.A (8); VIII.C (5); IX.A (4); IX.C (7); IX.D (1)	42
Fort Hall Public Hearing, Dennis Donnelly	III.B (3); IV.A (1); VIII.C (1); IX.C (2); IX.D (1); X (10)	42
Fort Hall Public Hearing, Blaine Edmo	VII.D (5); VII.E (1); IX.D (1)	42
	IX.A (2)	42
Fort Hall Public Hearing, Shirley Kaiyou	IX.C (3); IX.C (6); IX.D (1); X (13)	42
Idaho Falls Public Hearing, U.S. Senator Larry Craig (Comments read by Georgia Dixon)	IX.A (2)	35
Idaho Falls Public Hearing, U.S. Senator Michael Crapo (Comments read by Suzanne Hobbs)	VII.D (6)	35
Idaho Falls Public Hearing, Lowell Jobe	III.F.2 (1); III.F.2 (2); VII.A (1); VII.D (1); X (2); XI (3)	35
Idaho Falls Public Hearing, Darryl Siemer	I (2); III.D.1 (4); III.D.2.c (4); III.E (2); III.F.2 (1)	35
Idaho Falls Public Hearing, U.S. Representative Mike Simpson (Comments read by Laurel Hall)	IX.A (2)	35
Idaho Falls Public Hearing, John Tanner	III.D.1 (1); III.F.2 (1); X (7)	35
Jackson Public Hearing, Dan Bennett	XI (10)	36
Jackson Public Hearing, Ken Cady	II.A (3); VIII.B (2); VIII.B (5)	36
Jackson Public Hearing, Whit Clayton	IX.D (7); XI (1); XI (6)	36
Jackson Public Hearing, Avril Currier	II.A (2); III.D.1 (1); VII.D (1)	36
Jackson Public Hearing, Dan Fulton	IX.D (1); XI (6)	36
Jackson Public Hearing, Christy Gillespie	X (12); XI (5)	36
Jackson Public Hearing, David Henneberry	II.A (2); VIII.G (2); XI (5)	36
Jackson Public Hearing, Dave Hensel	III.D.2.c (1); III.D.3 (1); III.E (3); IV.C (1); VII.B (1); VII.D (3); VIII.H (4)	36
Jackson Public Hearing, Berte Herschfield	III.A (1); III.C (4); III.D.1 (1); III.F.2 (5); V (9); VI (1); VI (1); VII.A (6); VIII.G (7); IX.B (1); IX.C (2); IX.D (1)	36
Jackson Public Hearing, Jeffrey Joel	II.A (3); II.E (7); III.C (6); X (2)	36

Table 11-2. Index - Alphabetical List of Commentors by Name (continued).

ACRONYMS

CEQ	Council on Environmental Quality
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
DOE	U.S. Department of Energy
DOE-EM	U.S. Department of Energy - Environmental Management
DOE-ID	U.S. Department of Energy - Idaho Operations Office
EBR-II	Experimental Breeder Reactor II
EIS	environmental impact statement
EPA	U.S. Environmental Protection Agency
FR	Federal Register
FUETAP	formed under elevated temperature and pressure
HEPA	high efficiency particulate air
HIP	Hot Isostatic Pressed
HLW	high-level waste
ICPP	Idaho Chemical Processing Plant (now INTEC)
INEEL	Idaho National Engineering and Environmental Laboratory
INTEC	Idaho Nuclear Technology and Engineering Center (formerly ICPP)
MACT	Maximum Achievable Control Technology
MTHM	metric tons of heavy metal
NEPA	National Environmental Policy Act
NESHAP	National Emission Standards for Hazardous Air Pollutants
NRC	U.S. Nuclear Regulatory Commission
PUREX	plutonium uranium extraction
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*
TRUEX	transuranic extraction
WIPP	Waste Isolation Pilot Plant

11.3 Summary Comments and DOE Responses

I PURPOSE AND NEED

I (1)

Comment - A commentor supports the need for the waste addressed in the Draft EIS to be treated, stabilized, and isolated from the environment.

Response - Comment is noted.

I (2)

Comment - A commentor states that the nuclear fuel cycle should be closed.

Response - This EIS evaluates alternative ways to prepare mixed HLW for disposal and, thus, to close out the nuclear fuel cycle with respect to mixed HLW at the Idaho Nuclear Technology and Engineering Center (INTEC).

I (3)

Comment - A commentor asserts that INEEL's mission is to make waste forms, not dispose of them.

Response - A primary focus of the INEEL's mission is to manage, treat, and dispose of its inventory of new and legacy wastes. Producing acceptable waste forms that can be properly disposed of is important in protecting human health and the environment.

II ALTERNATIVES

II.A General: Alternatives

II.A (1)

Comment - Commentors express concern about mixing liquid sodium-bearing waste (SBW) and calcined waste at any stage during the waste management process. One commentor states that the calcine and liquid wastes should be treated independently due to their different properties, as recommended by the National Academy of Sciences. Another commentor suggests storing solidified SBW on-site in casks, but does not advocate limiting disposal options by mixing SBW and HLW in the casks.

Response - DOE agrees with these commentors' concern that calcine and liquid wastes be treated separately. Reasons for separate treatment include DOE's position that the SBW may be managed as mixed transuranic waste and, therefore, should not be combined and treated with the mixed HLW calcine. In other words, if a waste incidental to reprocessing determination concludes the SBW is transuranic waste, then it can be treated and disposed of at the Waste Isolation Pilot Plant and not stored at the INEEL until a national HLW geologic repository becomes available. Another reason for treating mixed transuranic waste/SBW liquid waste separately from calcine is the need to cease use of the underground 300,000-gallon tanks by December 31, 2012. By treating this liquid waste first, DOE would be in a better position to meet this milestone.

Analyses in this EIS provide for treating calcine and liquid wastes separately, which is consistent with the National Academy of Sciences' recommendations.

II.A (2)

Comment - A commentor asks various questions relating to the location of waste management facilities: Why ship it all the way over here (taken by DOE to mean the INEEL and surrounding region), do one thing, then ship it somewhere else? Why build a plant here? Why in our area? Why not where the problem is located?

Another commentor is opposed to treating waste at sites located in the West. Commentors suggest that DOE treat and/or dispose of HLW in other locations such as the Great Salt Lake Desert, the Sahara Desert, Mexico, or outer space.

Response - An EIS must evaluate a range of reasonable alternatives, which, in this case, includes treating and disposing of wastes onsite at INEEL and at other locations. In general, it is DOE's policy to treat waste at the DOE site where it was generated (FR Vol. 65, No. 38, 2000; FR Vol. 65, No. 251, 2000). Treating INEEL mixed HLW and mixed transuranic waste/SBW waste at sites other than the West, where it is currently stored, presents no clear advantage over the reasonable alternatives analyzed in this EIS. See the discussion in Appendix B and Section 3.3 of this EIS regarding Alternatives Eliminated from Detailed Analysis.

Regarding the suggestion that DOE consider disposing of HLW in other locations, the Yucca Mountain site in Nevada is the only candidate site for geologic disposal of HLW that Congress (in the Nuclear Waste Policy Act, as amended) directed the Secretary of Energy to consider with respect to its suitability as the potential geologic repository.

References:

Federal Register Vol. 65, No. 38, Page 10061, "Record of Decision for the DOE Waste Management Program: Treatment and Disposal of Low-Level Waste and Mixed Low-Level Waste; Amendment of the Record of Decision for the Nevada Test Site," February 25, 2000.

Federal Register Vol. 65, No. 251, Page 82985, "Revision to the Record of Decision for the Department of Energy's Waste Management Program: Treatment and Storage of Transuranic Waste," December 29, 2000.

II.A (3)

Comment - Commentors express opinions on "hybrid" or mixed alternatives, including the following:

- Why can't DOE use a mixture of alternatives such as No Action for calcine treatment?
- Hybrids were not integrated into the analysis in the Draft EIS, and the public had no opportunity to review and consider them.
- It may be possible to combine processes or otherwise try to develop alternatives that would have insignificant environmental impacts.
- The range of alternatives analyzed in the EIS, along with the possible combination of projects, appear complicated and, at the same time, represent only a limited range of real options, and that there might be simpler waste treatment alternatives.

Response - DOE developed the hybrid, or modular approach to its analyses of alternatives in order to provide flexibility in the selection of various combinations of options that could complete mixed transuranic waste/SBW and mixed HLW management activities at INTEC.

Section 3.1 of this EIS and the text boxes in Section 3.2 of the Summary describe how the alternative options may be combined. In addition, Table S-1 in the Summary identifies the modular units, which can be used to construct hybrid alternatives. These modular units are grouped by phases in the waste management process: pretreatment storage, calcination, treatment, interim storage, and disposal. Constructing a hybrid alternative involves deciding whether to calcine the waste and then selecting a treatment and disposal option. Whether an interim storage facility would be needed depends on whether a disposal destination is available. As stated in this EIS, the Waste Isolation Pilot Plant will be available for transuranic waste and near-surface landfills will be available for low-level waste. However, the availability of a final disposal facility for INEEL's HLW remains uncertain. The environmental impacts identified for each of these waste management modular units stand alone, and combining them does not create additional environmental impacts that were not evaluated separately in this EIS. That is, the EIS was structured to ensure consideration of the potential environmental impacts of each module individually and collectively, in any reasonable combination.

II.A (4)

Comment - A commentor asserts that the Draft EIS presents a complicated set of options, but there is no currently available option to correct past or future damage from the waste.

Response - The EIS summarizes ongoing cleanup activities that are being conducted under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) to remediate contamination from past operations at INTEC. These activities are factored into the cumulative impact analyses for each facility disposition alternative evaluated in Chapter 5 of this EIS. See also responses to comment summaries in VII.B concerning CERCLA activities.

As for future damage from the waste, this EIS specifically assesses potential environmental impacts for each waste processing and facility disposition alternative, including No Action and, where appropriate, discusses possible mitigation DOE could implement to correct, eliminate, or reduce identified environmental impacts.

II.A (5)

Comment - Commentors support selection of the alternative that provides the maximum amount of protection to the environment. Some commentors add that the selected alternative should be the one that also best protects human health and safety, and has protection of the environment as its primary focus.

Response - DOE is obligated to manage waste in a manner that protects human health and the environment including complying with all applicable Federal, state, and local regulations, as well as DOE orders.

With the exception of the No Action and Continued Current Operations alternatives, all other alternatives evaluated in this EIS would provide long-term protection of the environment. Chapter 5 of this EIS, Table 3-4, and Table S-2 in the Summary, summarize the environmental impacts of all the alternatives considered, including safety and human health considerations. DOE will consider these environmental impacts prior to making a decision.

II.B No Action Alternative

II.B (1)

Comment - Commentors object to the No Action Alternative for one or more of the following reasons:

- It is one of several alternatives that pose adverse risks to tribal populations and natural resources.
- Indefinite storage of liquid waste poses a threat to the Snake River Plain Aquifer and is subject to natural phenomena.
- No treatment would occur to enable HLW shipment out of Idaho, which must occur.

Another commentor supports the No Action Alternative and expresses the opinion that liquid and calcined wastes should remain in storage as they are now, as long as they can be safely contained.

Response - CEQ regulations require that an EIS analyze the range of reasonable alternatives, as well as a No Action Alternative. Accordingly, DOE analyzed the No Action Alternative, which serves as a baseline against which to compare the environmental impacts of the action alternatives.

In general, the No Action Alternative poses the greatest anticipated, long-term risk to human health and the environment because significant amounts of mixed transuranic waste/SBW would be left in 300,000-gallon underground tanks at INTEC, as would the calcine in the bin sets. Although DOE is confident that these liquid and calcined wastes currently stored at INTEC can be safely managed pending treatment and disposal, the No Action Alternative would present potential adverse environmental impacts over time and it would not satisfy the requirements of the Settlement Agreement/Consent Order. There is the possibility that over an extended period of time, especially after the loss of institutional control (assumed to occur in 2095 for purposes of analysis in this EIS), structural degradation of storage facilities could occur with eventual releases to the environment. Analyses in

Chapter 5 of this EIS show that under the No Action Alternative, groundwater concentrations could exceed U.S. Environmental Protection Agency (EPA) drinking water standards.

II.C Continued Current Operations Alternative

II.C (1)

Comment - A commentor objects to the Continued Current Operations Alternative for one or more of the following reasons:

- It relies on continued calcining, which is burdened with permitting and emission compliance uncertainties.
- It would not prepare INEEL HLW for shipment out of Idaho by 2035.

Response - In general, the Continued Current Operations Alternative poses greater anticipated risk to human health and the environment than other action alternatives because significant amounts of calcined mixed HLW would be left at INTEC indefinitely. Although DOE is confident that these wastes currently stored at INTEC can be safely managed in the interim before treatment and disposal, the Continued Current Operations Alternative would have potential long-term, adverse environmental impacts and would not satisfy the Settlement Agreement/Consent Order. See responses to comment summaries in III.C regarding continued calciner operations and in VII.D regarding compliance with the Settlement Agreement/Consent Order milestones.

II.D Planning Basis Option

II.D (1)

Comment - A commentor objects to selection of the Planning Basis Option because it is unrealistic and would not likely meet the Settlement Agreement/Consent Order anyway, although it was developed to comply with it. The commentor also says that the State of Idaho should work with DOE to determine the best method to treat the waste and isolate it from the environment rather than push for the Planning Basis Option.

Response - The Planning Basis Option represents the actions and milestones DOE agreed to take to cease use of the eleven 300,000-gallon tanks in the Tank Farm by December 2012 and, by a target date of December 31, 2035, prepare the mixed HLW for transport out of Idaho for disposal. Although DOE agrees that it would be difficult to make the 2012 date because of the time needed to permit and upgrade the calciner, DOE believes that, under an accelerated schedule, this commitment could be met. Therefore, the Planning Basis Option remains a reasonable alternative.

As a cooperating agency in the preparation of this EIS, the State of Idaho did not push for the Planning Basis Option, but worked closely with DOE to identify the best method for management of the INEEL's mixed HLW which includes mixed transuranic waste/SBW.

II.E Minimum INEEL Processing Alternative

II.E (1)

Comment - Commentors express concern about relying on Hanford to solve the INEEL's HLW problems:

- DOE has not made a convincing argument for this alternative, particularly since Hanford has been unable to deal effectively with its own wastes and does not have storage facilities for INEEL waste at present. Building such facilities and transporting calcine from safe storage facilities in Idaho is irresponsible.
- An agency (the EPA) cannot support the Hanford alternative because DOE will not commit to treating the existing HLW at Hanford.

Response - DOE is committed to treating Hanford's HLW at Hanford as indicated by the Record of Decision for the *Tank Waste Remediation System, Hanford Site, Richland, Washington, Final Environmental Impact*

Statement; the hiring of a contractor to construct tank waste treatment facilities at Hanford; and the fact that DOE is in the process of acquiring facilities to treat and immobilize HLW at the Hanford Site.

In preparing this EIS, DOE reviewed the activities at Hanford and determined that it would be a reasonable alternative to send INEEL mixed HLW calcine or the HLW fraction from separations to Hanford for treatment and immobilization, then return the immobilized waste to the INEEL for storage or send the treated waste directly to the geologic repository, if available. This alternative would substantially reduce the amount of onsite construction and operations to support the treatment of mixed HLW at the INEEL and would require one location for treatment of HLW rather than two. Although treatment facilities for mixed transuranic waste/SBW would be required at INEEL, this alternative could potentially reduce the overall demand on DOE resources (e.g., funding and labor). DOE continues to consider this alternative to be reasonable, even though updated information received from the Hanford Site indicates that there would be an increase in the previously assumed volume of final waste form and an associated longer treatment period for INEEL mixed HLW calcine.

II.E (2)

Comment - Commentors express concern about uncertainties associated with the Minimum INEEL Processing Alternative:

- Consideration of this alternative is premature as the Hanford Site has no vitrification facility (which must be fully funded and operational and be proven to be compatible with INEEL HLW) and construction of one is uncertain.
- Included in the uncertainties is the fact that waste pre-treatment (such as the need for separations) may also be necessary and the existence of a licensed HLW repository to receive the end product is uncertain.
- A commentor recommended that this alternative be removed from consideration in the EIS due to such uncertainties and another noted there are too many uncertainties.

Commentors state that the Minimum INEEL Processing Alternative is unrealistic because treatment of INEEL waste at Hanford would require construction of separations facilities not planned for the Hanford Site and there are differing HLW characteristics between Hanford and INEEL waste.

Response - The Hanford Site is planning to include a separations unit (a pretreatment facility to separate HLW into waste fractions) with its vitrification facility, but it would have to be modified to treat INEEL waste. Other modifications would be required to this facility; specifically, the calcined mixed HLW from the INEEL could require dissolution, a process capability that would have to be added to the Hanford facilities. Further, since the Hanford treatment process would be designed for caustic (basic) HLW, it would be necessary to include a unit for altering the pH of the highly acidic dissolved calcine from INEEL, so that compatibility can be assured.

DOE believes it would be feasible to adapt the planned Hanford facilities to treat INEEL mixed HLW during the design stages of the Hanford facilities. INEEL engineers and scientists would work with their Hanford counterparts during these stages to ensure such capatability. For this reason, DOE continues to consider this course of action a reasonable alternative.

If DOE could also determine that conducting the separations process at the INEEL is technically and economically advantageous and proceed to separate calcine into a mixed HLW fraction and a mixed transuranic- or mixed low-level-waste fraction at the INEEL. Under these circumstances, DOE could send the mixed HLW fraction to the Hanford facilities for vitrification. This is described in the Full Separations Option in Section 3.1.3.1. Any necessary modifications to the Hanford facilities would have to be determined when the composition and characteristics of the mixed HLW fraction from INEEL were known.

II.E (3)

Comment - Commentors state that treating Idaho's calcine at Hanford makes no financial sense. In addition, funding should cover all additional cost burdens by state and local governments. Funding for the shipment of wastes from sites such as the INEEL to Hanford for treatment must cover all associated costs because the Hanford budget is already inadequate to meet site cleanup needs and Tri-Party Agreement commitments.

Response - Other than evaluating the costs of the various alternatives in a separate document, the Cost Report (*Cost Analysis of Alternatives for the Idaho High-Level Waste and Facilities Disposition EIS* [DOE/ID 10702, January 2000]), DOE did not attempt to address, in this EIS, the funding sources and allocation of cost burdens between the INEEL and Hanford sites. DOE does recognize that there may be additional cost burdens to affected state and local agencies and tribal governments, such as the need for additional emergency response training and consultations, and toward these ends may provide assistance in expertise, equipment, and/or funding. DOE believes, however, that if the Minimum INEEL Processing Alternative would substantially reduce the combined life-cycle costs at INEEL and Hanford, then issues regarding funding and allocation of cost burdens among DOE sites could be correspondingly reduced.

II.E (4)

Comment - Commentors maintain that there are advantages to treatment of INEEL HLW at the Hanford Site:

- Blending feedstreams would reduce the total volume of waste and would be more cost-effective than other alternatives.
- Some constituents of INEEL HLW would increase the chemical durability of Hanford glass.
- The large volume of Hanford waste would dilute the low solubility in glass components in the INEEL calcine.
- Environmental impacts of the Hanford Alternative appear to be equivalent or less than the other alternatives presented in the Draft EIS.
- There are benefits to not building additional facilities in Idaho under this alternative.

Some commentors add that DOE should seriously consider the Minimum INEEL Processing Alternative because:

- It would result in cooperation instead of competition between sites for limited funds.
- Hanford is a logical choice because it is the most contaminated Western site.

Response - As indicated by the commentors, there are some advantages to this alternative, which is why DOE considers it reasonable and thus included it in this EIS. However, as discussed in the response to comment summaries II.E (2) and II.E (3), there are also some disadvantages associated with this alternative that must be taken into consideration. With regard to advantages, cost and programmatic benefits in using planned facilities at the Hanford Site make the alternative reasonable for consideration. Programmatic benefits include minimizing the need to construct, permit, and operate similar processing capability at the INEEL and the associated economies of scale and reduced support infrastructure in conducting larger processing campaigns.

However, since this alternative was discussed in the Draft EIS, both Hanford and INEEL engineers have reanalyzed waste volumes and have determined that the treated calcine would result in larger volumes of treated waste (Section 5.2.13). This would increase the costs and risks associated with production, transportation, storage, and disposal. Thus, although there are obvious advantages to consider for this alternative, the latest information available indicates there are also some offsetting disadvantages that DOE must consider in making a decision.

II.E (5)

Comment - Commentors state that the HLW in the tanks at Hanford poses serious problems, which include threats to the Columbia River. Commentors express the opinion that, as a result, Hanford's HLW should be treated before INEEL's waste is shipped to Hanford for treatment and that it may take until 2047 to treat all of Hanford's tank waste.

Response - Council on Environmental Quality Regulations for Implementing the Procedural Provisions of the National Environmental Policy Act require an assessment of the range of reasonable alternatives. Therefore, DOE evaluated the Minimum INEEL Processing Alternative to ensure that the range of reasonable alternatives is considered. Current plans at Hanford call for starting treatment of HLW by December 2007. During this time DOE would be conducting further technology development. After the Hanford HLW processing facility gained initial operating experience DOE could decide to send the INEEL calcine, or a HLW fraction, if the calcine has been separated, to Hanford for treatment. Before making such a decision, DOE would determine whether additional National Environmental Policy Act documentation is needed. As part of this process, DOE would consider Hanford treatment priorities as well as potential environmental impacts to human health and the environment, including the Columbia River. See response to comment summary VIII.C (2) for further discussion on environmental impacts at Hanford.

II.E (6)

Comment - Commentors state that any wastes processed or vitrified at Hanford must be returned to Idaho or to a national repository, and not be stored or disposed of at Hanford. The commentors cite a lack of appropriate facilities and additional burdens on the Hanford Site as reasons.

Commentors also state that:

- If INEEL waste is treated at other DOE sites, such as Hanford, and cannot be returned to the generator, then the waste must be sent to a repository.
- The timing and scheduling of the waste shipments are also concerns.
- DOE should not ship INEEL HLW to Hanford for treatment prior to actual treatment to minimize the need for storage at Hanford. One commentor expresses the opinion that the treated INEEL HLW should be stored at Hanford rather than sent back to INEEL.

Response - Section 3.1.5 of this EIS states that under the Minimum INEEL Processing Alternative, mixed HLW sent to Hanford for treatment would be returned to INEEL or shipped directly to a geologic repository if one is available. If returned to INEEL, HLW would be stored onsite until an interim storage site or geologic repository outside Idaho becomes available to accept this waste. If separations technologies were employed at Hanford and a mixed low-level waste fraction created, then this would be disposed of at a suitable DOE or commercial facility in accordance with the Record of Decision on the Waste Management Programmatic EIS. See also responses to comment summaries in III.F.4.

Just-in-time shipping of mixed HLW from INEEL to Hanford in order to minimize pretreatment storage is an approach that would be considered if the Minimum INEEL Processing Alternative were selected for implementation. Considerations regarding the timing of shipments would include storage capacity, treatment facility burden and production schedule forecasts, budget allocations, legal and/or regulatory requirements, and obligations/agreements such as the Hanford Tri-Party Agreement and Idaho Settlement Agreement/Consent Order (which requires DOE to treat all mixed HLW currently stored at INEEL so that it is ready by a target date of December 2035 to be moved out of Idaho for disposal). See also response to comment summary II.E (5) regarding treatment priorities.

II.E (7)

Comment - A commentor expresses concern that the amount of handling involved with the Minimum INEEL Processing Alternative increases the chances of an accident.

Response - The Minimum INEEL Processing Alternative does involve additional handling steps over some other alternatives, with an associated increase in the risk of an accident as discussed in Appendix C.8 of this EIS.

II.E (8)

Comment - Commentors cite concerns over increased transportation of radioactive waste associated with this alternative:

- The alternative involves too much inter-site transportation

- Transportation safety protocols would need to be enhanced such as those developed by the Western states for transportation of transuranic waste.

Response - Risks associated with the transportation of mixed HLW calcine to Hanford and the return of treated waste to INEEL are documented in Section 5.2.9 of this EIS. In the unlikely event of a severe transportation accident, the consequences would be higher for a calcine shipment in comparison with a shipment of vitrified HLW. However, because of the increased number of waste shipments necessary to implement this alternative, there is an increased probability of accidents. For non-accident shipment scenarios, the EIS analysis shows that environmental impacts to the maximally exposed individual would be small. If DOE were to decide to ship mixed HLW to Hanford, the agency would work with regulators, local responders, affected states, and tribes as necessary to establish transportation and emergency response protocols designed to ensure public safety and environmental protection as was done for the transuranic waste shipment program. Transportation burdens would be factored into decisions as to shipment of end-product waste either to the INEEL for interim storage or directly to a licensed HLW repository based on factors such as cost and minimization of risk. See response to comment summaries in VII.A.

II.E (9)

Comment - A commentor states that the EIS should address the impacts of this alternative on Hanford-specific cleanup programs.

Response - DOE believes that this alternative could be implemented without disruption to Hanford-specific cleanup programs. Nevertheless, before deciding whether to ship Idaho mixed HLW to Hanford, DOE would review the need for any appropriate further National Environmental Policy Act documentation at the Hanford Site to address site specific impacts.

III WASTE MANAGEMENT ELEMENTS

III.A Storage: Liquid Sodium-bearing Waste

III.A (1)

Comment - Commentors express concerns and opinions about the potential impacts of continued storage of SBW in the INTEC tank farm including:

- The possibility or existence of tank leakage or failures and the resulting impacts on the human health environment, from the Snake River Plain Aquifer, to the Snake and Columbia rivers, and eventually all of Idaho.

- Nuclear waste is already being transported to Hanford via contamination of the river system.

- Liquid wastes have been in storage for more than 50 years, 20 years beyond the tank design life.

- Despite DOE claims that the tanks have not leaked, they could in the 15 to 20 years it would take to implement a treatment alternative.

- The tanks and their concrete vaults do not meet seismic standards and could fail under a relatively minor seismic-induced stress.

- Leaks in the tanks or pipes should be repaired or new tanks should be built.

- Recommend quickly selecting and implementing an option to solidify liquid SBW due to the increased risks it poses in liquid form.

A commentor recommends that DOE postpone any further treatment of SBW beyond solidification until the ultimate disposal location has been identified.

Response - DOE recognizes there are risks associated with liquid waste storage, and, over the years, converted thousands of gallons of mixed HLW (completed February 1998) and some mixed transuranic waste/SBW from the INTEC tank farm into a more stable solid granular form called "calcine." This calcine is stored in bin sets estimated to provide safe containment for 500 years, pending final treatment and disposal decisions. Calcine processing at INTEC was suspended on May 31, 2000, in accordance with the Notice of Noncompliance Consent Order, leaving approximately one million gallons of mixed transuranic waste/SBW in the tanks. In the Record of Decision for this EIS, DOE will decide how to treat the liquids to expeditiously complete their removal from the 300,000-gallon tanks in the Tank Farm.

No liquid waste is known to have leaked from the 300,000-gallon underground storage tanks at the INTEC facility. However, despite the integrity of the tanks themselves, piping systems that connect the tanks and associated facility equipment, such as valves, have leaked. These problems have been corrected as they have been identified and the inter-tank transfer piping is now monitored by leak detection equipment. Presently, no lines are leaking. Primary contaminants of concern from past pipe system leakage include iodine-129, strontium-90, and tritium. Decisions related to remediation of Tank Farm soils will involve the EPA and the State of Idaho under the CERCLA process and will be part of the Record of Decision for the Operable Unit 3-14 portion of Waste Area Group 3 at INTEC. See also responses to comment summaries in VII.C.

Recognizing the risks that tank leakage could present to the environment, DOE maintains a leak detection system at the INTEC tank farm, and the ability to transfer waste from any leaking tank to unused, reserve tanks. Although such a transfer has never been necessary, DOE maintains this mitigative capability. DOE also maintains a Tank Integrity Program that requires periodic corrosion testing and inspection of the tanks. Based on the corrosion and inspection data to date, the eleven 300,000-gallon storage tanks in the Tank Farm containing the remaining mixed transuranic waste/SBW have sufficient useable remaining service life to allow DOE to safely implement any of the waste processing alternatives.

To date, no observable or measurable environmental impacts to the Snake River or Columbia River have resulted from INEEL activities. Since unevaporated surface water eventually migrates to the aquifer, the quality of water resources is verified by groundwater monitoring programs conducted by independent agencies such as U.S. Geological Survey and the State of Idaho INEEL Oversight Program. With improved management practices and remediation efforts planned or underway at INEEL, water quality in the Snake River Plain Aquifer is expected to improve. Therefore, no adverse environmental impacts to the Snake or Columbia Rivers resulting from past, present, or future INEEL operations are likely to occur.

Regarding structural integrity, it is true that the five pillar and panel tanks are located within concrete vaults that do not meet current seismic and structural standards, and that failure of these vaults could occur during a seismic event. DOE is evaporating the liquid in the remaining five tanks to reduce the volume and will transfer the liquid out of the pillar and panel tanks to one or more of the five remaining tanks (eleventh tank is a spare) to meet the June 2003 deadline established in the Notice of Noncompliance Consent Order signed by DOE, EPA, and the State of Idaho. See Section 5.2.14 of the EIS and Section 6.2.5 of the EIS Summary for potential environmental impacts of tank failure during a seismic event.

In 2005 or earlier, DOE intends to redirect all newly generated liquid waste to tanks that meet state and federal Resource Conservation and Recovery Act (RCRA) regulations, and no new liquid waste would be added to the tanks in the Tank Farm. DOE is also committed to cease use of the remaining RCRA non-compliant underground tanks by December 31, 2012 by either treating the liquid waste separately to render it to a solid form or transferring the waste to RCRA-compliant tanks.

III.A (2)

Comment - A commentor cites the Draft EIS Summary, Section 7.4, discussion of cumulative impacts to water, and asks if the term "design life" in reference to the underground HLW storage tanks is 500 years or estimated to be well in excess of 500 years.

Response - The storage tanks did not have an initial engineering requirement for a 500-year design life. However, recent in-tank inspections and measurement of corrosion test plates retrieved from the tanks show very little corrosion. The low corrosion rate is partially due to the acidic nature of the waste in the tanks and their stainless steel construction. The INEEL has a continuing tank inspection program. Data are obtained from the inspections and evaluations are performed to determine if the tanks' design service life estimates need to be revised. Based on these evaluations, DOE estimates the tanks to have "service lives" well in excess of 500 years.

III.B Storage: Calcine in Bin Sets

III.B (1)

Comment - A commentor believes the Draft EIS lacks vital information DOE needs to make informed decisions, specifically the decay of calcine radiation levels over time compared with the naturally occurring radioactive isotopes in Idaho soil.

Response - The information referred to by the commentor is included in this EIS. The effects of radiological decay on the calcine and mixed transuranic waste/SBW are provided in Appendix C.7 of this EIS. In addition, Appendix C.9 of this EIS models the environmental impacts from the few long-lived, persistent radionuclides that would pose a risk to public health and the environment should this waste be disposed of at the INEEL. Table 5.2-12 of this EIS provides natural background information for levels of radionuclides in soils and a comparison by alternative of expected maximum concentrations resulting from the implementation of each alternative.

III.B (2)

Comment - A commentor states that DOE should not treat calcine at this time because the risks to the environment from storing calcined waste do not justify the cost of treating it.

Response - The EIS estimates the long-term risks of not treating mixed HLW calcine and concludes that leaving calcine in the bin sets indefinitely (beyond the design life, estimated to be 500 years) could eventually lead to the degradation and release of bin set contents. Depending upon meteorological conditions and other influencing factors at that time, harmful effects to human health and the environment could occur, though there is considerable uncertainty involved with estimating the potential risks over long periods of time. In the near term, the costs of treating the calcine under either separations or non-separations alternatives are similar. Also, there is a disadvantage from a human health and environmental risk perspective of leaving this mixed HLW calcine in the bin sets over the long-term.

III.B (3)

Comment - A commentor states that the assumption that it is technically possible to retrieve calcine from the bin sets is questionable, and options based on this assumption may not be viable.

Response - DOE retrieved actual mixed HLW calcine from a bin set in 1978. The results indicate that calcine appears to be free flowing material which will make it easier to remove than if it were compacted or agglomerated. Although preparations for removal would necessitate considerable effort to ensure the health and safety of workers, current evaluations on calcine retrieval with a half-size bin and a third-size bin show that, even if the calcine is compacted, it could be retrieved. As described in the discussion of the projects identified for the alternatives in this EIS, methods would be developed and the necessary equipment would be constructed and installed to retrieve calcine. Any calcine residue that remains would be managed in accordance with facilities disposition decisions.

III.C Calcination

III.C (1)

Comment - A commentor states that liquid wastes should be calcined immediately, rendered ready for disposal by a FUETAP-like process (formed under elevated temperature and pressure), and shipped for disposal. Another commentor supports alternatives that utilize the calciner to finish processing liquid wastes into a more stable low-dispersible form, referring to learning from a "costly" decision at Hanford to discontinue PUREX (plutonium uranium extraction) operations before it processed all spent nuclear fuel. Commentors also state that calcination has the following advantages:

- It is a proven technology.
- It would convert the liquid to a good-quality waste form.
- It can be done on time (by 2012).
- Costs would be reasonable.

Response - DOE recognizes there are advantages to using the calciner and considered these when evaluating mixed transuranic waste/SBW treatment options. Although the EIS assumes that treatment of the liquid mixed transuranic waste/SBW under the EIS alternatives generally would not be completed until 2014-2016, it may be possible either to complete treatment or transfer any remaining liquid to RCRA-compliant tanks by December 2012 in order to meet the Notice of Noncompliance Consent Order requirement to cease-use of the mixed HLW tanks by that date.

Concerns associated with restarting the calciner include uncertainties associated with obtaining permit approvals for this aging facility and the potential for costly upgrades necessary to meet the EPA requirements for Maximum Achievable Control Technology. It is also estimated that calcining the remaining mixed transuranic waste/SBW may necessitate the use of bin set 7. Because bin set 7 has never been used, this action would incur the costs of decontamination, which can be considerable, and additional worker exposure. Finally, if the permits were delayed or calciner upgrades and restart took longer than anticipated, DOE would need to employ RCRA-compliant tanks to meet the Notice of Noncompliance Consent Order milestone to cease-use of the tanks by December 2012 (discussed above). If tank upgrades or construction were required, this would reduce the advantages of calcination.

A variation of the FUETAP process, which the commentor suggests as a viable technology for putting calcine into a "road ready" form, was analyzed in this EIS under the Non-Separations Alternative as the Hot Isostatic Pressed Waste Option. The primary disadvantages of these types of treatment processes are lack of technical maturity, which would necessitate a significant investment in research and development, and the fact that unlike vitrified waste, the FUETAP product may not be an acceptable waste form at the proposed geologic repository. See also response to comment summary III.D.4 (8).

III.C (2)

Comment - Commentors state that there are various modifications, demonstrated and/or successfully employed elsewhere, that DOE has not taken advantage of, and that could improve the efficiency of the calcining process, reduce emissions, and make it a more attractive alternative for SBW treatment. For example, the site's decision-makers have refused to consider and fund modifications to the New Waste Calcining Facility that would deal with the mercury and nitrogen oxide issues. Some commentors point out that adding sugar to the SBW produces better results than using higher temperatures and aluminum nitrate, because it increases calcination efficiency and lowers emissions of nitrogen oxides. Some commentors question why this proven method is not being considered.

Response - DOE has considered potential modifications to the calciner. For example, DOE evaluated various calcining technologies in the *Process for Identifying Potential Alternatives for the Idaho High-level Waste and Facilities Disposition Draft EIS* (DOE-ID 10627, March 1999) including the addition of sugar, which denitrates mixed transuranic waste/SBW and can prevent sodium agglomeration and improve process efficiencies. More recently, the calciner was operated at 600 degrees Celsius, which proved to be effective in controlling agglomeration without the addition of sugar. Both methods of calcination are technically viable and available, if DOE were to select an alternative that requires calcination.

III.C (3)

Comment - Commentors make various observations regarding past operations of the New Waste Calcining Facility and express concerns about consequent risks to public health and the environment. Because these comments were received before June 2000, when DOE put the calciner on standby, some of the issues raised address actual calciner operations at that time.

- The calciner has a history of environmental contamination and worker exposure.
- For 40 years in the past, DOE ran the calciner under a "hands-off" regulatory regime and ad hoc regulatory requirements not tied to quantifiable performance standards required for hazardous waste incinerators. DOE also failed to complete necessary upgrades or obtain a RCRA Part B permit, thereby creating an unacceptable risk to workers and the public.
- DOE has never wanted to spend the money required upgrading the calciner so it could meet full RCRA permit requirements.
- Risks of restarting the calciner to determine a technological proof of concept for HLW alternatives is unacceptably high for residents, workers, and the environment.
- Object to the restart of the calciner due to risks involved and concerns over past performance, stating that the Defense Nuclear Facilities Safety Board has challenged DOE restart operations.
- DOE restarted and ran the calciner to perform risky experiments under a regulatory loophole that ended in June 2000.
- The calciner must be immediately shut down as it meets neither RCRA, Clean Air Act, nor EPA Maximum Achievable Control Technology standards.
- Operation of the more dangerous calciner without necessary permits does not bode well for likely operation of the plutonium incinerator.
- If DOE is not measuring contaminants leaving the calciner stack or performing adequate measurements of the preponderance of contaminants by volume and toxicity, then it is not complying with the current Clean Air Act standards, as promulgated before 1995.

Response - Until June 2000 the calciner operated as an interim status, thermal treatment unit under RCRA. The standards for these units are found at 40 CFR Part 265, Subpart P. There is no evidence that the calciner created unacceptable risks to workers and the public from past operations. The analysis in this EIS reports that emissions from INEEL operations, including those from the calciner, have been well within standards and, therefore, have not posed unacceptable risks to workers or the public. See Sections 4.7.3 and 4.7.4 of this EIS.

DOE met its Notice of Noncompliance Consent Order requirement to cease operation of the calciner by June 1, 2000, until a permit is obtained. The final campaign of the calciner was designed to use special equipment to collect offgas samples for analysis to determine both the contaminants and concentrations in the offgas during the operation of the calciner at the elevated temperature of 600 degrees Celsius. These results show that operation of the calciner would require upgrades to meet Clean Air Act requirements for Maximum Achievable Control Technology requirements.

Every alternative in this EIS that includes future calciner operations would require the facility to meet applicable regulatory requirements, including applicable permitting requirements, as appropriate. Any restart of the calciner would also be subject to operational readiness, safety, and environmental reviews, which have been updated based on Defense Nuclear Facilities Safety Board comments. There is no "plutonium" incinerator in this EIS.

III.C (4)

Comment - Commentors object to alternatives that involve calcining for the following reasons:

- Calciner-based alternatives may not be permittable.
- Calcining emissions are not understood, and decommissioning of the calciner should start immediately.
- Calciner-based alternatives would require further treatment of RCRA wastes to meet repository disposal requirements.
- The calciner is an antiquated system.
- DOE should find an alternative that is safer and that poses the least threat to the public, workers, and the environment.
- Restart would be difficult; reliability is a problem.

Response - The commentors correctly note that there are uncertainties associated with the reliability of restarting the calciner and permitting, as discussed in response to comment summary III.C (1). See also responses to comment summaries III.C (6) and III.C (9).

The mixed transuranic waste/SBW currently stored in the underground tanks is considered mixed waste because it contains hazardous as well as radioactive constituents. If this liquid were calcined, it would have to undergo further evaluation and/or treatment to meet acceptance criteria or other regulatory requirements, depending on whether the waste is managed as transuranic waste, low-level waste, or HLW. However, this would be true for any waste form derived from the mixed transuranic waste/SBW. As discussed in this EIS, even if properly treated, HLW with listed hazardous waste codes may not be accepted at the proposed HLW geologic repository. Alternatively, if a waste incidental to reprocessing determination concludes that the liquid in the tank farm at INTEC is transuranic waste, then it could be sent to the Waste Isolation Pilot Plant for disposal, after proper treatment to meet transportation and waste acceptance requirements.

III.C (5)

Comment - A commentor states that the New Waste Calcining Facility is not an incinerator because it does not meet the EPA or any other definition of a hazardous waste combustor. The commentor cites National Emission Standards for Hazardous Air Pollutants, EPA document EPA530-R-97-057 (November 1997), and the Final Technical Support Document for Hazardous Waste Combustor Maximum Achievable Control Technology Standards (July 1999) as giving compelling evidence that the calciner technology and function is not that of a hazardous waste combustor used by the commercial sector, and that, therefore, Maximum Achievable Control Technology requirements do not apply.

Another commentor states that the calciner is defined as an incinerator because it burns off liquid and mixes residual ash with granular material for easy pneumatic handling. A commentor states that for four decades DOE and its predecessor agencies operated two high-level liquid radioactive waste incineration plants at the INEEL. [DOE assumes the commentor is referring to the two calciners.] Other commentors object to calcination as applied in the Hot Isostatic Pressed Waste or Direct Cement Waste options for one or more of the following reasons:

- They would require use of the calciner, which requires Maximum Achievable Control Technology upgrades.

- Calciner upgrades would be costly, time-consuming, and might encounter stakeholder opposition because the calciner is a form of incinerator.

Response - DOE does not consider the thermal treatment process known as calcination to be incineration. Incinerators are thermal treatment processes that function to reduce the volume of waste through combustion. The two calciners at INEEL were used successively from 1963 to 2000 to convert liquid mixed HLW (completed February 1998) and mixed transuranic waste/SBW to a more stable and manageable solid form without combustion.

Regardless of whether or not the calciner is classified as an incinerator, the Maximum Achievable Control Technology standards for hazardous waste combustors or emission limits would be imposed, as appropriate, through the permitting process for the calciner. The standards for hazardous waste permits are different depending upon the type of treatment unit involved. In a Federal Register notice (65 FR 42937, July 12, 2000), EPA addressed application of the hazardous waste combustion standards to other types of thermal treatment units, including miscellaneous units permitted under Subpart X of 40 CFR Part 264. Regarding the cost to complete the upgrade to these standards, see response to comment summary X (5).

III.C (6)

Comment - A commentor asks if a method exists to precipitate out salts from acidic offgases.

Response - Methods do exist for precipitating metals out of acidic offgas streams as metallic salts. For example, mercury, which is a metal, can be removed from offgas by precipitating it out as mercuric chloride, which is a metallic salt. This method works on metals that are in the offgas stream as volatile components such as mercury and antimony. Other metals such as plutonium or uranium in the offgas as particulate matter must be removed via a physical process such as filtration, impaction, deposition, agglomeration, or other particulate collection technology.

III.C (7)

Comment - A commentor states that there are uncertainties about offgas emissions from the New Waste Calcining Facility for one or more of the following reasons:

- Technical constraints have hindered DOE's efforts to sample offgas emissions.

- The State of Idaho has never had emissions information from independent monitoring.

Response - DOE resolved technical constraints and, in 2000, completed calciner offgas emissions sampling for hazardous waste regulated by RCRA. The State of Idaho was kept informed during this process and observed the sampling program. The baseline source term was compiled from INEEL emissions inventory reports issued in 1996 and 1997 and from National Emission Standards for Hazardous Air Pollutants reports issued in the same years. These reports show that operations emissions met radiological requirements, however DOE had technical constraints in obtaining RCRA offgas samples. This is discussed in Appendix C.2 of this EIS. In the event DOE decides to restart the calciner, emissions abatement and monitoring requirements would be negotiated with the State of Idaho, as part of the air permitting process.

III.C (8)

Comment - A commentor states DOE must consider an option of operating the New Waste Calcining Facility beyond June 1, 2000, without a permit or Maximum Achievable Control Technology upgrades, in order to comply with the Settlement Agreement/Consent Order requirement to eliminate liquid SBW by 2012. The commentor also states that DOE must work with the State of Idaho to obtain concurrence to continue operating the New Waste Calcining Facility beyond June 1, 2000.

Response - DOE considered the commentor's suggestion of including an alternative in this EIS that would continue operation of the calciner without a permit or upgrades to meet Maximum Achievable Control Technology standards. (See

Section 3.3 of this EIS.) Future operation of the calciner would require negotiations with the State of Idaho.

III.C (9)

Comment - A commentor asks why DOE does not consider calcining or incinerating various liquid wastes before they are grouted to reduce volume, destroy listed organics, and create a more durable grout. Another commentor asks why descriptions in the EIS of process options for newly generated liquid waste omit a calcining or incineration step before solidification. The commentor also asks if DOE hopes to have this waste reclassified so this step will not be necessary. The commentor also states that a description of one alternative suggested that low-level waste would be "denitrated" before grouting, yet no methodology was given.

Response - The EIS considers calcination of the mixed transuranic waste/SBW both as a final waste form and as an interim waste form that would be further treated for disposal. In these alternatives, liquid waste would first be reduced in volume by evaporation. In addition, the liquid would be denitrated through calcination prior to disposal. However, calciner operations would generate additional liquid wastes, and neither calcination nor incineration would constitute final treatment for some of the hazardous constituents in the waste. None of these treatment methods would remove the listed organic waste codes from the dried product. See Section 6.3.2.1 of this EIS as well as response to comment summary III.C (2).

Newly generated liquid waste would not continue to be co-mingled with mixed transuranic waste/SBW after 2005. At that time, newly generated liquid waste could be solidified, directly treated, or placed in RCRA-compliant tanks and managed as mixed low-level waste or mixed transuranic waste according to its characteristics. So long as the newly generated liquid waste is no longer commingled with liquid mixed transuranic waste/SBW or has not come into contact with HLW, then it can be classified without a waste incidental to reprocessing determination. How the newly generated liquid waste is treated for disposal would depend on its classification, RCRA requirements, and disposal destination.

III.C (10)

Comment - A commentor expresses concern that the State of Idaho's seemingly contradictory behavior in requiring the liquid SBW to be solidified by 2012, while at the same time requiring the New Waste Calcining Facility to be shut down by June 2000, is an attempt to abrogate the Settlement Agreement/Consent Order. The commentor says that operating the calciner (without the Maximum Achievable Control Technology upgrade) is the only method capable of safely solidifying the liquid waste by the 2012 milestone.

Response - DOE has an obligation to comply with all applicable federal statutes, regulations, and orders, as reaffirmed in the Settlement Agreement/Consent Order. Neither the State of Idaho nor EPA can abrogate its responsibilities to enforce legal and regulatory requirements. Thus, the commentor's suggestion that the State of Idaho allow DOE to operate the calciner without a hazardous waste treatment permit and Maximum Achievable Control Technology upgrades is not likely under the current legal and regulatory framework.

The State of Idaho agrees that running the calciner under an accelerated schedule as described in the Planning Basis Option (Section 3.1.3.2) could enable DOE to cease use of the tanks by December 31, 2012. However, the EIS shows that the Minimum INEEL Processing Alternative, which does not include calcination, could also enable DOE to cease use of the tanks by that date. The estimates for the other alternatives that show completion dates for treating mixed transuranic waste/SBW between 2013 and 2016 reflect conservative time allotments for funding cycles, permitting, and issue resolution. However, the commentor is correct in noting that implementing these other technologies could cause DOE to miss a key milestone in the Settlement Agreement/Consent Order.

If DOE selects a technology that would not complete treatment of the liquid waste by December 2012, then it is the State of Idaho's position that

DOE must cease use of the underground HLW tanks as required by the Notice of Noncompliance Consent Order and transfer any remaining liquid to permitted tanks in accordance with the State's hazardous waste management regulations.

Even if liquid is stored in compliant tanks, the fact that it would not be solidified for a period of time after December 2012 is a departure from specific actions agreed to in the 1995 Settlement Agreement/Consent Order. These actions include the commitment to calcine all of the liquid currently stored in the tank farm. The mixed HLW calcine would be stored in bin sets pending treatment to make the mixed HLW ready for disposal outside of Idaho by a target date of December 2035. If, in the Record of Decision, DOE decides to implement a treatment technology other than calcining, and if there is a possibility that liquid would remain untreated after 2012, then DOE would have in place an agreed-upon plan and schedule that specifies when the treatment would be completed. In all cases, treatment must be completed in a timely manner so as not to compromise a key 1995 Settlement Agreement/Consent Order HLW milestone, which states that DOE have all the liquid in the tanks and calcine in the bin sets treated and ready to leave Idaho by the target date of December 31, 2035.

III.D TREATMENT TECHNOLOGIES

III.D.1 General: Treatment Technologies

III.D.1 (1)

Comment - Commentors express concerns that treatment options could fail, thus exposing workers, the public, or the Snake River Plain Aquifer, air, or land to undue risk. Commentors cite past problems with calciner operations and a mining industry operation as examples of the types of events that can occur, no matter how unlikely, and can spread contaminants.

Response - DOE has a commitment to the State of Idaho to treat mixed transuranic waste/SBW and mixed HLW currently stored at the INEEL with an emphasis on meeting a target date of December 2035 for making these wastes transportable out of the State of Idaho for disposal. DOE recognizes there are risks associated with operating treatment facilities, as indicated by the impact analyses presented in this EIS. However, for routine operations, all treatment alternatives evaluated in this EIS present small risks to the public, as any exposures would be below health-based standards. Furthermore, leaving waste untreated in underground tanks or as calcine in the bin sets as contemplated by the No Action and Continued Current Operations alternatives poses considerably more risk to the public and the environment over the long-term.

Section 5.2.14 of this EIS analyzes a range of reasonably foreseeable accidents that have the potential to harm workers, the public, or the environment. Although the occurrence of any of these accidents would be cause for serious concern, the risk of an accident would exist only during operations, which for the waste treatment options would occur over a span of about 25 years. For any treatment option, DOE would identify and implement appropriate physical and administrative controls designed to reduce the risk of an accident and to mitigate the extent and effects of an accident should one occur. During project implementation and as required by 10 CFR 830, Subpart B (January 10, 2001), a safety analysis report covering nuclear operations is prepared before operations begin (and is adhered to throughout operations), for all facilities that could result in a hazard to workers or the public. The safety analysis report defines the parameters within which safe operations and storage are assured.

Regarding the calciner, during almost 40 years of operation there have been two minor process cell fires resulting from leakage of kerosene from remotely assembled fittings with no release of radioactive materials to the environment. DOE thoroughly investigates, critiques, and implements necessary improvements for all such unusual events before resuming operations. See also response to comment summary III.C (8) which addresses commentor's concerns regarding past operations of the calciner.

III.D.1 (2)

Comment - A commentor discusses the approach used and success achieved by other entities such as British Nuclear Fuels, Limited, in managing HLW, nuclear fuel, or other waste streams, and/or makes comments regarding these approaches/programs.

Response - DOE is aware of approaches and technologies being used by others in managing various radiological and hazardous waste forms and other nuclear materials. The relative success of these programs and lessons learned were factored into assessments of technology maturity and used in identifying candidate alternatives for analysis in this EIS.

III.D.1 (3)

Comment - A commentor expresses the opinion that existing waste treatment solutions are safe and effective.

Response - Comment noted.

III.D.1 (4)

Comment - Commentors state that decisions based on the alternatives in the EIS will be flawed or premature because the technologies studied are immature. Some commentors add that:

- The EIS is premature and that DOE should do things a step at a time.
- INEEL does not yet know enough about how to apply alternative treatments/solidification technologies to its waste.
- None of the technologies evaluated in the Draft EIS is sufficiently mature to support selection at this time.
- Another commentor asks why so many options were being considered when turning sand to rock is simple.
- Commentors state that in several places in the EIS, unproven technology and unsound scientific methods, if used, could create more risk than already exists with existing wastes; therefore, DOE should use proven technologies.

Response - Timing and regulatory considerations related to this EIS are discussed in Section 1.2 of this EIS. DOE has determined that it is appropriate to move forward with this EIS due to new regulatory developments affecting operation of existing facilities, commitments to the State of Idaho under the Settlement Agreement/Consent Order, a need to integrate environmental impacts of ongoing remediation actions at INTEC with anticipated environmental impacts of waste processing and facilities disposition, and a need to schedule appropriate time for facility development and to obtain funding of alternative technologies.

DOE has disclosed the maturity and uncertainties associated with all treatment technologies described in this EIS. Most of the technologies are supported by extensive documentation and include testing on surrogate or actual waste materials to be processed. In addition, technology development is continuing on the most promising waste treatment options. This work is described in Section 2.2.3 of this EIS. Nevertheless, the proposed treatment options have a range of technological maturity and are under continuing development. Such projects are not new at INTEC, which has been using technology development programs for the past 40 years.

III.D.1 (5)

Comment - Commentors suggest that treatment of HLW should not result in releases to the atmosphere or environment. Commentors state that careful monitoring should drive selection of waste treatment alternatives.

Response - Treating mixed HLW by any method would produce some level of emissions. However, any treatment option selected would be designed and operated to comply with air emission requirements and any other applicable regulations intended to protect human health and the environment. Such regulations would require appropriate monitoring to ensure regulatory compliance, which would be established during permit development.

III.D.1 (6)

Comment - Commentors make statements about good waste management practices:

- Liquid wastes are the most hazardous and expensive to clean up, and waste minimization is important to protect our children.
- Integrate waste treatment solutions across the INEEL to prevent duplication and save money, instead of establishing projects within organizational structures (stove piping).

Response - DOE recognizes and implements the tenets of waste minimization in its operations and would minimize the amount of waste generated during implementation of the selected alternatives. In addition, DOE has a goal of maximizing efficiency of waste management operations by various processes, including integration of similar activities as appropriate.

It is for this reason CERCLA remedial actions and proposed facility disposition alternatives at INTEC are being coordinated in this EIS analysis. Also, this EIS reviewed the potential for treating Idaho mixed HLW at the West Valley Demonstration Project, Savannah River Site, Hanford Site, and at the Advanced Mixed Waste Treatment Project on the INEEL.

III.D.1 (7)

Comment - A commentor expresses the opinion that waste generated elsewhere should not come to the INEEL for management, but rather should go directly to a disposal site, such as Yucca Mountain.

Response - This EIS addresses only those wastes that are currently stored at the INTEC or that would be generated onsite, either by ongoing existing processes or as a byproduct, under alternatives being considered in this EIS. Analyisis of the management of waste generated at other sites for storage or treatment at the INEEL is beyond the scope of this EIS.

III.D.1 (8)

Comment - A commentor says that, contrary to statements in the Draft EIS, treatment recommendations in the National Academy of Sciences report do conflict with some analyses in the Draft EIS.

Response - The Draft EIS drew no conclusion about the National Academy of Sciences' report because it had not been issued when the Draft EIS was approved. The Draft EIS did address the involvement of the National Academy of Sciences in reviewing alternative technologies and noted that their report would be issued. DOE reviewed the report and does not believe the alternatives analyzed in the EIS conflict with the National Academy of Sciences recommendations.

III.D.2 NON-SEPARATIONS TECHNOLOGIES

III.D.2.a Hot Isostatic Pressed Waste Technology

III.D.2.a (1)

Comment - A commentor states that the Hot Isostatic Pressed Waste Option needs to be modified because gas-forming materials cannot be processed in "HIP" cans without pre-treatment.

Response - If the Hot Isostatic Pressed Waste Option were selected, the design and engineering process would address any pre-treatment required.

III.D.2.b Direct Cement Technology

III.D.2.b (1)

Comment - Commentors express a preference for the Direct Cement Waste Option for one or more of the following reasons:

- It would have low environmental impact if properly implemented.

- It provides a simple, one-process/one-waste form/one repository scenario.

- It would be safer, cheaper, simpler, and more efficient to implement than other alternatives, and has been successfully implemented in Great Britain.

- DOE could complete treatment by the Direct Cement Waste Option quickly and meet the milestones in the Settlement Agreement/Consent Order.

- A hydroceramic variation of Direct Cement Waste Option could be used to produce an even more superior waste form.

- INEEL has not yet committed to any particular way of treatment and has no Preferred Alternative.

- It would not leave a large low-level waste stream that could end up staying in Idaho.

- Concrete making is intrinsically safer than glass-making or treatment with the Hot Isostatic Pressed Waste Option.

- Hydroceramic concrete monoliths could be hot isostatically pressed into "vitrified" monoliths within their canisters if vitrification is decided later to be necessary, leaving options open.

- If properly implemented, the waste streams could be small.

- INEEL wastes do not contain excessive amounts of soluble salts, so the "sodalite formulation" rule of thumb could be satisfied.

- No separations processes would be required.

- The feedstream could be a calcine/liquid reprocessing waste slurry, which would consolidate all INEEL reprocessing wastes.

- Other radioactive wastes could be treated by the same process: for example, about 1,000 metric tons of radioactive sodium hydroxide at INEEL which could be co-processed with calcine.

Response - Chapter 5 of this EIS presents the environmental impacts of all the alternatives considered in this EIS. The analyses show that, with the exception of potential long-term environmental impacts associated with the No Action and Continued Current Operations alternatives, the environmental impacts of all alternatives, including the Direct Cement Waste Option would be small.

DOE is aware that the direct cement process has been used elsewhere and is familiar with this technology, as well as the hydroceramic variation. While it does have some advantages over other alternatives, the Direct Cement/Hydroceramic Waste Option also has some disadvantages, including the final waste form which does not meet the current Waste Acceptance System Requirements Document for disposal in a geologic repository. See also response to comment summary III.D.2.b (6). DOE has documented the results of its evaluation of the relative merits of the direct cement technology in Appendix B. This appendix addresses factors such as safety, ability to meet existing Settlement Agreement/Consent Order milestones, flow sheet flexibility, technological maturity, permitability (such as calciner operations), resultant product volume as it relates to transportation and anticipated capacity in the proposed HLW geologic repository, and associated waste streams. If DOE should decide to restart the calciner, co-processing may be reevaluated.

However, the sodium hydroxide waste stream referred to by a commentor is assumed to be the quantity at the Argonne National Laboratory-West facility. This waste stream has been treated and disposed of. This was addressed in the SNF & INEL EIS Record of Decision. In addition, processing of sodium hydroxide from spent nuclear fuel processing at Argonne National Laboratory-West is discussed in the *Final EIS for the Treatment and Management of Sodium-Bonded Spent Nuclear Fuel* (DOE/EIS-0306), issued in July 2000. The Record of Decision for DOE/EIS-0306 has been issued (Federal Register, Vol. 65, No. 182, Page 56565, September 19, 2000).

The Cost Report (DOE/ID 10702, January 2000) estimates costs related to the Direct Cement Waste Option and other alternatives evaluated. It is available from DOE-ID on request. See also response to comment summary X (8).

III.D.2.b (2)

Comment - A commentor contends that, in light of the "command influence" dictating the production of DOE-EM technical reports and the resulting deliberate omission of data and literature citations inconsistent with foregone conclusions, it was no surprise that the EIS characterized the Direct Cement Waste Option as unattractive.

Response - All alternatives presented in this EIS, including the Direct Cement Waste Option, were subjected to the same degree of detailed analysis which are publicly available. DOE considers this EIS to present a fair and unbiased analysis of the environmental impacts of each alternative as well as full consideration of all public comments on the Draft EIS. Data and literature analyzed in this EIS are part of the Administrative Record.

III.D.2.b (3)

Comment - A commentor states that the Draft EIS overestimates the volume of grouted HLW that would result from the Direct Cement Waste Option.

Response - The waste volume numbers provided in this EIS are conservative engineering estimates and would be subject to change under detailed design. The type of concrete being produced and the assumed canister waste loading primarily controls the grout volume estimate. However, the waste volumes presented in Appendix C.7 and Chapter 3 of the EIS are considered to be sufficient for comparison with other waste treatment options, which is the intent of this EIS.

III.D.2.b (4)

Comment - A commentor expresses disappointment that the Direct Cement Waste Option was considered more dangerous than separations approaches by the Draft EIS preparers; the commentor claims that the opposite is true because of the complexity of operations, chemicals, temperatures, and an extra incineration step associated with separations.

Response - As discussed in Section 5.2.9 of this EIS, the environmental impacts of the Direct Cement Waste Option, though small, would result in the highest impact to the public because of the number of latent cancer fatalities that would be incurred during incident-free transport and the impacts to workers and the public from vehicle-related emissions during transportation. The higher transportation impacts associated with the Direct Cement Waste Option are directly related to the large volume of waste produced by the treatment option, which requires a correspondingly high number of truck shipments to transport the waste for disposal. In all other categories evaluated in this EIS, the Direct Cement Waste Option is equal to or less hazardous than any of the separations options.

III.D.2.b (5)

Comment - Commentors state that DOE, Idaho Department of Environmental Quality, and INEEL should learn from grouting failures at Hanford and focus on vitrification of existing liquid waste without separation since a permanent repository is decades away.

Response - Experience at other DOE sites was factored into the evaluation of alternatives that include grouting as a waste treatment option. Vitrification is one of the technologies analyzed in this EIS.

III.D.2.b (6)

Comment - One commentor states that the grouted waste forms produced might not meet repository acceptance criteria or retain physical integrity. However, another commentor asserts that calcine treated to a cement-like waste form would meet the "letter of the law" for repository disposal requirements cited in federal regulations.

Response - Although there could be various waste forms for mixed HLW, DOE has developed a Waste Acceptance System Requirements Document that specifies HLW must be in a borosilicate glass form contained in a stainless steel container that is seal welded. Also, vitrification was adopted by the EPA as the best demonstrated available technology for treatment of RCRA characteristics of corrosivity and toxicity for HLW (55 FR 22520; June 1, 1990), as referenced in Section 2.2.5 of this EIS. At present, there are no other final HLW forms (such as cement-like) or technologies approved by the EPA or DOE for disposal in the proposed geologic repository. As discussed in Section 2.2.5, if DOE were to select a waste processing alternative that results in a grout (cement-like forms) or ceramic (hot-isostatic-pressed waste) or direct calcine disposal, DOE would have to receive a determination of equivalency from the EPA.

III.D.2.c Vitrification Technology

III.D.2.c (1)

Comment - Commentors express a preference for the Early Vitrification Option for one or more of the following reasons:

- It employs a proven technology with fewer risks, and disposal is consistent with the current repository approach and the only alternative that meets Settlement Agreement/Consent Order requirements.
- Impacts to health, safety, and the environment would be smaller than for other options.
- Other technologies cost too much money, though some note that this option also would be very costly.
- It would be less harmful than injecting it into the ground, although air emissions would be a concern.
- It is the least offensive and most "do-able" without harm to people and the land.
- It would eliminate use of the calciner, thus lowering air emissions.
- It offers the most stable waste form for all the HLW.

Response - For many of the reasons cited by the commentors DOE analyzed early vitrification as an option for processing calcine and mixed transuranic waste/SBW. The rationale for the selection of this technology is contained in Appendix B.

Chapter 5 summarizes the environmental impacts of the alternatives analyzed in this EIS. The analyses show that, with the exception of potential long-term environmental impacts associated with the No Action and Continued Current Operations alternatives, the environmental impacts of all alternatives would be small. While there are differences in the environmental impacts among the action alternatives, these differences are not sufficient to clearly identify one alternative as environmentally preferable.

DOE continues to work with the State of Idaho and federal agencies to ensure that emissions and effluents (air and water) from treatment alternatives are properly modeled and that results fall within regulatory limits, or that pollution abatement controls would adequately mitigate potential exceedences. Analyses in this EIS were based on the assumption that any thermal treatment technology, such as vitrification, would require emissions controls that comply with the Clean Air Act.

As noted by the commentors, vitrification has advantages such as employing a proven technology that would produce a stable waste form consistent with the current geologic repository approach. Also, vitrification was adopted by the EPA as the best demonstrated available technology for treatment of RCRA characteristics of corrosivity and toxicity for HLW (55 FR 22520; June 1, 1990), as referenced in Section 2.2 of this EIS. Because vitrification is a proven technology, if selected, DOE would anticipate relatively fewer problems in implementation. In addition, creating a waste form consistent with EPA's regulations would eliminate potential delays associated with getting alternative waste forms approved. Thus, vitrification is considered an alternative that most closely aligns with the Settlement Agreement/Consent Order target date of December 2035 for mixed HLW to be ready for transport out of Idaho.

However, DOE also noted disadvantages of vitrification, such as a relatively high costs and schedule concerns. Regarding the costs of vitrification, recent DOE evaluations determined that this technology may be more expensive to deploy than others evaluated in this EIS.

III.D.2.c (2)

Comment - A commentor states that DOE must get on with cleanup and apply research and development to technologies that will put all radioactive waste into a stable, vitrified form so that it will meet repository acceptance criteria. In addition, vitrification should be the selected treatment technology, since there is no guarantee of any repository coming on line soon and a glass form would be suitable for near-term storage. The commentor further states that vitrification processing cannot be avoided in stabilizing and preparing the HLW to meet future repository acceptance criteria.

Response - DOE considers vitrification to be a mature technology that would not require significant additional investment in technology development. Vitrification of both the liquid mixed transuranic waste/SBW and the mixed HLW calcine or HLW fraction by 2035 are evaluated in this EIS. If the Record of Decision specifies vitrification as the treatment for mixed HLW, DOE would need to conduct additional waste form specific technology development work before constructing a full-scale facility, although DOE has already completed some technology development to see how Idaho waste would perform in a glass medium. See also response to comment summary III.D.2.C (4).

Vitrification puts the waste into a form consistent with that used for analysis purposes in the *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-0250).

III.D.2.c (3)

Comment - A commentor states that vitrification of calcine would be difficult for one or more of the following reasons:

- INTEC stores different types of calcine, each of which would be hard to separate and would require a different solidification process.

- Cesium-137 would have to be collected to prevent migration.

- The process would have high energy requirements and equipment costs.

Response - Calcine in the bin sets is layered due to the calcination of different types of liquid mixed HLW during different campaigns. However, past pilot studies using different types of calcine blended together have produced a vitrified product that may meet requirements for disposal at a geologic repository. Feasibility studies on vitrification have demonstrated that the calcine would have to be blended before vitrification, then sampled so the chemistry requirements of the melter could be properly adjusted to ensure a robust vitrified product. The technology would be demonstrated on a pilot scale before it was deployed in a production facility. Additional work would be needed to characterize the calcine and conduct some technology development on vitrification of this particular waste stream.

If the calcine were vitrified directly, the cesium-137 emissions would be controlled by the offgas system. If the calcine were chemically separated, cesium-137 would be contained in resins, which would be dried and vitrified. Either way, the glass form would be packaged and made ready for disposal in a national geologic repository. Chapter 5 of this EIS shows that utility demand for the Early Vitrification Option represents approximately 40 percent of the site's current electrical consumption, but less than 10 percent of the INEEL's total power capacity.

III.D.2.c (4)

Comment - Commentors express the following opinions about HLW treatment:

- Vitrification is not the only way that HLW can be treated.
- Volume is not the most difficult issue to deal with.
- Neither glass nor concrete waste forms can meet the demanding criteria for HLW disposal because glass will become friable and break down into a fine, dispersible powder over time in a radiation field, and concrete will do the same, even without radiation.

Response - As evaluated in this EIS, there are alternatives to vitrification including grout (cement-like) and ceramic forms (hot-isostatic-pressed waste), as well as shipping the calcine to the repository without further treatment. However, in order to dispose of these alternative waste forms, DOE would have to obtain a determination of equivalency from the EPA.

Although there could be various waste forms for HLW, DOE has developed a Waste Acceptance System Requirements Document (Revision 4) that contains requirements that HLW destined for disposal must be in a borosilicate glass or other qualified waste form and contained in stainless steel. Also, vitrification was adopted by the EPA as the best demonstrated available technology for treatment of RCRA characteristics of corrosivity and toxicity for HLW (55 FR 22520; June 1, 1990), as referenced in Section 2.2 of this EIS.

This glass has been shown to chemically bond the components of the waste in the glass, and does not readily leach these chemicals once bonded. Borosilicate glass is estimated to be as durable as obsidian glass, which remains intact in nature for thousands of years. However, as recommended by the National Academy of Sciences, if vitrification were selected, DOE will continue to study and refine glass-formulation chemistry specific to Idaho's mixed HLW to ensure compatibility with waste acceptance criteria for the proposed geologic repository. See Section 6.3.2 of this EIS as well as the Final EIS Summary, Section 4.1, and responses to comment summaries III.F.2 (5) and (6).

At the present time, there are no other final HLW forms, such as grout or ceramic, that have been approved for disposal in the proposed geologic repository.

III.D.2.c (5)

Comment - A commentor suggests moving an existing vitrification plant to the INEEL to eliminate transportation to an offsite vitrification plant, or vitrifying INEEL HLW at West Valley or Savannah River Site facilities. Another commentor suggests that a mobile furnace could service several sites and that the dome at Experimental Breeder Reactor II could serve as a containment structure for processing offgases from such usage at the INEEL.

Response - As discussed in Section 3.3.5 of this EIS, existing vitrification units at the Savannah River Site and at the West Valley Demonstration Project were evaluated for treatment of INEEL mixed HLW. Savannah River Site vitrification facility components would not be suitable for processing highly acidic INEEL mixed HLW because of fluorides in the calcine or phosphates in the separated mixed HLW fraction. The vitrification facility at West Valley will be shut down in 2002, and will not be able to treat INEEL waste. Moving the West Valley vitrification facility components to the INEEL was judged to be impractical because of health and safety concerns and technical uncertainties related to the long down time that would occur before reassembly and restart. However, DOE would determine the availability of any appropriate equipment, including mobile treatment facilities, that may be suitable for processing INEEL mixed HLW and the potential cost benefit from attempting to use such equipment. Also, lessons learned would be applied to implementation at Idaho if vitrification were selected as the technology to be implemented.

Use of INEEL facilities other than INTEC for various aspects of waste management has been considered, but only where there is some advantage in doing so. The Experimental Breeder Reactor II containment dome is not suitable for processing offgasses.

III.D.3 Separations Technologies

III.D.3 (1)

Comment - Commentors raised issues regarding separations technologies for one or more of the following reasons:

a. Waste Quantities

- Separations technologies generate more waste streams and volumes, compared to non-separations alternatives. They result in greater volumes of waste that have to be managed compared to non-separations options.

b. Redissolving calcine

- Re-dissolving calcine in order to separate it would be wasteful and a step backward in dealing with liquid waste. Calcine is a safe, stable waste form and should not be reconverted to a dangerous liquid. Also, redissolving calcine might not be easy or possible.

c. Low-level Waste Fraction

- The low-level waste stream that would result from separations treatment would leave behind the hottest fraction and greatest near-term threat. The Transuranic Separations Option would involve storage of low-level Class C-type waste at the INEEL. Even after separations, waste will still be radioactive.

d. Criticality

- Separations poses a greater criticality risk than other alternatives, as stated in the Draft EIS.

e. Incinerator

- They all employ an incinerator, which would be unacceptable to stakeholders.

f. Transuranic Extraction

- Hanford could not make the TRUEX (transuranic extraction) process work even though 60 percent of the nation's HLW is stored there (and INEEL has only 3 percent).

- DOE separated transuranics from non-transuranics at Hanford. But there is not regulatory distinction between the two fractions in terms of how they are managed, and some resultant wastes would have to be stored indefinitely at Hanford.

g. Technical Maturity

- A commentor indicates that the maturity level of alternative treatment technologies must be addressed in the Final EIS, and technologies with no apparent technical basis such as separations either need to be dropped or technically justified.

- Separations technologies have no technical basis; they may or may not be efficient or economical; they are uncertain and unproven; they have not been demonstrated to work on an industrial scale; and if they fail, environmental protection is failed.

- The National Academy of Sciences report concludes that separations processes are not realistic and processing existing calcine should have low priority.

- Separations options require proof of their technical viability, chemistry processes, effectiveness, and safety.

- The technologies are infeasible and unprovable, unless the Final EIS offers technical support for this option.

- The chemistry involved in separating HLW into high- and low-level fractions is not well understood.

- TRUEX would not be cost effective, and, as the National Academy of Sciences report says, it is highly unlikely that it would work.

Response -

a. Waste Quantity

- When compared to the non-separations treatment options, separations is projected to result in higher volumes of low-level and/or transuranic waste. However, these options have the advantage of producing a corresponding decrease in the amount of HLW. For example, it is estimated that 800 canisters of HLW would be produced if all the mixed transuranic waste/SBW and calcine are treated using the separations technologies evaluated in this EIS. In contrast, depending upon the method of immobilization, the non-separations technologies would produce between 5,700 and 18,000 HLW canisters (See Chapter 3, Table 3-2). Reducing the volume of the final HLW form is considered an advantage given the uncertainties and costs associated with disposal in the proposed HLW geologic repository. See response to comment summaries in III.F for more detailed discussions regarding disposal options for waste streams produced under different technologies evaluated in this EIS.

b. Redissolving Calcine

- If a separations process were implemented, calcine would have to be placed back into a liquid form because radionuclides would be extracted by chemical and physical processes that work efficiently in solutions. However, this would be accomplished by dissolving only enough calcine needed at any one time during treatment.

c. Mixed Low-level Waste Fraction

- DOE acknowledges that mixed low-level waste fractions evaluated in this EIS may be highly radioactive. However, any generated mixed low-level waste fractions would be managed and disposed of per DOE Order 435.1 and Manual 435.1-1 (Radioactive Waste Management Order and Manual) in order to ensure protection of human health and the environment. Alternatives analyzed in this EIS include offsite as well as onsite disposal of the treated mixed low-level waste fraction. For example, the Transuranic Separations Option analyzes the disposal of Class C-type grout at locations both on and off the INEEL. INEEL locations analyzed are the empty vessels of the closed Tank Farm and bin sets or a hypothetical new INEEL Low-Activity Waste Disposal Facility located approximately 2,000 feet east of the INTEC Coal-Fired Steam Generating Facility. The off-INEEL location analyzed is the Chem-Nuclear Systems commercial radioactive waste disposal site located in Barnwell, South Carolina. Disposal of low-level waste/mixed low-level waste will be determined consistent with the appropriate Record of Decision for the Waste Management Programmatic EIS.

d. Criticality

- The EIS does report an increased risk of criticality associated with the TRUEX separations process. There are accident scenarios identified for some alternatives that have an increased chance of occurring and could result in higher exposures to workers and the public. The criticality accident scenario could occur due to mishandling of transuranic waste fractions stored in containers and would result in a large dose to a noninvolved worker (218 millirem), but a relatively small dose to the maximally exposed individual living at the site boundary (3 mrem). The probability of such an event happening is conservatively estimated to be between one chance in one thousand and one chance in a million per year of facility operation.

e. Incinerator

- As described in Section 3.1.3 of this EIS, DOE analyzed the incineration of spent organics resulting from chemical separations. DOE determined that such an incinerator may not be required for the treatment of the organic waste stream because several treatment alternatives exist. However, the analysis in this EIS provides the impacts should DOE decide to incinerate the spent organics to reduce volume, treat hazardous constituents, and produce a disposable waste form. The resulting waste form would be mixed low-level waste and managed in accordance with the appropriate Record of Decision for the Waste Management Programmatic EIS.

f. Transuranic Extraction

- Separations, including the TRUEX (transuranic extraction) process, is technically feasible and is a reasonable alternative treatment technology. If this or any of the other separations alternatives were selected under a Record of Decision based on this EIS, extensive bench-scale and pilot-scale testing of processing methods with surrogate wastes would have to be conducted before implementation.

g. Technical Maturity

- DOE acknowledges the need for further design, technology development, and testing work to ensure the success of any separations option that it may select for processing the INEEL calcine or mixed transuranic waste/SBW. However, there are factors that could make the separations options attractive enough to warrant somewhat greater technical risk. As with any technology deployment, separations would be validated on a pilot-scale basis as necessary to ensure that the process can be performed within the necessary regulatory and safety parameters prior to full, production-scale deployment. In addition, separations processes would be on a batch-scale (or continuous dissolution) basis that would not result in accumulation and storage of large quantities of liquid at any one time. The National Academy of Sciences identified the need for design and development work (including work with actual aged calcine, rather than surrogates) to ensure that the desired process operability and decontamination factors can be achieved. DOE recognizes the concerns of the National Academy of Sciences and acknowledges the need for technology development as noted above.

III.D.3 (2)

Comment - A commentor states that one of the primary goals of separations is financial: to reclassify waste so that a higher fraction of the waste can be grouted instead of vitrified, because grouting is cheaper. The commentor adds that cost is one of the main reasons why the UK chose to grout reprocessing waste.

Response - As shown in the Cost Report (Section 6.0), treatment costs for the Direct Cement Waste Option and the Separations Alternative are comparable. However, options under the Separations Alternative produce a lower volume of final HLW product than the Direct Cement Waste Option. Because of this, the separations options have lower associated disposal costs, and, therefore, lower total costs. Classification and management of the waste streams would be in accordance with DOE Order 435.1 and Manual 435.1-1 (Radioactive Waste Management Order and Manual).

III.D.3 (3)

Comment - A commentor states that options under the Separations Alternative in the Draft EIS focus on repository issues and regulatory requirements and are not in the best interest of environmental protection. Separations was added as an alternative to engineer around problems at Yucca Mountain and dispose of the waste at the Waste Isolation Pilot Plant instead.

Response - Although Separations was not added to engineer around problems at the Yucca Mountain repository, it does provide for reduction in the amount of final waste form product for disposal at the repository and for transuranic waste the added benefit of disposal at a facility that is currently open.

III.D.3 (4)

Comment - A commentor questions whether a process designed to dissolve/extract calcines would work with ion exchange resins. The commentor also suggests that it would be better to incinerate the resins and treat the ash, and requests that figures in the EIS be modified to incorporate an incinerator.

Response - DOE recognizes that if separations is selected as part of the treatment process for calcine, then additional technology development would be conducted to determine if dissolved calcine is compatible with the separations method (such as ion exchange) at a production scale. At this time, DOE sees no advantages to incineration of cesium ion exchange resins. The total volume of resins would be small (about 40 cubic meters) and would not warrant further reduction through incineration.

III.D.4 Treatment Technologies Considered but Eliminated from Further Consideration

III.D.4 (1)

Comment - A commentor suggests that DOE consider immobilization in an aluminum matrix within stainless steel containers as a treatment for calcine that has been demonstrated on a laboratory scale, describing the process and citing numerous advantages over vitrification options discussed in the Draft EIS.

Response - As part of the process of identifying the waste treatment options analyzed in this EIS, DOE considered immobilization of calcine in an aluminum matrix. The immobilization of HLW calcine in an aluminum matrix was not carried forward in this EIS because of the lack of technical maturity and because it offered no advantage over direct disposal of calcine in a national geologic repository.

III.D.4 (2)

Comment - A commentor asks if DOE has considered treating HLW by immobilizing it in silicon ingots, citing a number of advantages to this approach.

Response - As part of the process of identifying treatment options analyzed in this EIS (see Appendix B), DOE considered silicon encapsulation of HLW and concluded this technology is similar enough in operation and application to vitrification that the potential environmental impacts would be substantially the same. Therefore DOE decided not to analyze silicon encapsulation as a separate option or alternative in this EIS.

III.D.4 (3)

Comment - A commentor suggests that DOE consider a dry-pack process for treatment of HLW because this approach would have cost advantages over the Full Separations Option.

Response - As part of the process of identifying the treatment options analyzed in this EIS, DOE considered two-stage evaporation (sometimes called Dry Pack) for the treatment of mixed transuranic waste/SBW. This technology was not brought forward for detailed analysis in this EIS because it did not present significant advantages over other treatment options that offered additional benefits. However, due to the National Academy of Sciences recommendation, this technology was reconsidered during the process of identifying a Preferred Alternative. However, it was subsequently eliminated from further consideration because of concerns about applicability of this process to treatment of mixed transuranic waste/SBW and operational concerns.

III.D.4 (4)

Comment - Commentors suggest that DOE consider the following proposed commercial treatment options for treating SBW:

- A new pyrolysis/steam reforming fluid bed technology developed by Studsvik, Inc.

- A cost-effective, mature, industrial technology developed by COGEMA, Inc.

Response - As a result of public comment and agency review, the steam reforming process was analyzed for mixed transuranic waste/SBW treatment. The cold-crucible vitrification (COGEMA) process was considered and could be used in vitrification treatment for mixed transuranic waste/SBW.

III.D.4 (5)

Comment - Commentors request that several additional alternatives be evaluated/considered in the EIS, including the following:

- Entomb the calcine *in situ* in the bin sets (because of the difficulty of retrieving it) or using direct cementation.
- Solidify and entomb the SBW in the tanks.

Commentors add that they realize that entombment of waste in place would not meet Settlement Agreement/Consent Order commitments to move the HLW out of state.

Response - The potential long-term impact of entombment of the calcine within the bin sets is similar to the evaluation of the No Action Alternative. The results for the No Action Alternative are provided in Chapter 5 of this EIS. DOE has assumed in this EIS that any structure is vulnerable to degradation failure after 500 years in accordance with the Nuclear Regulatory Commission position for long-term storage facilities (NRC, 1994, Branch Technical Position on Performance Assessment for Low-level Disposal Facilities, Washington, D.C.). Therefore, since it is difficult to quantitatively estimate the long-term mitigative effect, if any, of concrete surrounding the bin sets, DOE has conservatively assumed failure and leakage of calcine into the environment after 500 years. Environmental impacts of such an event are discussed in Appendix C.4 of this EIS. For direct cementation of the calcine in the bin sets, there is not enough capacity to direct cement the calcine in place.

The potential long-term impact of grouting the liquid mixed transuranic waste/SBW within the tanks lies between that of No Action (leaving liquid in the tanks) and that of disposal of grouted low-level waste in the tanks. Long-term environmental impacts of both of these alternatives have been evaluated in this EIS. However, the operational logistics of transforming the mixed transuranic waste/SBW into a stable solid form may require removal of the mixed transuranic waste/SBW from the tanks and the addition of neutralizing and stabilizing materials that would result in a substantial waste volume increase. Assuming a 30 percent waste loading of the grout, there may be marginally enough capacity to grout the existing volume of mixed transuranic waste/SBW in the tanks. DOE does not regard disposal of the mixed transuranic waste/SBW in the tanks and entombment of the calcine in the bin sets to be a reasonable alternative not only because it would violate the Settlement Agreement/Consent Order, but also because of physical uncertainties and because it would be highly unlikely to meet RCRA regulatory requirements for a disposal facility for mixed waste. For these reasons, DOE does not view this as a reasonable alternative, and it was eliminated from detailed analysis.

III.D.4 (6)

Comment - Commentors express opinions about the way in which DOE included or dismissed technology options for evaluation in the EIS:

- Instead of dismissing technologies because DOE has not yet completed research on them (such as Direct Cement/Hydroceramics), DOE should point the Draft EIS reader to information from other sources.
- DOE should insist that preparers of the EIS contact "champions" of other technologies, and the Final EIS should present this information.
- DOE has failed to consider all reasonable alternatives, has created unnecessary barriers to consideration of certain options, or has abnormally inflated their costs.
- DOE should describe the rationale used to dismiss alternatives from evaluation.

Response - In developing the waste processing alternatives analyzed in this EIS, DOE researched and considered literature available on potential treatment technologies and consulted the advocates ("champions"). Through a structured process extending over several months, DOE evaluated and screened the treatment alternatives to arrive at the range of reasonable alternatives that appeared to be technically feasible, required limited technology development, and meet various other criteria imposed by DOE or the State of Idaho. As part of this process, many of the treatment technologies or locations suggested by the commentors were considered. Appendix B, Waste Processing Alternative Selection Process, summarizes the alternative identification process by briefly describing those that were eliminated from detailed analysis and the reasons why they were eliminated.

Some of the commentors suggested alternatives that do not represent unique waste processing alternatives, but rather implementation options that could be representative of alternatives already considered in this EIS. For example, this EIS analyzes alternatives that would involve continuing calcination of mixed transuranic waste/SBW using the New Waste Calcining Facility. Similarly, this EIS considers several alternatives involving cementation. If DOE were to decide on a waste processing alternative that includes cementation, the specific additives, processing conditions such as cementitious waste, and final waste form would be determined through future technology development activities. Such implementation options would not result in substantially different environmental impacts and do not represent unique waste processing alternatives that require additional detailed evaluation in this EIS.

III.D.4 (7)

Comment - Commentors ask DOE to consider the following alternatives or explain why they were excluded from consideration:

- Options described in various non-DOE scientific and engineering journals, conference proceedings, and reports.
- Calcine/SBW slurry treatment, which, a commentor says, the National Academy of Sciences report supports.

Response - As part of the process of identifying the treatment options analyzed in this EIS, DOE considered treatment of the calcine and mixed transuranic waste/SBW slurry treatment. These technology options were not selected specifically for analysis in this EIS but are encompassed by alternatives already considered in this EIS. For example, this EIS analyzes non-separations alternatives that would involve cementing mixed transuranic waste/SBW and calcine, to make it ready for shipment out of Idaho by a target date of December 31, 2035. If DOE determines that SBW would be managed as a transuranic waste then it would be kept separate from the mixed HLW calcine and made ready for shipment to the Waste Isolation Pilot Plant. If DOE determines that SBW would be managed as HLW, then creating a slurry with calcine and adding this to the cementation mixture would be considered during the design and engineering stages for this alternative. Because this EIS analyzes the environmental impacts of managing the calcine and mixed transuranic waste/SBW as HLW, it can be concluded that the slurry suggestion is encompassed within the range of reasonable technological options evaluated in this EIS.

The commentors' suggestion that calcine should be blended with mixed transuranic waste/SBW is not consistent with the recommendations of the report from the National Academy of Sciences addressing HLW. The report recommended blending calcines of different compositions to achieve a uniform waste feed to the treatment process, but criticized DOE's current practice of blending mixed HLW and mixed transuranic waste/SBW calcines. The rationale against blending is that it would be counterproductive because it would convert the mixed transuranic waste/SBW to mixed HLW and eliminate management and disposal options that would otherwise be available to the mixed transuranic waste/SBW if it is determined not to be HLW.

III.D.4 (8)

Comment - Commentors ask DOE to consider the Oak Ridge National Laboratory FUETAP (formed under elevated temperature and pressure) cementation process.

Response - The FUETAP technology is similar to the Hot Isostatic Pressed Waste and Direct Cement Waste options evaluated in this EIS and has many of the same advantages and disadvantages. Primary disadvantages are lack of technical maturity, which would necessitate a significant investment in research and development, and the fact that unlike vitrified HLW, the FUETAP product is currently not considered an acceptable waste form at the proposed geologic repository. However, if this option were to be selected DOE could perform a determination of equivalent waste form for disposal of the FUETAP product. Because the FUETAP process does not offer any significant advantages over the Hot Isostatic Pressed Waste or the Direct Cement Waste Options evaluated in the EIS, it was not included as an alternative treatment process.

III.E Storage of Treated Waste

III.E (1)

Comment - Commentors agree with DOE's intent to solidify the remaining liquid waste and place the HLW calcine in a less dispersible form, but recommend that DOE drop assumptions about a repository opening. Commentors also suggest that DOE should:

- Learn by examples from Hanford and focus on solidifying the liquid waste for onsite storage without regard to speculative repository availability.
- Look at long-term onsite storage, because of uncertainties with availability of repositories for INEEL transuranic waste and HLW and conflicting demands for repository space for commercial spent nuclear fuel.
- Not move the waste to another location and, thus, minimize transportation risks.
- Consider only treatment alternatives that prepare the waste for safe, long-term onsite storage due to uncertainties as to whether it can ever be shipped, building new containers as necessary to safely store the waste for as long as it takes before it can be safely moved.

Commentors state that there are uncertainties with using Yucca Mountain in Nevada as a disposal site such as lack of water rights, indefinite opening date and schedule delays, political considerations, cost overruns, inadequate capacity, potential licensing problems, and questionable scientific basis. Commentors also note that DOE faces obstacles in the acceptance of INEEL waste at both the Waste Isolation Pilot Plant and Yucca Mountain repositories, such as capacity and waste acceptance criteria uncertainties, and these should be detailed in the EIS.

Response - Section 5.2 of the EIS addresses the potential environmental impacts of interim storage of treated HLW at the INEEL through 2095. Interim storage may be necessary if a geologic repository is not available. Potential environmental impacts of storage (10,000 years) of treated HLW at DOE sites, including INEEL, which do not include transportation risks, are addressed in Chapter 7 of the Yucca Mountain EIS. DOE acknowledges that there are a number of uncertainties associated with whether and when the proposed Yucca Mountain geologic repository will be available for disposal of INEEL HLW. Capacity availability and the evolving waste acceptance criteria at Yucca Mountain are discussed in detail in Section 2.2.4 in this EIS. With the exception of the No Action and Continued Current Operations alternatives, all alternatives under consideration in this EIS will render the remaining mixed transuranic waste/SBW in the tanks into a solid form which, along with the treated calcine, can be safely stored on-site pending disposal.

Currently, the Waste Isolation Pilot Plant is the designated disposal facility for defense-related transuranic waste. If SBW is classified as transuranic waste after a waste incidental to reprocessing determination, then the Waste Isolation Pilot Plant is the appropriate disposal destination. Waste Isolation Pilot Plant officials have confirmed that capacity availability at the Waste Isolation Pilot Plant for remote-handled and contact-handled transuranic waste would be available for INEEL waste classified as transuranic waste as a result of a waste incidental to reprocessing determination. Similarly, any transuranic waste fraction created through a separations process would also be sent there. Waste acceptance criteria for the Waste Isolation Pilot Plant are well defined, and INEEL transuranic waste would be treated and packaged accordingly. See also responses to comment summaries in III.F.3 regarding transuranic waste disposal at the Waste Isolation Pilot Plant.

III.E (2)

Comment - A commentor expresses the opinion that the U.S. should take advantage of experience gained by Great Britain and confirmed by technical reports and should emulate successful practices used in the United Kingdom for managing HLW. The commentor cites, as an example, storing HLW on an interim basis in cement-like waste forms suitable for either long-term storage or disposal at any viable location until a suitable repository becomes available.

Response - Great Britain's experience with managing HLW may not be applicable to mixed HLW stored at INTEC because of differing HLW regulatory approaches. However, DOE does share technical experience and lessons learned within the international industry. See responses to comment summaries III.D.1 and III.D.2.b regarding the direct cement approach.

III.E (3)

Comment - Commentors support stabilizing and storing wastes safely and securely to protect the environment. A commentor expresses a preference for safe storage of waste or moving the waste to another location if safe storage is not possible. Other commentors state that they want to store the waste in the safest possible way at the INEEL or move it elsewhere.

Response - This EIS addresses the range of reasonable alternatives that, with the exception of the No Action and Continued Current Operations alternatives, would prepare mixed HLW and its associated waste streams for safe onsite interim storage at the INEEL and/or transport out of Idaho for storage for disposal elsewhere.

Section 5.2 of the EIS addresses the potential environmental impacts of interim storage of treated HLW at the INEEL through 2095. Interim storage may be necessary if a geologic repository is not available. Potential environmental impacts of long-term storage (10,000 years) of treated HLW at DOE sites, including INEEL, are addressed in Chapter 7 of the Yucca Mountain EIS.

III.F Disposal of Treated Waste

III.F.1 General: Disposal

III.F.1 (1)

Comment - A commentor states DOE needs a responsible vision for the future and, to avoid more complications, should make disposal plans before generating any additional high-level and related wastes.

Response - DOE Order 435.1 and Manual 435.1-1 (Radioactive Waste Management Order and Manual) requires waste management plans, which must include identified disposition paths for all waste generated. Currently, the Waste Isolation Pilot Plant is open for disposal of transuranic waste, and there are a number of existing low-level and mixed low-level waste disposal facilities. HLW resulting from decisions based on this EIS would be placed in a form suitable for disposal at the proposed geologic repository.

III.F.1 (2)

Comment - A commentor states that the Draft EIS focuses too much on preparing waste for disposal in the near term in a HLW geologic repository and on meeting the Settlement Agreement/Consent Order and not enough on isolating waste from the environment.

Response - One of the fundamental purposes of this EIS is to provide a basis for making decisions as to how best to treat the mixed HLW and mixed transuranic waste/SBW so it can be properly disposed of and thereby permanently isolated from the environment. The Nuclear Waste Policy Act makes the Federal Government responsible for providing permanent disposal of spent nuclear fuel and HLW, and the Settlement Agreement/Consent Order is consistent with this. Specifically, the EIS analyzes options for producing several different final waste forms, including glass, glass-ceramic, or cementitious material, that impede the migration of contaminants to the environment during both short term interim storage and long term final disposal.

Some alternatives and options analyzed in this EIS do not meet Settlement Agreement/Consent Order milestones and some are not dependent upon the availability of a national HLW geologic repository. CEQ regulations do not require that all reasonable alternatives meet requirements of existing regulations or legal requirements such as the Settlement Agreement/Consent Order.

III.F.1 (3)

Comment - A commentor questions how DOE used information from specific Sandia National Laboratories reports regarding performance assessments of INEEL HLW, which the commentor states conclude that a competently sited repository would adequately retain radionuclides regardless of waste form characteristics. The commentor, therefore, suggests that calcine could be directly disposed of without additional treatment, thus dramatically reducing cost.

Response - The commentor provided DOE with the reports from Sandia National Laboratories, upon which the commentor based his conclusions. The reports (published in February 1995) present an analysis of the viability (from a waste isolation perspective) of direct disposal of HLW in unsaturated tuff, a geologic unit that DOE is studying at Yucca Mountain. As part of the alternative review process, the option of direct disposal of the HLW calcine without additional treatment has been added to this EIS. If this option is selected, DOE could pursue a determination of equivalent waste form for the disposal of calcine in a national geologic repository.

III.F.2 HLW Geologic Repository

III.F.2 (1)

Comment - Commentors state opinions and concerns regarding the method used to calculate inventory for the geologic repository, including:

- Equivalent metric tons of heavy metal (MTHM) should be based on relative radioactive and radiotoxic hazard.

- Using the historical projection method would significantly reduce the volume of HLW that could be disposed of in the repository to much less than equivalent commercial spent nuclear fuel loadings, thus handicapping DOE.

- Arbitrary definitions indexed to volume instead of heat load would bias against alternatives with higher product volume.

- The figure of 170,000 MTHM existing in the DOE complex (presented by DOE at an EIS public meeting) does not agree with a Sandia report that cites only 12,060 MTHM, of which only 320 MTHM is at the INEEL. This would represent only 7.3% of repository capacity of 4,400 MTHM.

- Support the State of Idaho's position that DOE must recalculate the MTHM derivation of HLW inventory so that all of DOE's HLW can go to the first repository.

- Internal DOE technical reports support the commentor's conclusion that DOE's HLW would fit into the allocation for the first repository if the inventory is derived from the parent fissile mass of the waste form.

- The policy of using 0.5 MTHM per canister for HLW is inconsistent with both the intent and letter of the law (see 40 CFR 191), and this is contributing to DOE's inability to deal with HLW. A stronger adjective than "controversial," as stated in the Draft EIS, should be used when discussing this issue.

- Decisions surrounding this issue appear to be made based on DOE policy, irrespective of the law, which should be followed.

Response - The State of Idaho's Foreword to this EIS, Section 6.3.2.4 of the EIS and Section 5.2 of the Summary, identify calculation of MTHM as an area of controversy. The DOE figure of 170,000 MTHM is based on the historical method of calculation without considering the reduction in volume that could be achieved through separations technologies and classification of the waste stream using DOE Order 435.1 and Manual 435.1-1 (Radioactive Waste Management Order and Manual). The Sandia calculation of MTHM was based on a different method of calculation than the historical method of 0.5 MTHM per canister. DOE recognizes that the State of Idaho would like to use a different method to calculate the MTHM values in order to solve the geologic repository volume issue. Calculating MTHM for the purposes of disposal in the proposed geologic repository is however more appropriately within the scope of the Yucca Mountain EIS and is discussed in Appendix A, Section A.2.3.1 of that document.

III.F.2 (2)

Comment - Commentors state that Waste Acceptance Criteria for the repository have not yet been finalized and express varying opinions regarding this issue:

- Establish finalized Waste Acceptance Criteria as soon as possible or before a final waste form is developed.
- DOE should move forward with plans to develop a final waste form even without final Waste Acceptance Criteria.
- DOE should identify the alternatives that have the best chance of yielding an acceptable final waste form that is acceptable under RCRA for disposal in a repository.
- The calcine product would not meet the requirements of the Waste Acceptance Criteria for the repository. Another commentor requests that the EIS be withdrawn until HLW disposal criteria have been established.

Response - DOE recognizes the need to produce a final HLW form that would meet requirements for disposal in the potential Yucca Mountain geologic repository and considered options in this EIS to address the RCRA characteristic and listed waste components to accommodate disposal.

DOE believes there is sufficient guidance on the disposal of HLW to proceed with this EIS. DOE has developed a Waste Acceptance System Requirements Document that contains performance requirements for disposal of HLW in the potential Yucca Mountain geologic repository. The EPA has established radiation protection standards for this repository pursuant to the Energy Policy Act of 1992. The Nuclear Regulatory Commission has published a rule (10 CFR 63, November 2001) that identifies criteria for licensing the repository. Based on this information, DOE can move forward to identify, select, and implement decisions regarding management of HLW. See also responses to comment summaries III.D.2.b (6) and III.D.2.c (4).

III.F.2 (3)

Comment - A commentor states that the cost of actually using Yucca Mountain for its intended purpose will add only a relatively small incremental cost and that Yucca Mountain is going to cost U.S. taxpayers billions of dollars whether or not any real waste is ever buried there.

Response - It is true that DOE has invested a significant amount of money in research and development to determine if the potential geologic repository at Yucca Mountain is suitable for disposal of spent nuclear fuel and HLW, of both commercial and DOE origin, and that these costs have been incurred whether or not such material is disposed of at the Yucca Mountain site. Nevertheless, as explained in Appendix F of the Cost Report (DOE/ID 10702, January 2000, a unit cost (cost per canister) of HLW was determined using a technique common to other DOE projects. The unit cost is a function of the expected inventory of HLW and other defense waste and the life cycle cost, including actual cost already incurred and estimated future costs. A calculation based on the *Analysis of the Total System Life Cycle Cost Report of the Civilian Radioactive Waste Management Program*

(DOE/RW-0533) assumes that 25 percent of the total life cycle cost of the potential Yucca Mountain geologic repository is for DOE defense waste. The 25 percent share ($10.8 billion) was divided by the number of canisters in the inventory of DOE waste. The remaining 75 percent of the repository cost would be secured through the Nuclear Waste Fund. This results in a unit cost value of $540,000 that was used to evaluate alternatives in the 2000 Cost Report. An update of the life cycle cost report was published in 2001 that presented a higher estimated cost of the potential repository. Using the updated numbers, the estimated cost per canister of HLW would be $740,000.

The costs associated with disposal are presented in the Cost Report to provide the estimated life cycle costs for full implementation of the alternatives analyzed in the draft EIS. Such information maybe useful to the DOE in making decisions regarding such alternatives.

III.F.2 (4)

Comment - A commentor states that schedules must be adjusted to ensure that all INEEL HLW can be treated and prepared for shipment and disposal before the proposed geologic repository closes.

Response - The availability of the potential Yucca Mountain geologic repository for treated HLW from INTEC is uncertain. Therefore, it would be premature to align repository and INEEL waste treatment activities with those regarding the potential Yucca Mountain repository until the schedule for its development and operation is final.

III.F.2 (5)

Comment - Commentors state that Idaho is not a suitable disposal site for HLW and that DOE should be looking for another repository site even if Yucca Mountain opens. Commentors express the opinion that it is difficult to favor any one method of disposal because of the technical uncertainties associated with these methods.

Response - DOE has completed an EIS (DOE/EIS-0250) to evaluate a potential geologic repository site at Yucca Mountain for disposal of DOE HLW.

Chapter 5 of this EIS evaluates environmental impacts associated with long-term onsite storage of mixed HLW. As discussed in Section 2.2.4 of this EIS and Section 1.3 of the Yucca Mountain EIS, the Nuclear Waste Policy Act, as amended, established a process leading to a decision by the Secretary of Energy on whether to recommend that the President approve Yucca Mountain for development as a potential geologic repository. The Secretary recommended the Yucca Mountain site to the President and he has authorized the repository. To date, DOE has not found any information or factors that would preclude the Yucca Mountain site from development as the potential geologic repository. The Nuclear Waste Policy Act does not currently authorize DOE to consider another site.

Section 2.2.4 of this EIS discusses the total quantity of waste that could be accepted at Yucca Mountain. Appendix C.7, Table C.7-6, provides a description of the final waste streams and the volumes of HLW that would be shipped to the repository from the INEEL for each alternative.

The potential environmental impacts of interim storage of treated HLW forms from INTEC at the INEEL through 2095 are addressed in Section 5.2 of this EIS. The potential environmental impacts of long-term storage of HLW at DOE sites are also addressed in Chapter 7 of the Yucca Mountain EIS.

III.F.2 (6)

Comment - Commentors assert that the Nevada Test Site is suitable for HLW and that volume reduction is not a criterion for disposal of defense-type wastes. Commentors also state that the Department of Defense and commercial spent nuclear fuel claims for repository space continue to interfere with the U.S. Government's promise to dispose of INEEL HLW. Commentors add that the Nevada Test Site is a reasonable disposal site because it:

- Is federal land that has already been withdrawn from the public domain.

- Is arid.

- Has a low water table.

- Is already contaminated from weapons testing and cannot reasonably be cleaned up.

One commentor advocates "Greater Confinement Disposal" and states that the site mineralogy would be compatible with a concrete waste form.

Response - DOE notes the commentor's suggestion that a greater confinement disposal facility may have advantages for HLW disposal for various treatment forms; however, Yucca Mountain is the only site authorized by the Nuclear Waste Policy Act, as amended, to be characterized for suitability as the HLW geologic repository. See also response to comment summary III.F.2 (5).

In addition, DOE issued the *Final Environmental Impact Statement, Management of Commercially Generated Radioactive Waste* (DOE/EIS-0046) in 1980. That EIS analyzed the environmental impacts that could occur if DOE developed and implemented various alternatives for the management and disposal of HLW. The 1981 Record of Decision for that EIS announced the DOE decision to pursue the mined geologic disposal alternative (46 FR 26677, May 14, 1981). Given this decision and the requirements of the Nuclear Waste Policy Act, as amended, DOE has selected Yucca Mountain in Nevada as the potential location for a geologic HLW repository and the President has authorized its development.

III.F.3 Waste Isolation Pilot Plant

III.F.3 (1)

Comment - Commentors state that the Transuranic Separations Option would convert all HLW into two waste forms that could be disposed of at either the Waste Isolation Pilot Plant or a landfill. Commentors also express a number of concerns and opinions about disposal of INEEL waste at the Waste Isolation Pilot Plant, including:

- The Early Vitrification Option would result in unacceptable and illegal disposal of SBW at the Waste Isolation Pilot Plant.

- Remote-handled transuranic waste can only be placed in limited locations at the Waste Isolation Pilot Plant, and there are wastes from other sites vying for these limited waste allocation slots. There is, thus, a risk that the Waste Isolation Pilot Plant cannot receive all the transuranic waste.

- Separation of waste into non-contact handled transuranic waste and "Class C" low-level grouted waste forms for shipment to the Waste Isolation Pilot Plant is a waste of money due to lack of disposal capacity at that facility.

Response - DOE has determined that there is adequate capacity at the Waste Isolation Pilot Plant to dispose of INEEL transuranic waste, including remote-handled transuranic waste, that could be generated under the alternatives analyzed in this EIS. This waste would not preclude the disposal at the Waste Isolation Pilot Plant of other INEEL transuranic wastes or transuranic waste from other DOE sites destined for disposal there. DOE would follow the waste incidental to reprocessing process as defined in DOE Order 435.1 and Manual 435.1-1 (Radioactive Waste Management Order and Manual) to determine whether any waste covered by the alternatives analyzed in this EIS would be managed as transuranic waste. Any transuranic waste thus classified would be managed and processed to meet waste acceptance criteria for the Waste Isolation Pilot Plant.

III.F.4 Low-level Waste Near-surface Landfill

III.F.4 (1)

Comment - A commentor asks why one EIS alternative would dispose of Class A-type grout waste on-site, while another alternative would ship it off-site for disposal.

Response - Both onsite and offsite disposal of low-level waste are reasonable disposal options for analysis in this EIS. It is for this reason that waste treatment scenarios that result in a low-level-waste stream or low-level waste fraction include onsite and offsite options for disposal. The exception is the Planning Basis Option, which includes only offsite disposal since this alternative reflects the State of Idaho position that the Settlement Agreement/Consent Order requirement is to have all calcine and mixed transuranic waste/SBW treated and ready to leave Idaho by a target date of December 31, 2035. Further, any mixed low-level waste streams resulting from the waste treatment alternatives would be candidates only for offsite disposal per the Record of Decision for the Waste Management Programmatic EIS.

III.F.4 (2)

Comment - A commentor states that the EIS should identify potential offsite low-level waste disposal facilities that would be available as well as the difficulties in using these potential disposal facilities. The commentor also asks for contingency plans for low-level waste disposal. A commentor states that the Draft EIS does not adequately describe the storage plans (onsite and offsite) for various subclassifications of low-level waste.

Another commentor (EPA Region X) rates the Draft EIS as EC-2 (Environmental Concerns -- Insufficient Information), citing uncertainties (due to a lack of analysis and documentation in the EIS) that facilities exist for handling and storing low-level waste.

Response - Section 5.2.13 of this EIS analyzes environmental impacts to facilities that would receive low-level waste from the treatment alternatives. This section states that annual production of low-level waste at the INEEL is currently about 2,900 cubic meters and although the peak annual quantity generated under the proposed action could be as high as 1,400 cubic meters, the highest annual average would be about 400 cubic meters. These quantities of low-level waste should not overload the INEEL's capacity and capability to accumulate, manage, and transport this type of waste.

In addition, this EIS analyzes three disposal options for low-level waste generated at the INEEL: (1) construction of a near-surface disposal facility, (2) use of existing INTEC facilities such as the Tank Farm and bin sets, and (3) transportation to an offsite disposal location. Offsite disposal facilities could accommodate the projected volumes of low-level waste that would be generated under the alternatives analyzed in this EIS. Those disposal facilities included in this EIS for analysis purposes are Envirocare of Utah for Class A-type low-level waste grout, and the Chem-Nuclear Systems disposal site in Barnwell, South Carolina for the Class C-type low-level waste grout. On February 25, 2000, DOE issued a Record of Decision for low-level waste and mixed low-level waste based on the Final Waste Management Programmatic EIS. In this Record of Decision, DOE decided to perform minimum low-level waste treatment at all sites and continue, to the extent practicable, onsite disposal of low-level waste at the INEEL and other DOE sites. In addition, this Record of Decision states that the Hanford Site in the State of Washington and the Nevada Test Site will be available to all DOE sites for disposal of low-level amd mixed low-level waste.

IV FACILITY DISPOSITION

IV.A Clean Closure

IV.A (1)

Comment - A commentor expresses doubt that the Clean Closure Alternative is worth the increased site worker mortality rate. Another commentor is of the opinion that 2,400 recordable injuries and 290 lost workdays (on page S-55, left column of the Draft EIS) associated with clean closure of the INTEC Tank Farm seems excessively high and asks how these figures were derived.

Response - DOE shares the commentor's concern about the increased site-worker mortality rate under clean closure of the Tank Farm. DOE based the worker injury projection on a five-year average of lost workdays and total recordable illness/injury rates from INEEL construction workforce data from 1992 to 1997. In the case of clean closure of the INTEC Tank Farm, DOE assumed that 280 workers, each working 2,000 hours per year, would be required for 27 years to clean close the Tank Farm. DOE calculated that for 280 workers, with a lost workday rate of 31.6 percent and a total recordable cases rate of 3.8 percent, there would be 2,388 total lost workdays and 287 total injuries/illnesses. DOE has updated the worker injury rates used in the Final EIS. Based on the updated information, DOE calculated that for 280 workers, with a lost workday rate of 28.4 percent and a total recordable cases rate of 3.7 percent, there would be 2,100 total lost workdays and 280 total injuries/illnesses. See Section 5.3.8 of this EIS.

IV.A (2)

Comment - A commentor supports the Clean Closure Alternative and states that contaminated underground structures such as tanks, vaults, and piping must be removed. Other commentors support the Clean Closure Alternative stating that DOE should remove wastes and keep background radiation at levels acceptable for general land use.

Response - Clean closure could make HLW facilities at INTEC available for general land use; however, there may be technological, economic, and worker health risks involved that would make it impractical to remove all residual material or decontaminate and remove all equipment from the INTEC facilities. RCRA hazardous waste regulation 40 CFR 264.197 states 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. These requirements would use performance-based standards. As indicated in Section 3.4 of this EIS, which describes the preferred facility disposition alternative, performance-based standards would be applied to existing facilities based on risk calculations. New facilities, built at INTEC, would be designed consistent with clean-closure methods as required by current DOE orders. For all RCRA closures, detailed closure plans would first have to be developed by DOE and approved by the State of Idaho in accordance with hazardous waste management standards.

IV.B Performance Based Closure

No specific comments.

IV.C Closure to Landfill Standards

IV.C (1)

Comment - Commentors express varying preferences about selection of the tank closure alternatives including:

- The alternative for facility disposition should be closure to landfill standards because INEEL will continue to operate for many years.
- The complexity of disposing of contaminated 300,000-gallon waste tanks means that the "simple" solution of capping the tanks and "walking away" is unacceptable.
- Tank heels should be removed using demonstrated technologies, and then the tanks should be filled with grout.

A commentor states that closure of the tanks and soils as a landfill assumes that a cap would be placed over the waste to serve as a barrier against future leachate generation, which assumes that the associated CERCLA soils would also be capped. The commentor also says that the Summary does not make clear what steps would be undertaken to meet the landfill closure goals.

A commentor expresses the opinion that unavoidable contaminated residues should be stored in well-defined, isolated, impervious spots.

Response - Tank closure to landfill standards would be performance-based, taking into consideration any contaminant levels that may be existing and determining what if any amount of contaminant, including tank residuals, could be left without exceeding regulatory standards. Under the Preferred Facility Disposition

Alternative, closure decisions would be made in the context of the impact of other facility closures in the area and CERCLA remediation efforts associated with the Tank Farm. Thus, the total residual burden to the environment from all remediation and closure activities in any area would be limited to a target value. Contaminants that exceed the limit would need to be reduced accordingly. Thus, although some contaminants could be left on site, including tank residuals, proper closure techniques to control or prevent dispersion to the environment would be implemented as required by closure permits.

As noted by the commentor, many release sites are being managed by CERCLA and the facilities being dispositioned under this EIS are co-located. Thus, it is important to coordinate facilities disposition with the decisions being made for release sites managed under CERCLA. These decisions on the final end-state for INTEC would consider the cumulative impacts of soils and groundwater contamination from release sites as well as facilities disposition activities. In this case, using an engineered cap over this area may be the final decision.

DOE is committed to long-term stewardship of sites and facilities where closure decisions involve leaving contaminants in place. In such instances, DOE would institute protective measures including institutional controls that provide long-term barriers to inadvertent intrusion and monitoring efforts that determine the effectiveness of contaminant controls. See Section 6.3 of the Summary as well as Section 5.3 of this EIS for Closure to Landfill Standards infomation.

IV.C (2)

Comment - A commentor states that the Idaho Chemical Processing Plant (ICPP, now INTEC) would not qualify as a Subtitle-D dump because it lies in a flood plain.

Response - Based on the U.S. Geological Survey preliminary 100-year flood plain map, parts of INTEC are within the flood plain. However, the flood plain analysis conducted by the Bureau of Reclamation indicates that none of INTEC is within the 100-year flood plain. This information is presented in Section 4.8.1.3 of this EIS. DOE is currently conducting additional flood plain analysis to resolve the differences in the flood plain boundaries calculated by the U.S. Geological Survey and Bureau of Reclamation methods. Under RCRA regulations, closure of the INTEC Tank Farm and surrounding facilities could occur even within a flood plain because it would not be considered a new landfill facility. The cap for final closure of the INTEC Tank Farm would be designed to prevent significant erosion of the cap during a flooding event, which is one of the major concerns of closing landfills within a flood plain. For these reasons, DOE believes the issue of the flood plain can be adequately resolved during closure. See also response to comment summary VIII.C (5).

IV.C (3)

Comment - A commentor states that void spaces in empty tanks and containers represent a concern for landfill subsidence and require stabilization. The commentor proposes filling the voids with soil rather than Class A grout.

Response - The need to stabilize void spaces in tanks and containers to avoid subsidence is accounted for in all facility disposition alternatives involving the in-place disposal of facility structures and equipment. However, the use of soils rather than a grout mixture would not be practical due the technical difficulties that would be encountered trying to transport a soil mixture into the tanks and containers as well as into voids within and around equipment and structures left in place. An additional concern is the inability to achieve a compaction density of the soil equivalent to the compression strength achieved by a solidified grout.

IV.D Performance Based Closure with Low-level Waste Class A or Class C Grout

IV.D (1)

Comment - The commentor (EPA Region X) rates the Draft EIS as EC-2 (Environmental Concerns -- Insufficient Information), citing uncertainties (due to a lack of analysis and documentation in the EIS) that: Grout containing the low-level waste would prevent contamination of the aquifer for 500 years.

Response - Appendix C.9 of this EIS contains the reasoning for assuming that grouted low-level waste would remain intact for 500 years, after which it is assumed to fail. In stating this, DOE cites the Nuclear Regulatory Commission Branch Technical Position on Performance Assessment for Low-level Disposal Facilities (1994), which does not endorse the integrity of any manmade structure after 500 years. However, as evidenced by some studies, under certain conditions cementitious materials (such as grout or concrete) can be expected to last for extended periods of time, approaching 1000 years or more (Poe, W. L., Jr., "Long-term Degradation of Concrete Facilities Presently Used for Storage of Spent Nuclear Fuel and High-Level Waste," Rev. 1, Report Prepared for Use in Preparation of the Yucca Mountain EIS, Tetra Tech NUS, Aiken, South Carolina, October 1998). To address the commentors concern the analysis in Appendix C.9 was expanded to include a modeling scenario where low-level waste grout fails in 100 years. The potential environmental impacts to the aquifer are described in Appendix C.9 of this EIS.

V WASTE DEFINITIONS, CHARACTERISTICS, AND QUANTITIES

V (1)

Comment - A commentor cites the Draft EIS Summary, Section 7.4, discussion of cumulative impacts and waste and materials, and states that the INEEL waste inventory as presented does not include HLW.

Response - As stated in Section 6.4 of the Summary of this Final EIS, the waste inventory referred to by the commentor is that INEEL waste in addition to the inventory of mixed HLW calcine and mixed transuranic waste/SBW targeted for treatment as part of the actions evaluated in this EIS. DOE proposes to prepare the inventory of calcine and mixed transuranic waste/SBW so that it is ready for removal from the State of Idaho. The EIS considers the environmental impacts of waste generated during the treatment of calcine and mixed transuranic waste/SBW (referred to in the EIS as process wastes) or shipping the calcine directly to the repository. These process wastes must be treated, stored, and disposed of in addition to other INEEL legacy wastes and newly generated wastes and are evaluated as cumulative environmental impacts in the EIS.

V (2)

Comment - A commentor questions statements in the Draft EIS regarding waste streams that would result from implementation of waste treatment options:

- The Draft EIS Summary states that construction activities would generate little radioactive and hazardous waste, but the volume reported for Full Separations construction impacts (over 2,000 cubic meters) does seem significant.

- The Draft EIS Summary identifies radioactive waste as part of construction wastes. How is radioactive waste generated during the construction process?

Commentors request that DOE add a clear definition of newly generated liquid waste in one or more places in the EIS, including the glossary.

Response - It is DOE's policy to minimize the generation of waste. Therefore, it may be possible for DOE to reduce the generation of waste under the Full Separations Option to something less than 2000 cubic meters. However, for comparative purposes, conservative estimates of generated waste were used and these relative quantities were factored into the analysis of the alternatives presented in this EIS.

Sections 6.2.4 and 6.3.4 of the Summary and Section 5.2.13 of this EIS discuss waste produced under the waste processing and facility disposition alternatives. Table S-2, pages 3 and 4 of 12, (Final EIS Summary) summarizes these environmental impacts from waste and materials. Section 6.2.4 of the Summary shows that construction activities produce relatively little radioactive or hazardous wastes and that this EIS examines environmental impacts associated with generation of both radioactive and non-radioactive wastes resulting from construction and waste processing operations. Construction activities generate some radioactive waste because new or modified facilities are tied in to existing contaminated structures - for example, via piping and ventilation connections.

Newly generated liquid waste was defined in the text box on page xi of the Draft EIS Summary, and its characteristics were given in the text box on page 3-11 in the Draft EIS. However, its definition was inadvertently omitted from the glossary, located in Appendix D of the Draft EIS, and the acronym was omitted from the Document-Wide Acronyms and Abbreviations list. In response to this comment, the definition of newly generated liquid waste was added to the revised glossary (Chapter 7 of the Final EIS), and the acronym was added to the revised list of acronyms in this EIS.

V (3)

Comment - A commentor states that much of the characterization now being performed in the DOE complex is unnecessary. The nominal purpose of these characterization activities is to assign codes to the waste, but the actual analyte concentrations do not determine how the barrel is shipped or what will be done with it at the repository. This allows decision makers to put off politically tough decisions and/or substantive actions while continuing to spend "programmatic" money.

Response - Characterization activities are a necessary component of regulatory compliance to determine if the waste meets the acceptance criteria for onsite or offsite treatment and disposal facilities. For example, characterization activities yield data on constituent concentrations that are used for hazardous wastes if the waste is regulated under RCRA and, if so, the kind of permitted treatment required for proper disposal. If the waste is going to a non-RCRA facility, characterization data are necessary to determine that the waste is below the concentrations required to demonstrate protection of human health and the environment. Characterization is also required for INTEC's mixed HLW for delisting purposes and for acceptance into the proposed geologic repository. See also response to comment summary VII.D (2).

V (4)

Comment - A commentor states that the volume of liquid SBW in the INTEC Tank Farm varies between 1.4 and 1.9 million gallons.

Response - The inventory of liquids in the INTEC Tank Farm does vary depending on operations and use of the High-Level Liquid Waste and Process Equipment Waste Evaporators. The current volume of mixed transuranic waste/SBW in the INTEC Tank Farm is approximately one million gallons.

V (5)

Comment - A commentor recommends that DOE undertake additional characterization of SBW and calcine in the bin sets to support decision making. The commentor requests that additional information on characterization data be published in an appendix to the Final EIS to allow for comparison with the detailed data on HLW provided in the Draft Geologic Repository EIS.

Response - DOE used the characterization data from the mixed transuranic waste/SBW, Tank Farm heel samples, and calcine samples taken in the last year. The updated INTEC data were checked against the data on INEEL mixed HLW used in the Final Yucca Mountain EIS. Data on INTEC mixed HLW is equivalent to that provided in the Yucca Mountain EIS and can be found in Appendix C.7 of this EIS. However, DOE agrees that, before any alterantive or option is implemented, additional characterization would be necessary.

V (6)

Comment - A commentor states that the National Academy of Sciences report on HLW treatment alternatives may be in error because it used as a reference an INEEL technical publication that over-estimates the radioactivity in HLW calcine by a factor of ten times. The commentor also states that the calcine will be below the Nuclear Regulatory Commission "Class C" disposal limits by the time DOE promised to have it ready for shipment off-site.

Response - For the reasons cited by the commentor, the technical report referenced in the comment was updated and sent back to the National Academy of Sciences before the academy submitted its recommendations.

The commentor's statement that the calcine will be below Nuclear Regulatory Commission "Class C" disposal limits by 2035 when DOE has agreed to have it ready to be shipped offsite is not supported by DOE's calculations of radioactive decay. Regardless of its radionuclide content, the current classification of calcine as HLW is based on the definition of HLW, which, in part, relates to the process under which the waste was generated. Any other classification of the calcine or any waste forms resulting from treatment would have to be conducted in accordance with the waste incidental to reprocessing determination process. See Section 6.3.2.2 of the EIS.

V (7)

Comment - A commentor indicates that review of quarterly reports issued by a former operator of the ICPP (Phillips Petroleum) shows that sodium nitrate and sodium hydroxide were used to dissolve reactor rods, which means that the resulting Tank Farm wastes clearly meet the HLW definition.

Response - In the 1950s, a small amount of dissolver product containing sodium was sent to the first cycle feed makeup tanks. Here the dissolver product was adjusted with nitric acid and aluminum nitrate to allow the solution to be chemically compatible for the first cycle extraction process to recover the radioactive lanthanum. The resulting first cycle waste containing the sodium was then sent to the first cycle waste HLW tank farm tanks. The HLW containing sodium from the radioactive lanthanum dissolution and recovery process was calcined and stored in the bin sets.

Also small amounts of Experimental Breeder Reactor-II (EBR-II) fuel was dissolved in acid and the resulting dissolver product was processed through the first cycle extraction process.

The small amount of sodium in the EBR-II fuel is the residual sodium from the heat transfer medium which is sodium potassium liquid (NAK). The resulting first cycle waste was also transferred to the HLW tank farm tanks and then calcined and stored in the bin sets. DOE currently considers the SBW stored in the eleven tanks in the Tank Farm to be mixed transuranic waste. However, determination of its classification will be made in accordance with DOE Order 435.1 and Manual 435.1-1, Radioactive Waste Management Order and Manual.

V (8)

Comment - The commentor (EPA Region X) rates the Draft EIS as EC-2 (Environmental Concerns -- Insufficient Information), citing uncertainties (due to a lack of analysis and documentation in the EIS) that waste stream products could be reclassified as low-level waste, thus allowing DOE to pursue separations alternatives.

Response - Alternatives that evaluate separations processes and classification of the separated fractions are reasonable despite the technical and administrative uncertainties involved. Additionally, DOE Order 435.1 and Manual 435.1-1 (Radioactive Waste Management Order and Manual) provide the process for classifying the waste. From a technical perspective, specific radionuclides can be separated from radioactive waste streams, resulting in two fractions having different radiotoxicity characteristics. From a practical standpoint, the two waste fractions could have correspondingly different handling and disposal requirements. Information associated with the technical aspects of waste treatment and administrative aspects of waste classification are addressed in Section 6.3.2 of this EIS and Sections 4.1 and 4.2 of the Summary.

V (9)

Comment - Commentors state that DOE must not be allowed to reclassify waste forms to avoid meeting legal regulatory requirements. Commentors further state that both "high" and "low" activity wastes are HLW by definition and must be managed accordingly, and that the attempt to reclassify SBW is a technical way of avoiding the Settlement Agreement/Consent

Order requirements to calcine all the Tank Farm waste. Commentors further assert that the attempt to reclassify SBW to a less stringent category of mixed transuranic waste is unilateral and is unsupported by any other state or federal agency.

Response - How waste streams associated with HLW in DOE's inventory should be classified and managed is determined through the waste incidental to reprocessing process prescribed by DOE Order 435.1 and Manual 435.1-1 (Radioactive Waste Management Order and Manual). The alternatives analyzed in this EIS identify how DOE would manage these waste streams depending on the outcome of the waste incidental to reprocessing determination. See Section 4.2 of the Summary. A more detailed discussion is included in Section 6.3.2.2 of this EIS.

It should be emphasized that classification of SBW is not for the purpose of avoiding Settlement Agreement/Consent Order requirements pertaining to HLW. The purpose of this classification is to determine if the waste will be mixed transuranic waste and disposed of at the Waste Isolation Pilot Plant.

The State of Idaho does not oppose DOE's plan to classify SBW through the process delineated in DOE Order 435.1 and Manual 435.1-1, provided that all constituent parts of the SBW are disposed of out of the State of Idaho, in accordance with the requirements of the Settlement Agreement/Consent Order, and managed in compliance with regulatory requirements.

V (10)

Comment - A commentor states DOE has authority to license disposal of low-level waste, not HLW, which must be permitted under the Nuclear Regulatory Commission by definition. The commentor further notes that HLW regulations extend to vitrified low-activity waste, salt grout, and related processing facilities when used in support of geologic disposal under Nuclear Regulatory Commission regulations.

Response - The Nuclear Regulatory Commission has authority to license a proposed geologic repository for disposal of HLW under 10 CFR Part 60. DOE and the Nuclear Regulatory Commission can authorize low-level waste disposal facilities. However, DOE's authority extends only to disposal of DOE low-level waste at a DOE site. The Nuclear Regulatory Commission can license commercial low-level waste disposal facilities, which DOE may opt to use. However, the Nuclear Regulatory Commission can also delegate its authority for licensing commercial low-level waste disposal facilities to states that have radiation programs meeting Nuclear Regulatory Commission standards.

It is within DOE's authority to manage its HLW during treatment and storage as well as after disposal in a national geological repository, which would be licensed by the Nuclear Regulatory Commission. Management of DOE's HLW, prior to disposal, is covered by DOE Order 435.1 and Manual 435.1-1 (Radioactive Waste Management Order and Manual). See also Section 6.3.2 of this EIS. The term low-activity waste is used to describe the separated fraction from which key radionuclides have been removed, thereby considerably reducing the amount of radioactivity and/or types of radioactive constituents. Although the term "low-activity waste" may be used descriptively, it does not denote the appropriate waste classification or, by inference, the proper disposal option. It is for this reason this EIS does not use the terms "low-activity" or "high-activity" waste.

V (11)

Comment - Commentors state that HLW is HLW regardless of its location - whether leaked, in processing equipment, or unintentionally disposed of. One commentor asks if defunct reactor cores at INEEL are not also HLW.

Response - DOE is addressing radioactively contaminated media from previous releases at INTEC under the CERCLA process (see Section 6.3.2.7 of the EIS), which includes coordination with EPA and the State of Idaho and public involvement. The management and disposal of radioactively contaminated media will meet applicable or relevant and appropriate requirements. Contaminated media will be analyzed for their radioactive and hazardous characteristics and managed accordingly. The defunct reactor cores by DOE definition are not HLW.

As for equipment or other materials contaminated with HLW, DOE would follow the waste incidental to reprocessing process (DOE Order 435.1 and Manual 435.1-1, Radioactive Waste Management Order and Manual) to determine whether to manage it as HLW or alternatively as transuranic or low-level waste. See responses to comment summaries V (10) and V (12).

V (12)

Comment - A commentor asserts that DOE is attempting to reclassify SBW, Tank Farm residuals, HLW in ancillary piping, waste residues in ventilation ducts, and waste leaked from piping as waste forms other than HLW to avoid regulatory or disposal requirements. The commentor also states that SBW is specifically either first-cycle raffinate or has been diluted to avoid classification as HLW. The commentor says that DOE is attempting to reclassify Tank Farm heels and other HLW to other ancillary waste streams and fails to recognize that "incidental waste" still falls under the classification of HLW.

Commentors also state that DOE must describe the processes used for reclassification of HLW fractions resulting from separations to other waste forms such as transuranic waste, and must also describe associated uncertainties. A commentor asserts that DOE processes used to reclassify waste at the Savannah River and Idaho sites are against the law, are rightfully opposed by the states of Washington, Idaho, and Oregon, and violate the Settlement Agreement/Consent Order

Response - In developing the waste processing alternatives analyzed in this EIS, DOE made certain assumptions about how the radioactive waste streams that would go into and come out of the selected treatment processes would be classified. DOE would classify all radioactive wastes in accordance with the processes described in DOE Order 435.1 and Manual 435.1-1 (Radioactive Waste Management Order and Manual). The term "waste incidental to reprocessing" is used when referring to a process for determining whether wastes that might be considered HLW due to their origin could be managed as low-level or transuranic waste. This process, which is included in DOE Order 435.1 and Manual 435.1-1, ensures that radioactive wastes are managed appropriately based on the risk they pose to the public and the environment. It is DOE's position that the waste incidental to reprocessing process, described in a Chapter 2 text box (page 2-9) and Section 6.3.2.2 of this EIS, is consistent with law and current policies of the Nuclear Regulatory Commission with respect to incidental wastes.

The State of Idaho does not oppose DOE's plan to classify SBW through the process delineated in DOE Order 435.1 and Manual 435.1-1, provided that all constituent parts of the waste are disposed out of the State of Idaho, in accordance with the terms of the Settlement Agreement/Consent Order, and managed in compliance with regulatory requirements. The State expects residual wastes to be managed and monitored in accordance with the applicable requirements of RCRA, the Idaho Hazardous Waste Management Act (HWMA), and the CERCLA Record of Decision for Waste Area Group 3 for the INEEL.

Waste incidental to reprocessing determinations are being developed for waste streams at INTEC, as described below. These waste streams include the existing mixed transuranic waste/SBW in the Tank Farm, the residual waste material remaining in the Tank Farm tanks after cleaning and closure, contaminated job wastes, and contaminated equipment (pumps, valves, etc.) used in HLW process systems.

Mixed transuranic waste/SBW - The existing inventory of mixed transuranic waste/SBW in the Tank Farm tanks at INTEC includes waste streams associated with spent fuel reprocessing. However, most of the liquid wastes sent to the Tank Farm during past reprocessing operations have been removed from the tanks and solidified by the calcination process. The bulk of the remaining inventory is comprised of waste solutions from plant decontamination activities and processes ancillary to reprocessing, although a small fraction of the Tank Farm Inventory is attributed directly to reprocessing extraction wastes. When compared to first cycle extraction wastes, the current inventory of mixed transuranic waste/SBW is generally much lower in radioactivity, and therefore poses significantly less risk. Of the approximately 44 million curies that resulted from spent nuclear fuel reprocessing at INTEC, about 43.5 million curies have been calcined or have decayed. Of this amount about 480,000 curies remains in the mixed transuranic waste/SBW. A waste incidental to reprocessing determination (by the evaluation method) draft has been prepared to evaluate whether the remaining mixed transuranic waste/SBW should be managed and disposed of as transuranic waste. The Nuclear Regulatory Commission is performing a technical review of the draft waste incidental to reprocessing determination prior to its finalization by DOE, which is anticipated in 2002.

Tank Farm Residuals - Closure of the HLW tanks is planned at INTEC. As treatment of the mixed transuranic waste/SBW is completed and the Tank Farm tanks are emptied, the tanks would be flushed to maximize waste removal. Flushing activities would remove waste to the maximum extent that is technically and economically feasible, and to a level that meets regulatory requirements for long term protection of the environment. However, some amount of residual waste will likely be unable to be retrieved from the tanks. A waste incidental to reprocessing determination (by the evaluation method) has been prepared for these Tank Farm residuals, which evaluates whether the waste remaining in the tanks after closure should be managed as low-level waste. The Nuclear Regulatory Commission will perform a technical review of the draft waste incidental to reprocessing determination prior to its finalization by DOE, which is anticipated in 2003.

There are two other waste streams eligible for waste incidental to reprocessing determinations. These determinations can be by either a citation of evaluation method as determined by applying DOE Order 435.1 and Manual 435.1-1 requirements to the waste. Waste incidental to reprocessing determinations are being developed to determine if contaminated job wastes and contaminated equipment and material meet the requirements to be managed and disposed of as low level or transuranic waste.

Contaminated Job Wastes - Wastes generated during HLW transfer, pretreatment, treatment, storage, and disposal maintenance, operating, sampling and analysis, closure, and decontamination activities and equivalent items are eligible for the waste incidental to reprocessing citation determination process. Contaminated job wastes contain small amounts of radioactivity on the materials in low concentrations or are limited to low levels on the components' surfaces. DOE Order 435.1 cites items eligible for the waste incidental to reprocessing citation determination process.

Contaminated Equipment and Materials - This waste incidental to reprocessing determination will cover contaminated equipment and materials removed from INTEC HLW facilities for disposal. The evaluation waste incidental to reprocessing determination will be prepared for the miscellaneous equipment and other related materials potentially contaminated by HLW reprocessing streams that have been or will be removed from service.

VI TIMING OF THE EIS

VI (1)

Comment - Commentors express concern about the timing of decisions made to treat waste (including HLW) at the INEEL, including:

- Do not rush a decision, especially if safe technology, procedures, and/or adequate funding are not available.
- Take time to consider the safest method of treatment for people and the environment, rather than repeating mistakes of the past.
- Avoid short-term solutions like DOE's predecessors of the 1950s, and find the best long-term solution.
- Recognize that the HLW stream needs attention; employ technology where containment and long-term stewardship are emphasized instead of expediency and profit of contractors.
- Be aware that the technology that seems right at the moment may not be right later.

Commentors also state the opinion that decisions based on the EIS can be made separately and/or in a phased manner and should be because:

- It is premature to make all decisions within the scope of the EIS due to lack of information.
- DOE should proceed when actions are planned and feasible and not wait until all plans can be formulated.
- It is premature to consider vitrification at Hanford until the facility is approved to be built and the best way to retrieve calcine from the bin sets has been determined.

Response - Chapter 1 of this EIS explains why DOE must make decisions in the near-term about how to manage the mixed HLW and mixed transuranic waste/SBW. These decisions need to be made in the near term so there is time to obtain the necessary funding, conduct the necessary technology development, engineering design, and facility construction that would enable DOE to meet its Settlement Agreement/Consent Order commitments. DOE believes that waste treatment technologies under evaluation in this EIS can be implemented safely and responsibly, as indicated by the minimal environmental impacts. Further, once DOE has selected a waste treatment alternative and obtained necessary funding, DOE would, as soon as practicable, complete technical development, design, construction, and commence treatment operations in accordance with approved safety analysis reports. DOE believes that this would be necessary in order to meet its regulatory requirements and agreements with the State of Idaho. However, because some of this information remains uncertain (e.g., progress of HLW treatment at Hanford), and since DOE's agreements contain phased treatment milestones, DOE anticipates that this EIS may result in a phased decision that would be implemented in steps, or in a series of decisions over time. It is also anticipated that the decision(s) would include milestones, so that actions would be neither premature nor postponed, but planned and implemented as a matter of public record in accordance with the decision(s). Refer to comment summary VII.D (2) for discussion on how phased decisions may impact the Settlement Agreement/Consent Order milestones.

It is the State of Idaho's position that if DOE decides on a phased approach, the decision will include a schedule to ensure DOE meets the Settlement Agreement/Consent Order milestones.

This EIS is part of a process to disclose and evaluate short- and long-term impacts to the human environment from alternatives to treat, store, and dispose of INEEL mixed HLW. In this EIS, DOE has attempted to report the risks to workers, public, and the environment clearly and concisely so that the relative merits of different ways to achieve the stated objectives can be evaluated and weighed.

In developing this EIS, DOE evaluated the best available demonstrated technologies along with technologies that are in development. DOE recognizes that new technologies would continue to be developed and considered in the future as appropriate.

VII LEGAL REQUIREMENTS AND GOVERNMENT-TO-GOVERNMENT RELATIONSHIPS

VII.A NEPA

VII.A (1)

Comment - A commentor states that DOE should place greater emphasis on the recommendations and comments of Citizens Advisory Boards because they represent a cross section of the public and have intensively studied the issues.

Response - In the process of identifying and evaluating alternatives, DOE considered all public comments including comments and recommendations from Citizens Advisory Boards, received on the Draft EIS, and they were all given equal consideration.

As the commentor states, the Citizens Advisory Boards at the various DOE sites are intended to represent a cross section of the community and assist DOE in making decisions and addressing issues. For example, DOE provided a presentation concerning the Draft EIS to the INEEL

Citizens Advisory Board at its January 2000 meeting, during the public comment period. The purpose of this presentation requested by the board was to assist members with their review of and comment on the document. The boards meet on a routine basis and work closely with DOE to accomplish its goal of efficient and responsible operations, in this case at the INEEL. In addition to this close association, boards also comment on National Environmental Policy Act documents, as do members of the general public and other interested parties. In this regard, DOE does not assign greater or lesser emphasis on comments received. See response to comment summary VII.A (6).

VII.A (2)

Comment - A commentor states that the EIS should evaluate the impacts at Hanford of the Full Separations and Early Vitrification options. Commentors stress that before selecting an alternative that involves the Hanford Site for treating INEEL waste, DOE must conduct a site-specific National Environmental Policy Act evaluation that expressly concentrates on involving Hanford stakeholders. A commentor asks what, if any, follow-on National Environmental Policy Act analysis would be necessary to implement a selected alternative.

Response - Section 3.1.5 of this EIS states that if DOE decides to pursue the Minimum INEEL Processing Alternative, DOE would review the need for additional National Environmental Policy Act documentation. The timing of this review would occur when the potential of the Hanford Tank Waste Remediation System for treating INEEL mixed HLW calcine could be evaluated with a degree of certainty sufficient to support DOE in making informed decisions. If it is determined that additional documentation is needed to select the Hanford Site for treatment of INEEL mixed HLW calcine, it would tier from the *Tank Waste Remediation System, Hanford Site, Richland, Washington, Final Environmental Impact Statement*. In this regard, the analysis would be site specific and the public involvement process would focus on local stakeholders and issues.

VII.A (3)

Comment - A commentor advises DOE that an EIS should explain the alternatives and be used to guide an agency in its decision making.

Response - DOE agrees that an EIS must explain the alternatives and act as a guide for DOE when making decisions within its scope. An EIS must also identify potential environmental impacts to the affected environment and be made available to inform the public about prospective agency actions.

VII.A (4)

Comment - Commentors state that the EIS is inadequate to support a Record of Decision because information about the most important variables - such as technical risk, repository acceptance, and costs of alternatives - is outside the scope of the document. Another commentor states that the scope of the EIS is too narrow considering the range of issues that have to be addressed.

Response - There are variables and uncertainties concerning DOE HLW management and treatment, some of which are within and some of which are outside the scope of this EIS. These are identified in the Summary and are discussed in relevant sections of this EIS. Technical risk, for example, is within the scope of this EIS and is discussed in the Summary, Section 4.3, and in Sections 6.3.2 and 6.3.3 of this EIS. However, repository acceptance is not within the scope of the EIS. The scope of this EIS adequately supports management of mixed HLW, mixed transuranic waste/SBW treatment and facility disposition decisions for the INEEL, and accommodates a range of technical, legal, and administrative uncertainties confronting DOE regardless of how they are resolved. As for the costs of alternatives, DOE issued a Cost Report for the Draft EIS alternatives to show estimated costs. Stakeholders can request the Cost Report (DOE/ID 10702, January 2000), though it is not part of this EIS itself.

VII.A (5)

Comment - A commentor states that it is hard to identify the alternatives that DOE is seriously considering because the Draft EIS has no Preferred Alternative.

Response - DOE considers the alternatives analyzed in this EIS to be representative of the range of available options that could be implemented. DOE had no Preferred Alternative when the Draft EIS was issued and was not required to have one. After receipt of public and agency comment on the draft EIS and updated information provided by DOE management, DOE and the State of Idaho have selected different preferred alternatives in this EIS. The two Preferred Alternatives are described in Section 3.4.

VII.A (6)

Comment - Commentors state that in its analysis, decision making, and project implementation processes, DOE must invite and maintain a process of full public participation and involvement for one or more of the following reasons:

- Public involvement is a constitutional right.
- Citizens should be involved whenever there is a potential threat to human health or the environment.
- DOE needs opinions from individuals other than government officials and those who stand to profit in some way from the decision.

Other commentors ask DOE to keep them apprised of new developments in the EIS, and to keep stakeholders involved throughout the process, including informing the public and the decision maker of the tradeoffs between costs and environmental impacts, particularly for projects of this cost magnitude. One commentor asks DOE to inform the public as soon as a decision is made on whether to upgrade the New Waste Calcining Facility to meet the new Maximum Achievable Control Technology rules.

Response - DOE agrees that public involvement is necessary and important to decisions that could potentially impact human health and the environment. DOE follows Council on Environmental Quality and DOE National Environmental Policy Act requirements for public involvement and disclosure. In this regard, DOE follows formal procedures for informing and updating the public at key points in the National Environmental Policy Act process. In addition, DOE works closely with stakeholders and media to inform the public of key decisions, initiatives, program developments, decisions based on this and other EISs, and other activities. This would include any decision to continue to run the calciner, should that decision be made. DOE Records of Decision, such as decisions on the continued operation of the calciner, are made publicly available.

In addition, DOE maintains other avenues of communication with the public. For example, DOE established the multidisciplinary INEEL Citizens Advisory Board in 1994 to review and make consensus-based recommendations to DOE on its activities and plans at the INEEL. Board meetings are open to the public; in fact, the public is encouraged to attend. DOE also maintains active communication with the media and special interest groups in order to keep the public informed of new initiatives, significant issues, and decisions of public interest. DOE public information offices will provide information upon request.

VII.A (7)

Comment - A commentor commends the State of Idaho INEEL Oversight Program for acting as a cooperating agency on this EIS and expresses hope that the state representatives will be extremely careful about making the transition from cooperator to regulator.

Response - The State of Idaho shares the commentor's concern regarding its dual role as a regulator and a cooperating agency with respect to this EIS. In both cases, state representatives must remain independent, represent the state's interests, and within their authority, act to protect human health and the environment. However, by cooperating with DOE toward the mutual goal of producing an adequate EIS, the state must also work diligently to maintain objectivity so as not to compromise the subsequent review of permit applications for facilities selected by DOE through this EIS process. Regulators must conduct permitting and enforcement activities related to the decisions DOE makes as a result of this EIS in accordance with applicable laws and regulations.

One of the ways the state worked to preserve objectivity was by assigning the project lead to the INEEL Oversight Program, which is not a regulatory program. INEEL Oversight Program scientists and engineers served as the state's primary technical reviewers of this EIS, and worked on this EIS, reviewing data and participating in verification and validation efforts. Representatives from the regulatory agencies were recruited to review portions of this EIS that describe state law and implementing regulations (Chapter 6). In this capacity, they made sure that applicable law and related state policy were accurately characterized.

Further, it was necessary to involve state regulators in discussions and reviews of EIS facility disposition alternatives. Except for clean closure, which would remove all hazardous and radioactive contaminants to levels that are indistinguishable from background, these alternatives involve leaving residues and/or wastes in an area that was contaminated by past practices at INTEC. This area is also undergoing a remedial investigation and remediation pursuant to CERCLA. Therefore, in presenting the facility disposition alternatives and evaluating potential environmental consequences it was important to coordinate EIS and CERCLA perspectives, evaluate cumulative environmental impacts, and address related stakeholder concerns. In all cases where state regulators were involved, their contributions were confined to duties that did not compromise their responsibilities.

VII.A (8)

Comment - A commentor remarks that whenever there is a state equivalent to the National Environmental Policy Act, as is the case in the State of Washington, DOE must also comply with the state law.

Response - State environmental policy acts, such as the one adopted in Washington State, apply to actions that involve decisions made on the part of that state and local jurisdictions within that state. Although these acts differ among states that have them, they are all based on the federal National Environmental Policy Act model and are very similar in requirements and processes. The State of Idaho does not have such a law.

When a federal agency like DOE applies to the State of Washington for a permit, the state determines whether issuing the permit could result in significant adverse environmental impacts. A finding in the affirmative would require DOE to prepare an environmental impact statement to address those concerns before the state would make a decision on the permit. In instances in which a federal agency is already preparing an environmental impact statement, it is not uncommon for the state and the federal agency to cooperate in its preparation, making sure that the document meets the requirements of both. Or, as an alternative, one agency prepares the environmental impact statement and the other adopts it, along with preparation of any amendments or supplements that might be necessary for its purposes. Under these circumstances, DOE could use an EIS to make its decision to take an action. And, the same EIS could be used by the state in its review of permit applications that DOE must submit for approval before implementing the proposed action.

VII.B <u>CERCLA</u>

VII.B (1)

Comment - Several commentors state that DOE should coordinate treatment to address all forms of contamination including groundwater, soil, facilities, and HLW. One commentor states that the consequences of cleanup should be examined so that the problem of dealing with contaminated soils in the future is not compounded. Another commentor states that soil contamination from previous INTEC Tank Farm piping system releases is being evaluated by the CERCLA program, but that this issue is not being considered in the EIS.

Response - DOE is aware of the benefits of coordinating waste treatment activities and has addressed this issue in this EIS with respect to INTEC. As explained in Section 6.3.2 of this EIS, the waste treatment and facility disposition activities selected by DOE would be closely coordinated with ongoing CERCLA and other waste management and environmental restoration actions at INTEC. The releases from the INTEC Tank Farm piping system are being considered in this EIS from a cumulative environmental impacts standpoint. See responses to comment summaries IV.A (2), IV.C (2), IV.C (3).

VII.B (2)

Comment - A commentor states that remediation of the INTEC Tank Farm soils must be conducted in accordance with the Nuclear Regulatory Commission HLW disposal requirements as well as Applicable or Relevant and Appropriate Requirements under the CERCLA program.

Response - DOE, not the Nuclear Regulatory Commission, is responsible for managing contaminated soils at INTEC. The soils will be managed in accordance with DOE orders and other applicable or relevant and appropriate requirements agreed to by EPA and the State of Idaho and specified in the CERCLA Record of Decision.

VII.B (3)

Comment - Several commentors recommend that the cleanup be conducted on a prioritized schedule and that the highest risk waste at the INEEL be dealt with first. One commentor adds that the liquid waste at INTEC should be a high priority.

Response - Remediation of contaminated sites at the INEEL is proceeding on a schedule under CERCLA. The radioactive liquid waste in the INTEC Tank Farm represents a higher near-term risk than the calcine in the bin sets under non-accident conditions. Except for the No Action Alternative, all of the waste processing alternatives evaluated in this EIS would treat the liquid waste in the INTEC Tank Farm first. The State of Idaho believes the liquid mixed transuranic waste/SBW in the tanks could present the highest long-term risk and agrees it should be dealt with first. The National Academy of Sciences also recommends treating the liquid mixed transuranic waste/SBW first.

VII.C <u>RCRA</u>

VII.C (1)

Comment - A commentor states that the DOE document, "Regulatory Analysis and Proposed Path Forward for INEEL High-Level Waste Program," is a shocking rerun of the terminated Hanford tank waste grouting program. The commentor also refers to DOE's actions at the Savannah River Site and the INEEL's intent to illegally delist HLW at the Tank Farm.

Response - The regulatory analysis document that the commentor refers to was developed to determine the appropriate list of hazardous waste codes for the INTEC Tank Farm waste. The analysis resulted in four listed waste codes comprising nine listed waste constituents. As a result of the document, the revised list of RCRA listed waste constituents has been identified and presented to the State of Idaho for review and concurrence. Once concurrence is reached, a plan for future management of this waste can be determined. With regard to delisting of waste codes, this EIS discusses in detail the EPA-approved process DOE would follow if the INEEL mixed HLW is to be delisted before disposal. See Sections 6.3.2.1 and 6.3.2.3 of this EIS.

Activities at the Savannah River Site and the Hanford grouting program are outside of the scope of this EIS.

VII.C (2)

Comment - A commentor recommends devising a strategy that will allow acceptance of hazardous materials in a final repository.

Response - DOE's strategy for managing hazardous waste disposal in the proposed geologic repository is addressed in Section 6.3.2.1 of this EIS. At this time, the strategy involves obtaining concurrence from the State of Idaho on hazardous waste codes and pursuing a delisting effort for listed codes associated with the mixed HLW destined for the proposed HLW geologic repository.

VII.C (3)

Comment - A commentor states that the characteristics of the remaining liquid SBW are sufficiently different from waste calcined in the past that previous emission data would not be applicable to a RCRA permitting process.

Response - DOE recognizes that mixed transuranic waste/SBW is different from the mixed HLW that was previously calcined at INTEC. One of the reasons for operating the calciner up to June 1, 2000, was to obtain and characterize offgas samples from mixed transuranic waste/SBW processing campaigns. The data collected would be used in the authorization process if DOE were to decide to calcine the remaining mixed transuranic waste/SBW at INTEC. See also response to comment summaries in III.A.

VII.C (4)

Comment - A commentor states that the high-level liquid waste in the Tank Farm is considered "mixed hazardous waste," yet DOE is not complying with legal requirements, nor is the state or the EPA adequately exercising their regulatory authority.

Response - As discussed in Chapter 1 of this EIS, DOE must decide how to treat the liquids so DOE can cease use of the tanks by December 2012 in accordance with the Notice of Noncompliance Consent Order. Ceasing use of the tanks, which do not have compliant secondary containment and, therefore, do not comply with hazardous waste regulation, is a priority for DOE and the State of Idaho. DOE could also meet its commitment to cease use of the underground tanks by employing compliant tanks to store any liquid remaining after 2012. The EPA and the State of Idaho have adequately exercised their regulatory authority.

VII.D Settlement Agreement Consent Order

VII.D (1)

Comment - Commentors caution against adherence to Settlement Agreement/Consent Order provisions at the expense of public health and the environment. Specifically, commentors stress the need to establish a more realistic schedule that gives DOE time to plan and implement a HLW treatment program that protects Idaho and its environment.

Response - DOE's plan and schedule with the State of Idaho under the Settlement Agreement/Consent Order for waste treatment at INEEL is contemplated to be completed by a target date of December 31, 2035. DOE intends to aggressively pursue the means to implement the Settlement Agreement/Consent Order because it is in the best interest of public health and the environment. Protection of human health and the environment is the primary impetus behind the Settlement Agreement/Consent Order. By its implementation, radioactive liquid would be removed from tanks that do not meet regulations, thus reducing the risk of contamination to the Snake River Plain Aquifer. Further, DOE agrees to place the mixed transuranic waste/SBW and mixed HLW calcine in a form suitable for transport to a disposal or storage facility outside Idaho. DOE successfully calcined all of the liquid mixed HLW in the tanks and commenced calcination of the mixed transuranic waste/SBW, in accordance with the Settlement Agreement/Consent Order milestones, prior to placing the calciner in standby.

All treatment alternatives evaluated in this EIS would pose a small risk to public health and the environment during the years of operation, eliminate risks to the groundwater, put wastes into a solid form suitable for disposal, and meet the Settlement Agreement/Consent Order road-ready target date of December 31, 2035. Only the No Action and Continued Current Operations alternatives, which would leave waste in storage after 2035, could result in long-term risks to public health and the environment.

VII.D (2)

Comment - Commentors ask whether the state's concurrence on the Draft EIS is an indication of the state's willingness to change the Settlement Agreement/Consent Order. Further, if changes are not made to this agreement, how would DOE solve the HLW issues? A commentor states that, in any event, the public must be kept informed of DOE plans.

Response - One of the primary reasons the State of Idaho agreed to be a cooperating agency is Section E6 of the Settlement Agreement/Consent Order, which directs both DOE and the State to begin negotiation on a plan and schedule for the treatment of calcined waste by December 31, 1999. Both parties agree that this milestone was met by working together on this EIS, which evaluates alternative ways to prepare the calcine so that it will be suitable for disposal.

The State of Idaho was aware that DOE was also preparing the EIS to take a comprehensive look at the entire HLW program at INTEC and that this evaluation could form the basis for proposals to modify the Settlement Agreement/Consent Order, as provided by Section J4 of the agreement, which reads:

"In the event any required National Environmental Policy Act 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. If the State refuses to accept the requested modification, DOE or the Navy may seek relief from the Court. On motion of any party, the Court may extend the time for DOE or the Navy to perform until the Court has decided whether to grant relief. If the Court determines that the State has unreasonably withheld approval, the Agreement shall be conformed to the selected action. If the Court determines that the State has reasonably withheld approval, the time for DOE or the Navy to perform the action at issue shall be as set forth in this Agreement and subject to enforcement as set forth section in Section K.1."

The State of Idaho concurred on the EIS as a cooperating agency. Concurrence means that state representatives have participated in the development, review, and preparation of the document and found it to adequately analyze the environmental issues it addresses as required by Council on Environmental Quality guidance. However, the EIS itself does not make decisions, and the State's concurrence on the EIS does not predetermine its reaction to any agreement modifications DOE may propose. The State of Idaho is willing to consider proposed changes to the Settlement Agreement/Consent Order that would provide more environmental benefits within the same timeframe. The Planning Basis Option in the EIS describes how DOE proposes to manage its HLW issues without modifying the Settlement Agreement/Consent Order.

DOE will announce its plans for managing HLW at INTEC in a Record of Decision published in the Federal Register. If these plans are inconsistent with the Settlement Agreement/Consent Order, they may require negotiations with the State of Idaho. Notification of the availability of the decision will be sent to recipients of the Final EIS and to anyone who expresses an interest in receiving this information. The public is always encouraged to contact DOE or the State of Idaho regarding DOE's plans and status of implementation.

VII.D (3)

Comment - A commentor suggests that the EIS analyze all reasonable and technically viable alternatives, not just those considered politically feasible or those meeting Settlement Agreement/Consent Order milestones.

One commentor states the opinion that the term "road ready" defines a political goal that is driven by a political agenda. Another commentor asks if Idaho Department of Environmental Quality and EPA regulatory standards are based on scientific and health considerations or on political considerations. A commentor states that DOE's mission is to get reprocessing waste "road ready" and not "make work" for thousands of employees or justify dumb decisions made elsewhere with respect to implementing/siting repositories and categorizing radioactive wastes.

Response - DOE believes that this EIS presents the range of reasonable alternatives, the selection of which was not constrained by political considerations or limited by the requirements of the Settlement Agreement/Consent Order. Among the alternatives analyzed in this EIS, only the Planning Basis Option of the Separations Alternative reflects verbatim agreement commitments, as well as other legal requirements and associated DOE decisions. One of the primary purposes for preparing this EIS is to address alternative methods of treating the remaining liquid mixed transuranic waste/SBW in the underground tanks and preparing the mixed HLW calcine so that it will be suitable for disposal. It was recognized that alternative waste treatment methods may necessitate changes in the Settlement Agreement/Consent Order, and this EIS identifies in each case how compliance would be affected. Further, additional alternatives proposed through the public comment process were evaluated after release of the Draft EIS to determine if any provided an advantage over those already analyzed. In response to public comment, a new option was added to this EIS. This option under the Non-Separations Alternative is called Steam Reforming and includes direct disposal of the mixed HLW calcine in the geologic repository. DOE continues to stay informed about potential new waste management technologies and, when appropriate, conducts evaluations to determine if such technologies could optimize waste management operations.

The term "road ready" describes the condition in which HLW may be safely transported and accepted by a designated storage or disposal facility. It is a term that DOE and the State of Idaho use to describe the INEEL treated mixed HLW by the target date of December 2035. This date was agreed upon because this is when DOE believes it can reasonably accomplish the task. This date was negotiated by political entities. The overriding concern was human health and protection of the environment, not to make work for employees. In performing its activities, DOE complies with applicable regulatory standards established to protect human health and the environment. Some relevant agencies responsible for ensuring compliance include the EPA, the U.S. Department of Transportation, and the State of Idaho. Environmental regulatory standards are based on scientific and health considerations promulgated through processes which include public input. See response to comment summary VII.D (1).

VII.D (4)

Comment - A commentor states that items in the Draft EIS Summary relating to the Settlement Agreement/Consent Order require status updates and/or clarification.

Response - The EIS Summary listing elements of the Settlement Agreement/Consent Order pertaining to HLW management has been updated.

VII.D (5)

Comment - A commentor expresses disbelief that the State of Idaho has the ability to make the DOE live up to the legacy of promises it has made.

Response - The Settlement Agreement/Consent Order, which is under the continuing jurisdiction of the U.S. District Court in Idaho, contains enforcement provisions if DOE does not comply with its obligations. These provisions include the stoppage of DOE spent nuclear fuel shipments into Idaho if DOE does not meet agreement requirements. The court may also use all of its powers to enforce certain obligations, including DOE's obligation, by a target date of December 2035 to have all of the INEEL's mixed HLW ready to leave Idaho.

V II.D (6)

Comment - Commentors state that DOE should select an alternative that meets the requirements of the Settlement Agreement/Consent Order and that DOE should:

- Treat all liquid and calcined wastes and remove them (including tank heels) from the INEEL.

- Close the INTEC Tank Farm as they are emptied (focusing first on the pillar and panel tanks).

- Make treated waste ready for shipment out of Idaho by 2035.

- Retrieve, solidify, and store remaining liquid waste to reduce threats to the groundwater.

- Immobilize all wastes as soon as possible to reduce cost and make treatment easier.

- Adhere to the provisions of this agreement, including getting the waste out of Idaho.

- Maintain deadlines.

- Calcine all the liquid waste as promised; this technology is the only one that will enable DOE to meet its obligation of removing the SBW from the tanks by 2012.

- Combine liquid waste and HLW calcine in bin sets where it can be retrieved, treated, and made ready to leave Idaho by 2035.

- Get the waste out of Idaho somehow.

Commentors also say that any alternative that leaves this waste permanently in Idaho, such as grouting waste in storage tanks, would be inconsistent with the provisions of the Settlement Agreement/Consent Order.

Response - In accordance with the Settlement Agreement/Consent Order, DOE has already completed the following milestones relating to management of HLW:

- Complete calcination of liquid mixed HLW by June 30, 1998 (completed February 22, 1998).

- Begin calcination of liquid mixed transuranic waste/SBW by June 2001 (completed February 1998).

- Start negotiations with the State of Idaho regarding a plan and schedule for treating calcined waste by December 31, 1999 (actual, September 1999). The plan and schedule for treating INEEL HLW would be established by the Record of Decision for this EIS and would be the basis for consideration of associated Settlement Agreement/Consent Order matters.

DOE is committed to complying with the Settlement Agreement/Consent Order, and the State of Idaho agrees with commentors that deadlines are important to ensuring continued progress in treating and removing waste from Idaho. As noted in this EIS, Section J4 of the Settlement Agreement/Consent Order provides a process whereby DOE can propose changes to the agreement based on a required National Environmental Policy Act analysis. See response to comment summary VII.D (2). Based on this EIS, DOE could request a modification to the Settlement Agreement/Consent Order, such as using a technology other than calcination to solidify mixed transuranic waste/SBW. While this EIS indicates that most alternatives with or without the calciner could fail to meet the December 2012 date for removal of the liquid mixed transuranic/SBW from the RCRA non-compliant tanks, there were many assumptions built into those schedules, which may or may not materialize. Nevertheless, any liquid remaining above heel level could be transferred to newly constructed or upgraded compliant tanks which would enable DOE to cease use of noncompliant underground tanks on schedule. Thus, based on this EIS, DOE could propose a modification to the Settlement Agreement/Consent Order that would be consistent with DOE's decision regarding treatment of mixed transuranic waste/SBW as documented in the Record of Decision resulting from this EIS. The State of Idaho will carefully evaluate any proposed modification to determine whether it is reasonable.

Combining mixed transuranic waste/SBW and mixed HLW calcine is an alternative evaluated in this EIS. However, it is not the only alternative that would enable DOE to treat the waste by the target date of December 2035 to have it ready to leave Idaho. With the exception of the No Action and Continued Current Operations alternatives, all the other waste processing alternatives would meet the 2035 target date, whether involving separations or non-separations.

The State of Idaho's postion is that alternatives that involve disposal of grouted waste in below grade tanks in the Tank Farm at INTEC would be a violation of the Settlement Agreement/Consent Order. Any residual hazardous waste contamination associated with facilities would be addressed through state approved facility RCRA closure plans following public review.

VII.E Tribal Issues

VII.E (1)

Comment - Commentors, representing the Shoshone-Bannock Tribes, state that DOE and the federal government must honor trust and treaty agreements with the Tribes, and the Tribes have a right to say what is done on their ancestral lands. The commentors also suggest that a memorandum of understanding would ensure protection of the Fort Hall Indian Reservation and its people.

Response - Both Executive and DOE orders recognize the trust responsibilities and tribal sovereignty related to the lands, and the necessity for consultation and communication. DOE works with the tribes on a government-to-government basis. DOE has entered into an Agreement in Principle with the Shoshone-Bannock Tribes that provides a process for coordination and consultation in accordance with trust responsibilities. As stewards of federal lands, DOE endeavors, in collaboration with the tribes, to manage the natural and cultural resources at INEEL consistent with the principles of ecosystem management and resource protection in accordance with applicable federal laws, regulations, policies, and executive orders.

VII.E (2)

Comment - Commentors, representing the Shoshone-Bannock Tribes, request that DOE:

- Hold an official consultation with the tribes to discuss technical questions and comments as well as to directly communicate concerns and special needs of the tribes with regard to trust resources.

- Provide funds so the tribes can hire expertise and properly participate in the EIS process and implementation.

- Ensure that other federal agencies (such as the Department of Interior) with trust responsibilities to the tribes will be involved in the EIS process, since DOE chose not to include the tribes as a cooperating agency.

Response - DOE recognizes the concerns of the Shoshone-Bannock Tribes and involved them early and frequently during preparation of this EIS to ensure that tribal concerns and issues were documented. This involvement included hearings before and during this EIS scoping period, subsequent briefings and open discussions at tribal facilities, and a public hearing on the Fort Hall Reservation. DOE entered into an Agreement in Principle with the tribes that provides a process for consultation under the National Environmental Policy Act, and DOE conducted consultation in accordance with this agreement. The agreement also includes the process for the tribes to obtain the needed resources and expertise for reviews or involvement in DOE activities. Other federal agencies such as the Department of Interior are provided the opportunity to comment on DOE EISs. DOE believes that a memorandum of understanding between DOE and the Department of Interior is not necessary at this time, because DOE has already recognized its trust responsibilities and signed the Agreement in Principle with the tribes.

VII.E (3)

Comment - Commentors state regional Native American concerns, including the following:

- HLW management could result in long-term impacts to the reservation because it is located near the INEEL.

- The tribes do not have the ability to readily move from the reservation.

- DOE will leave the land contaminated and, thus, interfere with their aboriginal uses of the land.

- DOE should comply with scheduled commitments, including removing HLW from Idaho by 2035.

Response - Section 4.7.3 of this EIS shows that current offsite doses from INEEL operations are below EPA dose limits established for the protection of the public and the environment. This has been substantiated by independent Environmental Surveillance Reports produced by the State of Idaho INEEL Oversight Program, which has included air monitoring results sampled by the Shoshone-Bannock Tribes at the Fort Hall Reservation.

This EIS estimates the potential cumulative increase to baseline offsite doses (discussed above) from activities associated with the alternatives evaluated. Sections 5.2.6, 5.2.8, and 5.2.10 of this EIS discuss potential environmental impacts of operational releases on human health of offsite populations and the environment. As shown in these environmental consequence evaluations, none of the alternatives would result in significant adverse environmental impacts to offsite populations such as those residing at the Fort Hall Reservation.

Environmental impacts from high-consequence, low-probability accident scenarios (Section 5.2.14) would be significant should they occur, but the probability of one of these accidents occurring is extremely low (Table C.4-2). The potential impact to specific populations such as the Fort Hall Reservation would be subject to the meteorological conditions at the time of the accident. In the unlikely event of a transportation accident, the random nature of transportation accidents with respect to timing and location makes it impossible to predict what populations would be affected. Based on the analysis in this EIS, the environmental impacts of transportation are expected to be low on the population as a whole.

Due to past operations, some contamination would remain at the INEEL Site for the foreseeable future. The *INEEL Comprehensive Facility and Land Use Plan* (DOE-ID 10514), which was developed with public and tribal participation, notes that the INEEL would remain under government management and control at least until 2095. Further, the federal government would have to maintain control of areas that pose a significant risk to the public as noted on Table 4 of the Land Use Plan. Although the INEEL site is included in the traditional and aboriginal areas frequented by the Shoshone-Bannock people, the INEEL does not lie within any of the land boundaries established by the Fort Bridger Treaty of 1868. As discussed in Section 4.2.1 of this EIS, the INEEL has been set aside as occupied land; hence, it is not open to unrestricted gathering and recreational activities.

DOE is committed to meeting the 2035 milestone for having the HLW ready for disposal.

VIII ENVIRONMENTAL IMPACTS

VIII.A General: Environmental Consequences

VIII.A (1)

Comment - A commentor expresses the opinion that the EIS should address questions such as how much radiation or hazardous material would result from activities proposed therein, what damage it would do, and how many people would be injured or affected.

Response - Section 5.2 and 5.3 of this EIS addresses the environmental impacts of hazardous releases including radiation. Radiation exposures from waste processing and facilities disposition alternatives are in addition to exposures that occur from natural background sources such as cosmic rays, radioactive potassium-40 within the body (involuntary exposures), and man-made sources such as chest or dental x-rays (voluntary exposures). In Idaho, radiation that includes voluntary and involuntary exposures is about 360 millirem per year. Over a 72-year lifetime, an Idahoan thus receives an exposure of about 26 rem (26,000 millirem) from natural and voluntary background radiation exposures. By way of comparison, the dose to the maximally exposed offsite individual from implementation of the evaluated waste treatment alternatives would be a very small fraction of that received from voluntary and involuntary exposures of radiation. This EIS indicates that the maximum annual offsite dose would result from implementing either the Planning Basis or Hot Isostatic Pressed Waste options and is calculated to be 0.0018 millirem. This dose is well below the EPA standard of a total of 10 millirem per year from all airborne sources at the INEEL. In recent years, the total annual airborne emission level of radionuclides from the INEEL was about 0.031 millirem in 1996. This dose would result in a cumulative lifetime dose (72 years) of about 2 millirem. Table 5.2-20 in this EIS summarizes the doses from air emissions and the associated health effects.

VIII.A (2)

Comment - Commentors express concern that focusing on worst-case bounding scenarios without including best-engineering estimates for radiological doses represents a barrier to making rational assessments of the HLW treatment alternatives, and provides a distorted and unrealistic perception to the public, impairing the public's ability to intelligently evaluate alternatives and their attendant risks. Commentors request that an objective rating scale be used in looking at accident consequences, contamination scenarios, environmental impacts, and health risks to workers and the public.

A commentor considers worst-case or bounding-case analysis of environmental impacts to be too conservative and likely to overstate or exaggerate environmental impacts. The commentor advises that in addition to a worst-case analysis, a best-engineering judgment approach should be used that more closely estimates projected actual environmental impacts.

Response - DOE acknowledges that the EIS focuses on worst case or bounding accidents. This is appropriate so DOE and the public can look at the various alternatives and their associated risks on an equivalent basis. However, when evaluating potential environmental impacts from alternatives, DOE uses neither worst-case analyses nor best-engineering estimates. Rather, DOE evaluates reasonably foreseeable bounding accidents, as well as unmitigated normal and abnormal operations, in order to allow an unbiased and meaningful comparison of alternatives. The resulting environmental impacts, presented in this EIS, are greater than the actual environmental impacts that would occur when engineered safeguards and mitigative systems are factored into facility designs.

Environmental impacts projected in this EIS from accident scenarios are based on models, or other methods of analyses and use assumptions considered to be conservative. Further, it would be misleading to presume that a future environmental impact can be calculated exactly. It is reasonable, however, to characterize future possible environmental impacts conservatively when, as in this EIS, it is stated up-front that the analysis is conservative and the parameters and method(s) of analysis used, along with the uncertainties and limitations, are identified. Whereas DOE is aware that, by and large, the environmental impacts estimated in this EIS are overstated, DOE believes it is important to maintain this conservatism to reduce the potential to understate an impact of potential significance. Refer to Section 5.2.14 and 5.3.12 in this EIS.

VIII.A (3)

Comment - A commentor maintains that there is a need for pilot demonstrations of technologies and emission controls prior to operations.

Response - DOE conducts pilot demonstrations when appropriate prior to placing technologies and processes in full operation. Processes that treat hazardous materials require an appropriate permit from the State of Idaho and undergo test runs in order to prove that emission requirements would be met prior to full operation.

VIII.A (4)

Comment - A commentor states that the cardinal rule is "Don't spread nuclear waste."

Response - Comment noted.

VIII.A (5)

Comment - A commentor states that the priorities of the government must be changed. The public should be made or must be made aware of the threat posed by installations like Hanford and INEEL.

Response - DOE's process for implementing the National Environmental Policy Act, under which this EIS is prepared, is designed to inform the public of proposed federal actions and to solicit public comments and concerns. The EIS also supports DOE in making informed decisions by evaluating the environmental impacts of reasonable alternatives for addressing proposed actions, with the benefit of public review and comment. Thus, informed decisions help federal agencies such as DOE to assign priorities and accomplish their missions in a safe and environmentally responsible manner. DOE's goal is to maintain open communication and to present information in an understandable format.

VIII.A (6)

Comment - Commentors express concerns about the validity of data and/or methods used in the EIS, stating opinions that:

- The EIS perpetuates inaccuracies because invalid methods gain credibility by appearing in a government document.
- Incorrect and inappropriate data in the Draft EIS compromise the credibility of other analyses in the EIS that have been performed properly.

Response - All analytical models and methods of analysis used in this EIS are referenced and documented, and there are no conclusions in this EIS that are not supported by appropriate references or identified as being based on judgment. The standards used in preparing this EIS are the same as those used in scientific and academic peer review. There are issues dealt with in this EIS that contain unknowns or various degrees of uncertainty, and these are fully disclosed.

The data in this EIS were prepared, assembled, and analyzed using appropriate quality assurance and quality control standards, and references used in this EIS are part of the administrative record file and are available for public review. Where there are assumptions, or if uncertainty exists with regard to the reliability of data, it is so stated in this EIS. There are a number of refinements in presentation and in the data included in this EIS resulting from public comment; these changes are identified in the responses. DOE has made additional changes as new or additional data was developed following publication of the Draft EIS. In no case has any data been intentionally included in this EIS that is incorrect or inappropriate.

VIII.A (7)

Comment - A commentor requests that the EIS address the actual effects on the people, land, and crops of the State of Idaho.

Response - Past effects of INEEL operations based on sampling, measurements, operating records, and projected effects based on analyses of data, are addressed in the SNF & INEL EIS, and in Chapter 4 (Affected Environment) of this EIS. Chapter 5 of this EIS (Environmental Consequences) analyzes the anticipated effects that implementation of the alternatives would have on the people, land, and crops of the affected region in conjunction with cumulative environmental impacts of any ongoing or reasonably foreseeable activities. The effects on people in the region are given in terms of economic impacts in Section 5.2.2, and in terms of health expressed as latent cancer fatalities or fatalities resulting from accidents in Sections 5.2.9, 5.2.10, and 5.2.14. Effects on soils and vegetation are presented in Section 5.2.6.6 of this EIS (Other Air-Quality-Related Values) under the "Impacts to Soils and Vegetation" heading, and in Section 5.2.8 (Ecological Resources). See also Section 5.2.11 (Environmental Justice), which evaluates whether there could be disproportionately high and adverse impacts to human health and the environment for minority or low-income populations within a 50-mile radius of INTEC. These analyses use conservative assumptions, and the potential effects on people, land, and crops are based on probabilities. The level of analysis used to arrive at a comparative evaluation of environmental impacts among alternatives is appropriate for an EIS.

VIII.A (8)

Comment - A commentor expresses opinions on the quality of the EIS and concerns that the study does not address the problem adequately.

Response - DOE and the State of Idaho, as a cooperating agency, consider the analyses presented in both the Draft and Final EIS to be adequate. Additional analyses and refinements were incorporated after publication of the Draft EIS in response to public comment and determinations that additional information would be needed. Examples include further clarification of source terms in mixed HLW and mixed transuranic waste/SBW, subsequent changes to accident analyses, and long-term environmental impacts of facility disposition alternatives. These additional analyses are incorporated into this EIS as summarized text and updated appendices.

VIII.A (9)

Comment - A commentor raises a concern about burial of any waste over the Idaho aquifer and any atmospheric emissions resulting from the proposed action.

Response - This EIS addresses the range of reasonable alternatives that, with the exception of the No Action and Continued Current Operations alternatives, are designed to both prepare mixed HLW for safe onsite storage (as appropriate) and for transport out of Idaho for storage or disposal elsewhere. Though wastes in liquid form are not necessarily the most hazardous waste, they tend to be more difficult to contain and, given their relative mobility, represent the greatest potential threat to migrate to the aquifer. Alternatives analyzed in this EIS focus on preparing mixed transuranic waste/SBW and mixed HLW calcine so that they are in a form suitable for transport out of state for disposal, and onsite storage on an interim basis.

Implementing treatment alternatives in this EIS would result in air emissions; however, such emissions would be within regulatory standards designed to ensure protection of human health and the environment. In addition, a range of reasonably foreseeable facility accidents have been postulated and evaluated.; In the opinion of DOE and the State of Idaho, these near-term risks during the relatively short timeframe of treatment operations are more than offset by the reduction of long-term risk presented by onsite storage of mixed HLW calcine and mixed transuranic waste/SBW.

In this EIS, the potential environmental impacts of leaving waste over the aquifer are addressed in Section 5.3.5 for normal operations and in Section 5.2.14 for accidents. See also response to comment summaries in VIII.C regarding the aquifer. The potential environmental impacts of air emissions on air quality are presented in Section 5.2.6 for implementing the waste processing alternatives, and Section 5.3.4 for facility disposition alternatives. See also response to comment summaries in VIII.B regarding air quality.

VIII.A (10)

Comment - Commentors state that there is a need to assume short-term risk if necessary to ensure long-term safety, with one commentor recommending facility closure based on usage and risks to the environment on a case by case basis.

Response - The EIS discloses in Appendix C.4 that, during implementation of a waste processing alternative, there could be a temporary increase in risk to human health and the environment. However, avoiding these short-term risks by leaving mixed HLW calcine and mixed transuranic waste/SBW untreated and stored indefinitely at the INEEL poses long-term risks to human health and the environment. As part of the decision making process DOE will compare the risks and determine how best to balance short- and long-term risk while achieving DOE's objectives.

VIII.A (11)

Comment - A commentor states that the EIS makes reference to risk factors from both the International Commission on Radiological Protection and the National Council on Radiation Protection and Measurements, yet reference should only be made to the National Council on Radiation Protection and Measurements which reviews and decides upon

International Commission on Radiological Protection recommendations for adoption in the United States. In addition, the commentor states that:

- The National Council on Radiation Protection and Measurements risk factors are for populations, not individuals as presented in the EIS. Thus, the calculation of latent cancer fatalities to the maximally exposed individual and noninvolved worker should be removed from the EIS.
- National Council on Radiation Protection and Measurements risk factors are only valid within a stochastic range where cancers dominate, not at levels where non-cancerous deterministic effects dominate (where death from acute radiation effects preclude the survival time necessary to even develop a cancer).
- Discussion of collective dose and its effects on populations is oversimplified and should be revised to include information regarding uncertainties of radiation risk factors, to correct the dose rate limitation, and to include baseline cancer risk data.
- This information should be referred to by cross-reference throughout the document. The commentor cites an example of oversimplification where risk factors for dose rates of less than 10 rem/hr for a standard accident analysis default time of 2 hours are simply referred to as "doses of less than 20 rem" in the explanatory EIS text box.

The commentor also states the opinion that:

- Calculation of latent cancer fatalities well above routine radiation protection levels in this EIS is a clear example of the use of scientific values outside their valid range.
- Latent cancer fatalities from low radiation exposures should be compared to statistical background cancer data in addition to the radiation level being compared to average local human exposure from voluntary and natural sources, in order to provide a useful basis of comparison.

Response - DOE uses National Council on Radiation Protection and Measurements, 1993 "Limitations of Exposure to Ionizing Radiation" Report 116 as a basis for estimating effects of low-level radiation exposures, which Section 5.2.10 and Appendix C.3 of this EIS address. In addition, this report states that the uncertainty in risk factors estimated from exposure at high dose and high dose rate is about a factor of two. Uncertainty extrapolation of risks from exposures at high dose to exposure at low dose and low dose rate is estimated to be an additional factor of two or more since, at very low doses, the possibility that there is no risk cannot be excluded. Most of the risk estimates adopted by this report are the same as those recommended by the International Commission on Radiological Protection. As indicated in Section 5.2.10 of this EIS, the National Council on Radiation Protection and Measurements risk factors are used for doses less than 20 rem, where cancer is the dominant health effect. This is an adequate level of analysis for informing the public and enabling DOE to make informed decisions as to individual risks associated with alternatives evaluated in this EIS. DOE takes a population-based risk and applies it to an individual to conservatively bias the health effects and provide perspective on potential health effects. However, both DOE and the Nuclear Regulatory Commission limit radiation exposures to workers to 5 rem per year, which is many times the exposures predicted to result from any of the alternatives analyzed in this EIS. Even this level of exposure causes no known acute effects and, for that reason, DOE uses population doses to estimate latent cancer fatalities from low-level radiation exposures.

The EIS does discuss background regional cancer statistics in Section 5.4.3. This section explains that the maximally exposed individual received a radiation dose of 0.031 millirem in 1996 from INEEL operations. This compares to a radiation dose of 360 millirem per year from naturally occurring background radiation for individuals residing near the INEEL. Using standard risk factors for estimating fatal cancers from a given calculated exposure, a value of 0.0005 fatal cancers would be obtained as a result of cumulative radiation dose received by the population within 50 miles of INTEC from existing HLW operations, treatment of mixed HLW, and other reasonably foreseeable actions at the INEEL. This compares to the natural lifetime incidence of cancer in the same population from all other causes of about 24,000 fatal cancers. DOE believes that adding cross references in the document would not add to the understanding of this topic.

VIII.B Air Quality

VIII.B (1)

Comment - A commentor states that the Defense Nuclear Facilities Safety Board conducted an audit of the Department's high efficiency particulate air (HEPA) filter program and that DOE has shut down its facility for testing of new filters and has no funding to correct material deficiencies with the filter test system and place it back in operation. The commentor asks how the Department will resolve the issues identified by the Defense Nuclear Facilities Safety Board in its report and be able to test the HEPA filters necessary for implementing the Draft EIS alternatives.

Response - The Oak Ridge HEPA filter pre-test facility certifies all INEEL filters prior to use. The Oak Ridge facility is funded on a yearly basis; DOE has contingency plans to test filters at the INEEL if this facility is not funded.

DOE recently developed a plan to address HEPA filter issues, and it was included as an enclosure to a December 6, 1999, letter from the Secretary of Energy to the Chairman of the Defense Nuclear Facilities Safety Board (Board) (available at http://www.deprep.org). Subsequently, the Board issued a formal recommendation to DOE regarding HEPA filters and other issues. This Recommendation, 2000-2, was accepted by DOE, and the remaining open items from the 1999 HEPA filter action plan were incorporated into DOE's Implementation Plan for Recommendation 2000-2, dated October 31, 2000, and also available at the above web site. Although DOE is committed to taking appropriate action to maintain the HEPA filters employed in its facilities, it is important to note that calculations conducted to determine the environmental impacts of the facility accident scenarios in the EIS do not take credit for the existence of HEPA filters as emission control devices.

VIII.B (2)

Comment - Commentors state that air pollution is unsafe and that the public doesn't approve of new releases to the air. Other commentors express opinions, including the following, about the models used to calculate air impacts:

- Air models used in the Draft EIS are incorrect. One commentor states that DOE should use the EPA CALPUFF modeling system to analyze impacts to the National Ambient Air Quality Standards, Class I increments, and acid deposition to receptors beyond 50 km, in particular the Yellowstone and Grand Teton National Parks.

- Craters of the Moon National Monument and Yellowstone and Grand Teton National Parks are reserved for the cleanest air, but nothing has been said about their air sheds.

- The EIS should address the air-quality-related values of far-field visible haze and acid deposition at the following Class I areas: Yellowstone and Grand Teton National Parks and the portion of Craters of the Moon National Monument that is greater than 50 km from the INEEL.

- Acid deposition analysis should address the impacts of total nitrogen and total sulfur.

- Far-field haze and acid deposition analyses should follow the guidelines in the Interagency Workgroup on Air Quality Modeling Phase 2 report.

- Human health and the health of all life forms are not the foremost consideration with the air dispersion models used in the Draft EIS.

- EIS air models should use on-site meteorological data with concurrent National Weather Service upper air or mixing height data. The commentor points out the upper air data is available from the National Climatic Data Center and recommends using the Salt Lake City mixing height data.

Some commentors also request information about how models are used to ensure air quality and want to know if data for Craters of the Moon National Monument are extrapolated to Yellowstone and Grand Teton National Parks.

Response - The purpose of the air dispersion models is to provide an indication, using methods based on sound technical principles, of the level of impact with respect to health-based standards promulgated under the Clean Air Act and its amendments. Thus, if the environmental impacts are within limits specified by standards, human health is considered to be adequately protected. Also, the Clean Air Act is designed to protect flora, fauna, and air-quality-related values, such as visibility. The air dispersion models and the health-based standards are both designed to be conservative and protective of human health and the environment.

For the actions evaluated in this EIS, appropriate measures would be incorporated into each project design to ensure that emissions would not exceed applicable standards. Also, DOE emphasizes that emissions resulting from the alternatives are a direct result of actions aimed at ensuring the isolation of radioactive wastes from the environment. In the broader context, the net benefit of these actions is protection of the environment.

The Industrial Source Complex model, which was used for this EIS, remains the most widely recommended and used model for complex air dispersion applications, and DOE considers this model well-suited for assessing comparative environmental impacts of alternative courses of action. In addition, DOE decided to use the CALPUFF model to assess air impacts of a bounding waste processing alternative (the Planning Basis Option) at National Park Service lands that are beyond 50 km (the maximum range for which the Industrial Source Complex model is valid) from the INTEC. The CALPUFF analyses would consider Prevention of Significant Deterioration increment consumption, regional haze, and far-field sulfur and nitrogen deposition.

Onsite surface meteorological data are used in the application of the air dispersion models. For CALPUFF modeling, upper air data using Salt Lake City mixing heights were used, and the results are reported in Section 5.2.6 and Appendix C.2 of the EIS. In addition, the CALPUFF modeling protocol was taken directly from the *Interagency Workgroup on Air Quality Modeling (IWAQM) Phase 2 Sumary Report and Recomendations for Modeling Long Range Transport Impacts* with additional guidance provided by the National Park Service, Denver, Colorado. CALPUFF was used to assess air quality impacts in Class I Areas that include Craters of the Moon, Yellowstone National Park, and Grand Teton National Park.

Air quality impacts at Craters of the Moon Wilderness Area were quantitatively evaluated in the Draft EIS, while only qualitative assessments were performed for the more distant Class I areas (Yellowstone and Grand Teton National Parks). As noted above, the level of analysis (in Section 5.2.6 of this EIS) has been increased by using the recently developed CALPUFF model to quantitatively assess environmental impacts at each of these areas. The assessed environmental impacts are those specified in state and federal regulations that apply to these areas, including Prevention of Significant Deterioration regulations, which are intended to ensure that air in these areas remain pristine. These assessments have been performed in consultation with air quality specialists from the National Park Service.

Air quality dispersion models are used here as tools to estimate potential downwind environmental impacts from alternative courses of action. The application of the models is site-specific using local meteorological, regional solar radiation, terrain data, estimates of emission rates, and source configuration. The models are designed to be conservative, i.e., to not underestimate air quality impacts. Prior to any construction activity, any major project or major modification would undergo additional review by the State of Idaho Department of Environmental Quality, which would issue a permit to construct or operate only after completion of the review and a determination that the operation would comply with all standards. Continuing compliance would be subject to regulatory oversight, which includes review of records, monitoring, and inspections.

VIII.B (3)

Comment - A commentor states that DOE lacks accurate data about emissions from the New Waste Calcining Facility.

Response - Air emission analysis in this EIS includes New Waste Calcining Facility emission data available at the time. Subsequent to the preparation of the Draft EIS, DOE was able to collect representative calciner off-gasses for a period of about a month at elevated operation temperatures of 500 and 600 degrees Celsius. However, current emissions data do not reflect the emissions that would be seen from the New Waste Calcining Facility after Maximum Achievable Control Technology upgrades which is how the facility would operate in those waste processing options analyzed in this EIS that involve calcining.

VIII.B (4)

Comment - Commentors express opinions about various risks ranging from mechanical failures to global harm, and state that Yellowstone National Park and Grand Teton National Park are national treasures and should be protected.

Response - DOE is concerned about the health of local and global ecosystems, including national parks, and realizes that all operations analyzed in this EIS present some element of risk to the environment.

Mechanical and process failures could occur and could have an impact on the environment. The EIS addresses the potential impacts to the environment under both normal operations and postulated abnormal events. Section 5.2.14 analyzes a range of reasonably foreseeable accidents that have the potential to harm workers, the public, or the environment. However, potential environmental impacts from normal and abnormal events are conservatively calculated in the EIS using minimal mitigative design measures, which in operational reality would be included with consequent reductions in environmental impacts.

To reduce risks associated with implementing activities such as those evaluated in this EIS, DOE Orders require a safety analysis report covering nuclear and non-nuclear operations, which governs operations conducted in facilities that could result in a hazard to workers or the public. The safety analysis report defines a safety envelope within which operations must occur.

VIII.B (5)

Comment - A commentor states that the idea that there is a standard that allows emissions (pollution) from facilities is unacceptable. The commentor also states that DOE should have a requirement of no releases.

Response - Air quality standards have been established to protect the public health and welfare. In addition, Clean Air Act stipulations pertaining to prevention of significant deterioration requires use of best available control technology to further reduce emissions. Council on Environmental Quality regulations require federal agencies to consider air emissions and other environmental impacts in National Environmental Policy Act documents supporting decisions regarding design and operation of facilities. The EIS identifies air emissions that could occur under the alternatives, including any alternative that involves new construction. As discussed in Section 6.2 of this EIS, DOE complies with the same laws and regulations as non-federal agencies. Projects associated with the waste processing alternatives can not go forward unless compliance with these laws and regulations can be demonstrated. Though DOE strives for minimal releases, a "no-release" policy is unachievable.

VIII.B (6)

Comment - A commentor expresses concern that monitoring of the New Waste Calcining Facility stack emissions has not been adequate, that the State of Idaho has never independently monitored the facility's stack emissions, and that, if the calciner is restarted, the EPA should review the adequacy of the monitoring required by the State of Idaho's Consent Order.

Response - When the calciner was operating, DOE sampled stack emissions for particulate matter in accordance with regulatory requirements. These samples were analyzed daily by gamma spectroscopy for specific radionuclides, composited, and analyzed for strontium-90 and total plutonium (see DOE Environmental Monitoring Plan). In addition to collecting and analyzing particulate matter, DOE also monitored continuously for nitrogen oxides and gross gamma-emitting radioactive species. Results of these measurements were reported routinely to the State of Idaho and to the EPA (air emissions inventory, National Emission Standards for Hazardous Air Pollutants (NESHAP) report). If the calciner were restarted and operated under a hazardous waste treatment permit (Hazardous Waste Management Act/RCRA) and under the Maximum Achievable Control Technology provisions of the Clean Air Act amendments, additional monitoring would be required as a condition of permits to operate. Both the state and the EPA would be involved in the review of these permit applications to ensure the adequacy of the monitoring and reporting requirements.

The State of Idaho does not have separate equipment to monitor calciner stack emissions. However, DOE's monitoring of the calciner is subject to state and EPA review and inspection under environmental laws and regulations. The State of Idaho INEEL Oversight Program also operates a surveillance network of 14 ambient air and radiation monitoring stations on and in the vicinity of the INEEL. These stations continuously measure gamma radiation and collect samples that are routinely analyzed for alpha, beta, and gamma-emitting radioactive species. This surveillance network is complemented by almost 100 radiation measuring devices strategically placed around the site. In six years of operating the surveillance network, the state has never detected radioactive species or ambient radiation at levels that pose risk to the public or the environment that varies significantly from data reported by DOE. Furthermore, the state's data have corroborated DOE's NESHAP report conclusions, which are based on actual stack samples and calculated emissions from INEEL facilities.

VIII.C Water Resources

VIII.C (1)

Comment - Several commentors state that both the chemical and radiological toxicity of waste must be considered. Also, the commentors state that several comparisons should be made between the amount of liquid waste in the INTEC Tank Farm and the amount of water in the Snake River Plain Aquifer, including the amount of water necessary to dilute the waste to the drinking water standards. A commentor expresses concern that a leak in the waste tanks could jeopardize Idaho's primary water source.

Response - The EIS addresses the potential environmental impacts to the Snake River Plain Aquifer from the range of reasonable alternatives, as well as contaminants known to be present in the aquifer based on past practices at the INEEL and water sampling data. These potential environmental impacts and existing pollutants in the aquifer include both radioactive and nonradioactive contaminants. Extensive groundwater monitoring programs conducted by the U.S. Geological Survey, the State of Idaho, and DOE indicate that no contaminants attributable to INEEL activities currently exceed EPA drinking water standards at the site boundary.

The volume of water present in the Snake River Plain Aquifer would dilute the maximum potential burden from existing and potential contaminants to far below EPA drinking water standards. However, evaluating the quantity of contaminants in the waste and comparing that to the total volume of water in the aquifer greatly over-simplifies contaminant transport through the vadose zone and the aquifer.

For example, the total curies of iodine-129 in the Tank Farm under the No Action Alternative is 0.73 curies, and the total volume of the aquifer is estimated to be 2 billion acre-ft, or approximately 650 trillion gallons

(2,500,000,000,000,000 liters). If the total curies of I-129 were mixed directly into the aquifer and spread evenly throughout the total volume of the water in the aquifer, the concentration would be approximately 0.0003 picocuries per liter, compared to the drinking water maximum contaminant level of 1 picocurie per liter. However, this illustrative scenario could not occur because there are interactions between the soil and waste in the vadose zone and the aquifer that retard the movement of the contaminants (both radionuclides and nonradionuclide contaminants), such as adsorption and impermeable rock that result in zones of perched water.

Additionally, waste would not be dispersed through the whole aquifer, but would be concentrated in plumes down-gradient from the source of contamination. Figures 4-13, -14 and -15 in Chapter 4 are examples of plumes from contaminant sources at INTEC. The groundwater velocity in the aquifer under INTEC has been estimated between 10 to 25 feet per day. In a river, velocity is usually measured in feet per second. This comparison between the velocity in a river and in an aquifer is indicative of the difference in dispersion between the two. Contaminants placed directly in a river would disperse relatively quickly downstream. In an aquifer, dispersion is a very slow process, slowed even more by adsorption of contaminants into the soil.

Because of these differences, modeling of the various processes affecting groundwater transport is performed rather than reporting the total amount of contaminants mixed throughout the whole aquifer. Appendix C.9 describes the modeling of both the radioactive and nonradioactive contaminants performed for this EIS. In addition, Section 5.2.14, Facility Accidents, modeled events and the associated potential environmental impacts to the aquifer. To minimize potential for a tank leak, DOE is committed to cease use of the eleven tanks in the Tank Farm by December 31, 2012.

VIII.C (2)

Comment - A commentor states that the information contained in Appendix C.8 should be expanded to include a discussion of the uses of the Columbia River along with the impacts of the alternatives on these uses of the river.

Response - Environmental impacts to the Columbia River from processing at Hanford are covered in more detail in the Tank Waste Remediation System EIS, DOE/EIS-0189, August 1996. For the Minimum INEEL Processing Alternative, DOE summarized the potential environmental impacts to the Hanford area from processing INEEL waste and the environmental impacts to the INEEL to provide a basis for comparison between alternatives. If the Minimum INEEL Processing Alternative or a hybrid Hanford option were selected for implementation in the Record of Decision, DOE would review the need for additional site-specific National Environmental Policy Act documentation, as necessary, including analysis of environmental impacts at the Hanford Site and the Columbia River. See response to comment summary VII.A (2).

VIII.C (3)

Comment - A commentor states that the groundwater modeling was overly simplified and failed to consider uncertainties and preferential pathways for migration. In addition, the commentor recommends that these uncertainties be discussed in the EIS.

Response - While the models used to predict waste migration through the vadose zone do not examine in detail the preferential pathways through the vadose zone and aquifer, DOE believes the models are sufficiently conservative to bound the environmental impacts. A sensitivity analysis including a discussion of the uncertainties has been incorporated into Appendix C.9.

VIII.C (4)

Comment - Commentors question the use of a 500-year design life for grout and state that the groundwater impacts should be evaluated for failure of the grout at shorter time frames. One commentor expresses particular concern over I-129 leaching from the grout and impacting groundwater coincident with peak concentrations from the former INTEC injection well.

Response - As documented in Appendix C.9, DOE performed a quantitative sensitivity analysis of the effect of changes in assumed time of grout failure (as well as infiltration rate and distribution coefficient) on the resulting groundwater concentrations. DOE used the Tank Farm - Performance-Based Closure or Closure to Landfill Standards as the basis for this sensitivity analysis. The time of grout failure sensitivity analysis was performed for 100- and 1,000-year grout failure times in addition to the 500 years analyzed in this EIS.

The commentors concerns about I-129 leaching and cumulative environmental impacts to the aquifer are addressed in this EIS. If the grout fails at 100 years, the cumulative impact would include both the contaminants from the grout failure and the prior contamination from the injection well (reduced to a concentration below drinking water standards). Cumulative environmental impacts of grout failure combined with contamination remaining from the injection well are covered in Section 5.4 of this EIS.

VIII.C (5)

Comment - Commentors state that DOE should use the U.S. Geological Survey flood plain estimate because it is more conservative than the U.S. Bureau of Reclamation estimate. Commentors also express further concern with waste remaining within either the 100-year (U.S. Geological Survey) or 500-year (Bureau of Reclamation) flood plains and state that the structures should be designed to withstand either flood event.

Another commentor is concerned that contamination remaining in the INEEL soils may eventually be in the pathway of any flood or alteration of the flow pattern of the Big Lost River, whose meander patterns are susceptible to large variations due to the Arco Desert Plain's low gradient. A commentor states that DOE should not base programmatically critical decisions on the U.S. Geological Survey report because it is excessively conservative and/or incorrect.

Another commentor notes the following specific concerns:

(1) The report does not accurately represent Big Lost River/Birch Creek 100-year flows because the combined probability of all the assumptions used to estimate the flow frequency results in a frequency that is much less than 1 in 100.

(2) Procedures used to determine 100-year flow below the Mackay Dam are inappropriately applied in order to produce the largest possible flow.

(3) Information about inflow into Mackay Reservoir is incomplete because it does not account for the fact that most surface water flows from snow melt, nor does it include data about the design discharge of the dam or historical releases relating to past floods cited.

(4) Estimates of flood frequency may be inaccurate because they are based on old data, or data developed with older estimating techniques.

Response - Commentors concerns regarding data quality, assumptions, probabilities and flood frequency are being addressed as part of ongoing studies being conducted by the Bureau of Reclamation and the U.S. Geological Survey. It is expected these studies will be completed in 2002. Following review and evaluation by the INEEL Natural Phenomena Hazards Committee, the DOE Idaho Operations Office will issue a formal Floodplain Determination in accordance with 10 CFR 1022. The Floodplain Determination will be based on a map identifying the 100- and 500-year flood elevations.

As discussed in Section 4.8.1.3 of the EIS, estimates for the 100-year flood were most recently published by the U.S. Geological Survey (Berenbrock and Kjelstrom 1996) and by the Bureau of Reclamation (Ostenaa et al. 1999). These studies differ markedly in their estimation of the 100-year return period flood. The U.S. Geological Survey used conventional flood-frequency and regional regression analysis to determine a 100-year flow rate of 6,220 cubic feet per second (cfs) for the Big Lost River downstream of the INEEL Diversion Dam. For the purposes of this study, the INEEL Diversion Dam was assumed not to exist. The Bureau of

Reclamation utilized a probabilistic approach based on paleoflood, soils, stream gauge, and geomorphic analyses. These analyses were conducted along two different two-mile study areas on the lower reaches of the Big Lost River on the INEEL to estimate a 100-year flow of 3,270 cfs. The Bureau of Reclamation approach meets requirements delineated in DOE standards for the determination of flood hazards.

Faced with this considerable difference in estimates of the 100-year flood, DOE established a Flood Subcommittee of the INEEL Natural Phenomena Hazards Committee. The subcommittee consists of DOE personnel as well as experts from the U.S. Geological Survey and management and operating contractors working at the INEEL. The subcommittee met several times in 2000, after the comment response period on the Draft EIS was concluded, to evaluate and critique the U.S. Geological Survey and Bureau of Reclamation reports as well as other applicable reports. The subcommittee also conducted a field trip to the lower reaches of the Big Lost River accompanied by U.S. Geological Survey and Bureau of Reclamation.

Based upon this review, the subcommittee recommended that additional field studies and analyses be performed by both the U.S. Geological Survey and Bureau of Reclamation to more fully address specific questions regarding assumptions and analyses used by each agency. The additional field work started in August 2000.

A U.S. Army Corps of Engineers analysis of existing data (Bhamidipaty 1997) and INEEL geotechnical analysis (INEEL/INT-98-0090) concluded that the INEEL Diversion Dam structures could withstand flood flows up to 6,000 cfs. Culverts running through the diversion structure could convey a maximum of 900 cfs downstream but their condition and capacity as a function of water elevation is unknown (Bhamidipaty 1997). This preliminary analysis indicates that the diversion dike would tend to reduce the impact of the 100-year flood on INEEL facilities. The flood-hazard mitigation potential of the INEEL Diversion Dam will be further evaluated as the flood hazard studies are completed.

In this EIS, DOE analyzed the environmental impacts that would result from the more conservative 100-year flood identified by the U.S. Geological Survey, (Berenbrock and Kjelstrom 1998) (Figure 4-9 of the EIS), which could result in a maximum flood depth of 1-foot in the northern half of INTEC. Within this flood contour at INTEC, there are radioactively and chemically (mixed-waste) contaminated soils. There are also contaminated soil piles protected by tarps from wind and precipitation, and contaminated soils exposed to erosion and water infiltration. Without mitigation, such as constructing berms to divert flooding, this area would be inundated. Though the area would be inundated, it is expected there would be no erosion and little transport of contaminates because of very low flow velocity. Infiltration would occur but would not be significantly greater than infiltration resulting from average annual precipitation over several years.

On January 18, 2001, DOE issued a floodplain determination, an estimate of the 100-year flood elevation, for RCRA permitting purposes at INTEC (Guyman 2001). The determination is based on the Flood Routing Analysis for a Failure of Mackay Dam (Koslow and Van Haaften 1986), as is the probable maximum probable flood described above. The RCRA determination, however, is based on a 100-year flow scenario, which involves the overtopping of Mackay Dam resulting in a flood elevation of 4,916 ft, whereas the maximum probable flow estimate results in a flood elevation of 4,917 ft at INTEC. The 4,916 ft elevation is consistent with the safety authorization basis for facilities at INTEC. See Section 4.8.1.3 of this EIS and response to comment summary IV.C (2).

References:

Berenbrock, C. and L. C. Kjelstrom, 1996, *Estimated 100-Year Peak Flows and Flow Volumes in the Big Lost River and Birch Creek at the Idaho National Engineering Laboratory*, Idaho, U.S. Geological Survey Water-Resources Investigation Report 96-4163, in cooperation with U.S. Department of Energy.

Berenbrock, C. and L. C. Kjelstrom, 1998, *Preliminary Water-Surface Elevations and Boundary of the 100-Year Peak Flow in the Big Lost River at the Idaho National Engineering and Environmental Laboratory*, Idaho, DOE/ID-22148, U.S. Geological Survey Water Resources

Investigations Report 98-4065, Idaho Operations Office, Idaho Falls, Idaho.

Bhamidipaty, S., 1997, *Plan of Study Big Lost River Diversion System*, Department of the Army, Walla Walla District, Corps of Engineers, Walla Walla, Washington, June 17.

Guyman, R. H., 2001, Bechtel BWXT Idaho, LLC, Idaho Falls, Idaho, letter to K. B. Kelly, State of Idaho, Department of Environmental Quality, Boise, Idaho, "Response to Department of Environmental Quality Request for Additional Floodplain Information for the Idaho National Engineering and Environmental Laboratory," January 18.

Koslow, K. N. and D. H. Van Haaften, 1986, Flood Routing Analysis for a Failure of Mackay Dam, EGG-EP-7184, EG&G Idaho, Inc., Idaho Falls, Idaho, June.

LMITCO (Lockheed Martin Idaho Technologies Company), 1998, *LMITCO Internal Report, Big Lost River Diversion Dike Foundation Investigation*, INEEL/INT-98-0090, Idaho Falls, Idaho, February.

Ostenaa, D. A., D. R. Levish, R. E. Klinger, and D. R. H. O'Connell, 1999, *Phase 2 Paleohydrolgic and Geomorphic Studies for the Assessment of Flood Risk for the Idaho National Engineering and Environmental Laboratory, Idaho*, Report 99-7, Geophysics, Paleohydrology, and Seismotechonics Group, Technical Service Center, Bureau of Reclamation, Denver, Colorado, September 16.

VIII.C (6)

Comment - A commentor cites the Draft EIS Summary, Section 7.4, discussion of cumulative impacts to water, and asks that the projected increase in plutonium concentrations be explained.

Response - Section 5.2.14 of this EIS discusses groundwater impacts for accident conditions for the various waste processing alternatives. The accident analysis considers the increase in groundwater contaminant concentrations due to the initiating event (e.g., material released from a full mixed transuranic waste/SBW tank at failure) plus the historical concentrations due to past contamination of the vadose zone and aquifer. Key radionuclides, metals, and organic contaminants are considered in the analysis including total plutonium. By including historical concentrations of contaminants in the analysis, the groundwater impacts from past waste practices such as the use of injection wells and leaks from valves and piping associated with the underground Tank Farm are considered. The apparent increase in plutonium concentrations in the aquifer is a projected value based on modeling of the plume that considers injection well contaminants in the aquifer and the contribution from contaminated soils. However, the modeling predicted concentrations are directly beneath the spills and/or release, so bounding environmental impacts can be presented. Modeling in the Remedial Investigation/Baseline Risk Assessment for CERCLA Waste Area Group 3 shows that plutonium could result in concentrations that would exceed EPA drinking water standards, if no remediation of the INTEC Tank Farm soils takes place.

VIII.C (7)

Comment - A commentor requests the location of the hypothetical well used in calculating the maximally exposed individual dose, shown on page S-55 (left column) in the Draft EIS, in relation to the INTEC Tank Farm.

Response - The maximally exposed individual is assumed to be a farmer who takes up residency within the existing INTEC facility fence line, about 100 meters from the Tank Farm. This would occur after 2095, when it is assumed for modeling purposes that DOE would lose institutional control of INTEC and the farmer has no knowledge of groundwater contamination in this area. Since the farmer would require a source of water for domestic and agricultural needs, it is assumed he would drill a well into the aquifer directly below the existing INTEC Tank Farm. Under this scenario, this farmer would proceed to drink 2 liters of contaminated water per day for 30 years. This analysis appears in Appendix C.9 of this EIS.

VIII.C (8)

Comment - A commentor supports the State of Idaho's concern for prevention of further contamination of the aquifer and supports appropriate treatment of all HLW requiring disposal in a geologic repository outside of Idaho.

Response - The Snake River Plain Aquifer is a resource that must be protected. That is among the reasons why the State of Idaho scrutinizes DOE activities at the INEEL and has actively overseen waste treatment and disposal activities. In the case of HLW, the Settlement Agreement/Consent Order and subsequent regulatory Consent Orders are the vehicles for ensuring that the liquid stored in non-compliant underground tanks no longer poses a threat to the aquifer. Further, the Settlement Agreement/Consent Order was crafted so that all of the liquid in the underground tanks and calcine in the bin sets would be prepared for disposal so these wastes pose less risk to the environment and can be transported to an interim storage or disposal facility outside of Idaho. The State of Idaho agrees with the commentor's contention that INEEL, positioned over the Snake River Plain Aquifer, is not an appropriate location for long-term storage or disposal of this waste.

VIII.C (9)

Comment - A commentor recommends that the effects of organic decay and colloid formation on the mobilization of plutonium and other actinides be addressed in the EIS.

Response - The effects of facilitated transport mechanisms such as organic complexing agents and colloid formation are difficult to predict. Although not directly evaluated in this EIS, these mechanisms are indirectly addressed by evaluating smaller distribution coefficients (K_ds) in the sensitivity analyses described in Appendix C.9 of this EIS. A smaller distribution coefficient has the same effect on the modeling results as facilitated transport mechanisms, namely increased contaminant solubility and mobility.

VIII.D Biological Resources

VIII.D (1)

Comment - A commentor is concerned about the impact on 52 acres of sage shrub-steppe at Hanford described in the Draft EIS in the discussion of the Minimum INEEL Processing Alternative. The commentor further indicates that the State of Washington has identified sage shrub-steppe as an ecosystem of special concern, because it is home to 17 species that may be listed as rare, threatened, or endangered. The commentor asserts that DOE has failed to evaluate/consider the cumulative environmental impacts of all activities at Hanford on sage shrub-steppe habitat in the EIS or to consult with either the State of Washington or area Native American tribes about this issue.

Response - Prime shrub-steppe is considered by the State of Washington to be of special concern and has been designated a "priority habitat" by the Washington State Department of Fish and Wildlife. The DOE-Richland Operations Office recognizes and shares this concern. Areas of the site are designated as preservation or industrialization under the *Final Hanford Comprehensive Land-Use Plan EIS* (DOE/EIS-0222). No new facility would be placed in the preservation-designated area if DOE were to decide to implement this alternative, and appropriate mitigation would be considered.

Should DOE decide to implement the Minimum INEEL Processing Alternative, the environmental impacts identified in this EIS would be added to cumulative environmental impacts from all other activities at Hanford as analyzed and set forth in Hanford site-specific EISs via additional National Environmental Policy Act documentation as necessary.

VIII.E Geology Seismic Risk

VIII.E (1)

Comment - A commentor states that all waste should be removed from INEEL because the site is located in a seismically active area on top of a large aquifer.

Response - As stated in Section 4.6.3 of this EIS, the Eastern Snake River Plain has a relatively low rate seismic activity, compared to the surrounding basin and range. Potential seismic hazards from earthquakes at the INEEL consist of ground shaking and surface deformation, but avalanches, mudslides, landslides, and soil liquefaction are not likely to occur because the onsite geologic conditions would not likely support these events. Based on seismic history of the Eastern Snake River Plain, earthquakes greater than a moment magnitude of 5.5 are not likely to occur, but the environmental impacts from a strong earthquake have nevertheless been evaluated and are presented in Section 5.2.14 of this EIS. The EIS discloses environmental impacts to the aquifer from treatment alternatives considered, including No Action.

VIII.F Land Use

VIII.F (1)

Comment - A commentor states that for any of the projects in the EIS that would disturb or destroy any geodetic control monuments, the Department of Commerce requires 90 days notice before DOE proceeds. The commentor requests that DOE cover any costs associated with moving any geodetic control monuments.

Response - DOE would coordinate any impacts to geodetic control monuments with the Department of Commerce as required, including any associated costs of replacement of such monuments.

VIII.G Health and Safety

VIII.G (1)

Comment - Commentors express concern that waste and other by-products are finding their way into food and water supplies and may result in cancer and other sickness to people in Idaho, and threaten their longevity and future generations.

Response - Models used to determine the environmental impacts to public health due to INEEL operations, such as the alternatives analyzed in this EIS, include the effects of consumption of food and water. Prior to 2095, when it is assumed for modeling purposes that DOE retains institutional control of the site, consumption by an individual living at the site boundary is assumed to occur. After 2095, consumption would occur within the INTEC fence line, including food grown in the area and water taken from a well drilled there. The results of these analyses through 2095 indicate that under normal operating conditions, none of the alternatives would result in health and safety impacts that would exceed regulatory limits designed to ensure public safety. Furthermore, except for the No Action and Continued Current Operations alternatives, long-term environmental impacts (up to 10,000 years) from residual radiological contamination would not exceed regulatory limits to the environment or members of the public. The No Action Alternative and disposal of Class A or C-type grout in a new Low Activity Waste Disposal Facility would exceed regulatory limits for nonradiological contamination (cadmium).

DOE has also evaluated potential accidents associated with the alternatives that could, if they were to occur, result in significant environmental impacts to the public. The probability of such an occurrence makes it unlikely, and when the risk is calculated (consequence multiplied by chance of occurrence), the environmental impacts are considered small. Because mixed transuranic waste/SBW and mixed HLW calcine would remain on site at the INTEC facility under the No Action and Continued Current Operations alternatives, these alternatives present the highest long-term risk to the public and the environment, particularly in the areas of facility degradation over time and potential for accidents, particularly those induced by natural phenomena.

Partly in response to concerns such as those expressed by the commentor, DOE has in place a routine environmental surveillance program that regularly monitors air emissions and actual environmental impacts to the aquifer, wildlife, and local vegetation. Results are reported annually in a publicly available INEEL Annual Environmental Report. The State of Idaho also performs monitoring to independently verify the environmental surveillance data reported by DOE and in some cases collects supplemental samples to attain a higher level of assurance. This information is made publicly available on a quarterly basis and a report comparing State of Idaho and DOE data is issued annually. The commentors can expect that such programs would be in place during the period of time covered by the waste processing alternatives evaluated in this EIS. Further, facility disposition alternatives would be implemented based on established levels of acceptable risk to public health and the environment. See responses to comment summaries in VIII.B and VIII.C for additional responses to concerns regarding air emissions and environmental impacts to the aquifer respectively, as well as Chapter 4 and Chapter 5 of this EIS.

VIII.G (2)

Comment - Commentors express the opinion that safety is more of an issue than cost, and also express concern that ultimate safety is hard to define, quantify, and understand.

Response - Safety is always of paramount concern to DOE and an extensive set of rules and regulations are applied to ensure the protection of workers and the public at DOE facilities. However, undertaking waste management activities, such as those contemplated in this EIS, necessarily involves the assumption of some risk. Thus, when making a decision on how to proceed, DOE strives to achieve a reasonable balance between the total reduction of risk desired and the available funding needed to do so. Thus, while cost is not an over-riding factor, as a matter of practicality it is a real issue that DOE must consider as part of the process of making reasonable and informed decisions.

The commentor correctly notes that ultimate safety is hard to define, quantify, and understand. For these reasons, DOE and the State of Idaho expended considerable effort in analysis and assessment so that accurate, reliable information regarding safety could be presented in this EIS. Further, a concerted emphasis was placed on conveying this information as clearly as possible in text, figures, and tables. Where appropriate, quantitative analysis is provided, as in the case of assessing risk.

VIII.G (3)

Comment - A commentor states that discussions of the health effects of ionizing radiation should be revised to add information, indicate uncertainties/limitations, correct errors, eliminate repetition, and address baseline cancer risk data in the Draft EIS. Commentor also expresses concern about inconsistent and inappropriate discussions of radiation risk factors and associated health effect calculations in the Draft EIS.

Response - Section 5.2.10 of this EIS presents radiation risks. Uncertainties and limitations of the analysis are identified in Appendix C.3.2 and are discussed in the National Council of Radiation Protection and Measurements, 1993 "Limitations of Exposure to Ionizing Radiation" Report Number 116, Washington, D.C. This report has been used as a basis for INEEL estimates of radiation impacts in recent DOE EISs and is considered a consistent and an appropriate approach for National Environmental Policy Act evaluations and decisions. Baseline cancer risk data are presented in this EIS and are compared to the exposure risks from waste processing and facility disposition alternatives in this EIS.

VIII.G (4)

Comment - A commentor states that remote handling techniques should be enhanced to protect the workers involved in treating the waste discussed in this EIS.

Response - DOE, through its Office of Environmental Management, has as a primary mission to reduce threats to health and safety posed by contamination and waste at DOE sites and to keep exposure to workers as low as reasonably achievable. If remote handling is warranted, DOE would include such technologies in the design of waste management facilities. In addition, the DOE Office of Science and Technology Development undertakes crosscutting technology development in various areas, including remote handling techniques for waste treatment, facility transitioning, decommissioning, and final disposition, using robotics and other innovative technologies. After the Office of Science and Technology Development identifies and evaluates innovative remote-handling technologies, these technologies become available for deployment in the field. DOE would only deploy technologies that have been proven to be truly protective of the health and safety of the workers, the public, and the environment.

VIII.G (5)

Comment - A commentor states that the discussion and calculation of Integrated Involved Worker Risk should be removed from the document. The commentor further says that the Facility Accident Appendix (Appendix C.4) introduces the concept of Integrated Involved Worker Risk (page C.4-32), combining the risk from nonradiological occupational accidents, the risk associated with occupational radiation exposure, and the normalized risk from accidental exposure to much higher levels of radiation. The commentor expresses the opinion that the combination of three extremely different types of risk is both novel and inappropriate.

Response - Workers involved in projects associated with alternatives evaluated in this EIS could be exposed simultaneously to the risk from nonradiological occupational accidents, occupational radiation exposure, and accidental exposure to much higher levels of radiation. Accidents in these three risk categories could occur from unrelated phenomena during the construction and operation of treatment facilities, and facility disposition activities. Therefore, from a total worker-risk perspective, it is appropriate to integrate these risks and consider them cumulatively. However, this EIS also discusses each of the risk categories separately. DOE recognizes that numerical values of its risk estimates are not necessarily additive. See Section 5.2.14 of the EIS.

VIII.G (6)

Comment - A commentor states that INTEC has experienced numerous releases of contamination to the environment and exposures to workers in the past:

- In 1991, negligence by the contractor and the DOE resulted in an explosion that caused worker exposures and significant damage to the facility.

- There were six fires between 1991 and 1999, and inspectors found several instances where fire and radiation alarms were shut off.

- There were at least 18 incidents where workers were overexposed to radiation.

Response - Although past operations are beyond the scope of this EIS, it is worthwhile to address the commentors concerns as they relate to past conduct of operations in related facilities. At INTEC, there have been minor equipment failures, power outages, and filter failures (filters are changed when they do not pass in-place testing). However, no occurrence has exceeded release limits for radioactive materials. For nonradiological materials release limits have been exceeded for emissions at the New Waste Calcining Facility. In one case, nitrogen oxide limits were exceeded due to a software failure. This was quickly corrected. A second case, perhaps the "explosion" referred to by the commentor, involved a release of ammonium nitrate flakes from the main stack. These flakes did settle beyond INTEC boundaries but were cleaned up. There have been two minor fires in nearly 40 years of calciner operating history. Both were caused by leakage of kerosene from remote fittings at a fuel nozzle. One occurred in 1992, and one occurred in 1999.

Routine exposures do occur during operations, but there have been no incidents where any workers have been overexposed. There was a case in 1992 where an audible alarm bell was taped over to reduce its volume, but the bell was still audible. This problem was corrected upon discovery. In 1998, electronics technicians found two failed communications cards in the INTEC fire alarm system during routine maintenance. The New Waste Calcining Facility building was one of four buildings affected by the loss of fire alarms. The cards were replaced. There have been no other known instances where alarms were not operational.

VIII.G (7)

Comment - A commentor is concerned that INEEL activities, particularly radioactive waste treatment and storage, rarely have protection of human health and the environment as the primary concern. Another commentor states that the level of public concern should compel DOE to place increased emphasis on assured safety, viability, and practicality of HLW management options.

Response - For activities at the INEEL, DOE places top priority on public and worker safety and environmental protection.

DOE's primary missions at the INEEL are environmental restoration and waste management, which are accomplished within a regulatory framework designed to focus on and protect human health and the environment. DOE works closely with its regulators, including the State of Idaho, to ensure that the operations and program initiatives involved in meeting mission requirements do not significantly compromise human health and the environment. Further, the health and safety impacts as well as the practicality and viability for each alternative in this EIS, along with public comment, will be factored into any waste processing and facilities disposition decision made by DOE.

VIII.G (8)

Comment - Commentors ask that the EIS compare radiation risk resulting from INEEL operations to natural Idaho background radiation risk in order to properly identify environmental impacts. Another commentor asks that natural background radiation, by isotope and concentration, be compared with values for radiological impacts that would result from alternatives analyzed in EISs. One commentor asserts that if the risk is small, then the EIS process may not be necessary.

Response - Table 5.2-12 of this EIS provides natural background concentrations in soil by nuclides (where known) and a comparison of the environmental impacts to soil concentrations by alternative. Radiation risks are presented in Section 5.2.10 of this EIS. The maximally exposed individual received a radiation dose of 0.031 millirem per year during 1996 from INEEL operations (which is well below the EPA standard of 10 millirem per year for air exposures). For individuals residing near the INEEL, 0.031 millirem per year is also about 10,000 times smaller than the average radiation dose of 360 millirem per year from naturally occurring background radiation and voluntary (man-made) exposures such as medical sources.

Using standard risk factors for estimating fatal cancers from a given calculated exposure to the population within 50 miles of INEEL, a value of 0.0005 fatal cancers would result from the cumulative radiation dose of existing HLW operations at INTEC, mixed HLW treatment alternatives under normal operating conditions, and other reasonably foreseeable actions at the site. This compares to the natural lifetime incidence of cancer in the same population from all other causes of about 24,000 fatal cancers in the region during the same timeframe as this EIS. The EIS presents this and other information, such as economic impacts and the effects of potential accidents, which must also be analyzed and made available to the public and to allow DOE to make informed decisions.

VIII.H <u>Transportation</u>

VIII.H (1)

Comment - A commentor states that DOE's proposed action does not conflict with any State of Nevada, Department of Transportation plans.

Response - DOE would continue to follow all applicable requirements governing the management of radioactive or hazardous material, including coordination with state agencies as appropriate.

VIII.H (2)

Comment - A commentor requests information on the planned configuration of HLW shipping containers and in what form the calcine would be packaged for shipment to Hanford under the Minimum INEEL Processing Alternative.

Response - DOE would pursue a final container design as part of implementation planning for transportation of the calcine. In Section 5.2.9 and Appendix C.5 of this EIS, DOE analyzed the potential environmental impacts of a release from a Type B package with a stainless steel inner canister containing calcine or ion exchange resins. The release fractions used are similar to those used in NUREG-0170 *Final Environmental Statement on the Transportation of Radioactive Material by Air and Other Modes*.

The final packaging for the mixed HLW calcine has not been determined, although various methods have been considered. As noted in Section 6.2.5 of this EIS, the U.S. Department of Transportation, Nuclear Regulatory Commission, and the EPA would regulate the transport of calcine. If DOE were to decide to transport calcine, the packaging would undergo appropriate testing and Nuclear Regulatory Commission certification.

VIII.H (3)

Comment - Commentors emphasize that the EIS should identify environmental impacts and risks to human health and safety resulting from radioactive waste transportation operations, and that such transportation must be coordinated with local and tribal governments.

Response - The environmental risks and consequences for transportation of wastes are covered in Section 5.2.9 and in Appendix C.5 of this EIS. DOE determined radiological impacts to both workers and the general public during normal, incident-free transportation and accident conditions. For accident conditions, the Nuclear Regulatory Commission developed the methods for impact analysis. When shipping radioactive material, DOE involves potentially affected tribes and state agencies in transportation planning, provides advance notification as appropriate, and offers assistance in developing emergency preparedness plans.

VIII.H (4)

Comment - A commentor states that HLW is shipped into the state periodically and is, therefore, already "road-ready."

Response - There have been no shipments of high-level radioactive wastes into the State of Idaho. All of the mixed HLW addressed in this EIS was generated and managed at the INEEL as a result of former spent nuclear fuel reprocessing operations (that were terminated in April 1992). DOE does periodically ship spent nuclear fuel into Idaho in accordance with provisions of the Settlement Agreement/Consent Order discussed in Section 6.2.5 of this EIS. However, DOE does not consider SNF to be HLW, and decisions regarding its management are covered in the SNF & INEL EIS.

VIII.H (5)

Comment - Commentors state that DOE must provide enhanced transportation safety protocols for interstate shipment of spent nuclear fuel and HLW that go beyond regulatory requirements (similar to Waste Isolation Pilot Plant transportation safety protocols) before commentors would support shipment of HLW for treatment or disposal. A commentor notes that trucking treated waste to the Waste Isolation Pilot Plant is preferred over rail shipments because the smaller truck shipments may be transported when ready rather than having to wait on a trainload.

Response - DOE complies with Nuclear Regulatory Commission and Department of Transportation protocols for safe shipment of radioactive materials over highway and rail. INTEC mixed HLW would be packaged and shipped to the national geologic repository in accordance with regulatory requirements designed to address conditions incidental to normal transport and potential accidents. If additional enhanced safety protocols such as emergency preparedness exercises are considered appropriate, DOE would enhance its safety measures accordingly. While truck shipments of radioactive materials may avoid interim storage requirements, rail shipments can reduce overall risk by minimizing the number of shipments. These risks are presented in Section 5.2.9 and Appendix C.5 of this EIS.

VIII.I Socioeconomics

VIII.I (1)

Comment - A commentor expresses the opinion that continued employment at the site may depend on how promptly and successfully INEEL treats its HLW.

Response - Comment is noted.

VIII.I (2)

Comment - Commentors stress that the EIS should identify impacts to local government services, such as police, fire, roads, and schools.

Response - Section 4.3.3 of this EIS provides a baseline for important community services. Section 5.2.2 shows that the estimated socioeconomic impacts of any waste processing alternative would be minimal.

IX PUBLIC INVOLVEMENT

IX.A EIS - Overall Content, Format, and Appearance

IX.A (1)

Comment - Commentors state that the Summary contains a lot of material that does not appear in the main document, that the EIS fails to address areas of uncertainty and controversy that DOE covered in the public hearings, and that the Summary should be revised to summarize the actual content of the EIS more accurately, including the limitations and uncertainties of the analyses.

Response - DOE believes that the Summary accurately represents the content of this EIS. The Summary condenses much of the material presented in the main EIS document. This information is presented in text, text boxes, or a slightly different format to facilitate readability, but the data are the same. The Draft and Final EIS Summaries do not contain information that is not presented in the EIS including discussions of areas of uncertainty and controversy. However, it may appear that areas of uncertainty and controversy are not included in the EIS, since these issues are dispersed in applicable sections throughout the EIS, but compiled, as required by the CEQ regulations, 40 CFR 1502.12, for the EIS Summary. The purpose of pulling the uncertainty and controversy information together in the Summary is to provide the public and agency reviewers with a complete picture of these issues, which can be critical to decision making. The EIS does not presume to resolve the areas of uncertainty or controversy. However, presenting them may present an awareness that helps bring them to future resolution.

IX.A (2)

Comment - Commentors make various statements commending DOE for the appearance and readability of the Draft EIS:

- DOE has worked hard to make the Draft EIS understandable.
- It is readable and understandable by the general public.
- The document has useful, high-quality graphics and layout.
- It is reliable.
- It has very high production qualities and the same publisher should be used for the EIS.
- It was prepared carefully and thoughtfully.

Response - Comments noted.

IX.A (3)

Comment - Commentors state that DOE worked hard to make the Draft EIS understandable as required by the National Environmental Policy Act, but the agency still needs to improve the readability of the EIS because facts and figures in it should be understandable by the general public. For instance, one commentor says that DOE could have made the Minimum INEEL Processing Alternative more understandable. Another commentor states that DOE intentionally misleads the public by using numbers the public does not understand.

Response - DOE regrets that any readers had difficulty understanding the document. DOE recognizes that this EIS addresses highly complex technical materials and issues and has attempted to respond to all requests for clarification. DOE's goal, in the spirit of the National Environmental Policy Act and as required by CEQ regulations, is to present all information in this EIS so it that can be understood by the public as well as by Congress and regulatory agencies. The commentor should note that the Minimum INEEL Processing Alternative is also discussed in Appendix C.8. See also response to comment summary IX.A (7).

IX.A (4)

Comment - Commentors question the costs related to the multi-color layout of the Draft EIS and request an estimate of the unnecessary extra costs involved.

Response - The cost to print the Draft EIS was about $134,000, of which approximately $77,000 was for higher-quality paper to prevent bleeding of the ink through the paper and for color printing above the cost for printing black and white. The incremental cost of printing the Draft EIS in color instead of black and white is about one half of one percent of total projected EIS costs of about $15 million. DOE considers this additional cost worthwhile because it serves to promote interest, readability, and understanding. The format and printing of the Final EIS was revised to reduce the costs.

IX.A (5)

Comment - A commentor requests clarification/definition of terms relating to the measure of levels of radiation/contamination, use of scientific notation in the Draft EIS, and the relevancy of fractional conclusions that cannot be measured with instruments.

Response - Text boxes on pages S-12 and S-13 of the Draft EIS Summary (and on pages S-42 through S-44 of the Final EIS Summary) discussed radiation in units as applied to the calculation of latent cancer fatalities. Section AA.4 of this EIS explains scientific notation used in this document. Existing radiological risk is described in Section 4.11.1.1, and the radiological health and safety effects under the alternatives are analyzed in Section 5.2.10 of this EIS. The calculation of radiological health effects is described in Appendix C.3 of this EIS. The nature of radiation, at detectable levels, is such that it can be measured in units relevant to calculating health effects and these effects can be expressed in terms of latent cancer fatalities. Calculations can result in conclusions that, in and of themselves, are not measurable, but these conclusions can be compared with measurable levels defining environmental impacts as a frame of reference for comparison. Latent cancer fatalities are calculated mathematically based on National Council on Radiation Protection and Measurements conversion standards.

IX.A (6)

Comment - A commentor states that the EIS uses few adjectives.

Response - The objectivity required in the context of an EIS limits the use of adjectives.

IX.A (7)

Comment - A commentor states that DOE should use layman's terms to help the public better understand the issues.

Response - DOE regrets that any readers had difficulty understanding the document. DOE used techniques in this EIS such as explanation text boxes, color graphs, and diagrams that were designed specifically to communicate the highly technically subject matter using plain language and in an easily understood manner, as required by CEQ regulations (40 CFR 1502.8).

IX.A (8)

Comment - Commentors request that inconsistencies be resolved and/or editorial/presentational improvements be made, including:

- The date and month should be added to the timeline for newly generated liquid waste on page 3-2.
- Figures depicting alternatives should be more detailed because they are over-simplified.
- A table showing co-located facilities by alternative should be added.
- Section 5.2.13.4 should be clarified to show the difference between process and product wastes.
- Section 3.1 and Table 3.1 should be clarified as to the actual number of alternatives being considered.
- Figure S-18 incorrectly shows a HLW fraction in the Transuranic Separations Option.

Response - The data presented in Figure S-18 in the Draft EIS Summary has been corrected and is presented in Table S-2 of the Final EIS Summary. The 2005 date for newly generated liquid waste is not a legal requirement, however, the date was added to the timeline for the appropriate alternatives/options. DOE believes that the figures depicting the alternatives/options have sufficient detail for this EIS. The EIS indicates from a conceptual standpoint the types of facilities that would be required under each alternative, and all INEEL HLW treatment facilities would be located within INTEC boundaries. Their exact location, and whether they are co-located, would be determined after a decision is made and in the early phases of actual facility design. Section 3.1 of the EIS presents the alternatives and options and Table 3-1 shows the facilities that may be constructed under each alternative/option. Section 5.2.13.1 addresses the difference between process and product waste.

IX.B EIS Distribution

IX.B (1)

Comment - A commentor questions the motive behind the "long overdue" release of the Draft EIS.

Response - The Notice of Intent for this EIS presented a schedule for publishing the Record of Decision by September 30, 1999. After publication of the Notice of Intent, as a result of agency and public scoping comments, DOE identified a number of programmatic and technical issues that expanded the scope of this EIS and required additional analysis. This expanded scope increased the amount of time needed to prepare the Draft EIS.

IX.B (2)

Comment - Commentors request various address and quantity changes in distribution of the Final EIS.

Response - The distribution list will be revised to accommodate all reasonable requests. Initial distribution of the Draft EIS was based on a list of tribes, legislators, agencies, groups, and individuals involved or interested in INEEL environmental issues. The mailing list also included those who, during scoping or other DOE public involvement efforts, indicated they were interested in receiving the Draft EIS.

DOE sent postcards to those interested in receiving information on this EIS. The distribution of this EIS was identified through the responses received and follow-up telephone calls. This EIS has been distributed on compact disc, hard copy, and the Internet.

IX.B (3)

Comment - A commentor expresses concern that media information misleads readers and suggests that DOE should involve the next generation by notifying local high schools directly.

Response - DOE maintains regular contact with the media through press releases, press conferences, editorial board briefings to reporters and editors covering INEEL issues such as this EIS, and distribution of fact sheets and other information materials to promote understanding of complex technical subjects. In this case, the State of Idaho, as a cooperating agency, also produced fact sheets and participated in media briefing opportunities. In spite of these efforts, some individuals may question whether they are receiving complete and accurate information. Both DOE and the State of Idaho have made, and will continue to make, staff and resources available to respond to public inquiry and provide clarification upon request. Primary contacts are provided in the front of this EIS.

DOE makes specific efforts to involve schools. For example, DOE supports programs such as the INEEL Scholastic Tournament to actively encourage students interested in the sciences. With regard to this EIS, DOE gave a presentation to students in Wyoming on the National Environmental Policy Act process and this EIS. DOE also received numerous comments from an elementary school class in Boise, Idaho, that reviewed this EIS as part of their curriculum. In addition, the Draft EIS was widely distributed and made available in public reading rooms throughout the region.

IX.C EIS Comment Period and Public Meetings

IX.C (1)

Comment - Commentors request that DOE respond to their comments. Some commentors ask DOE to provide considered, fact-based responses to questions in their comment letters.

Response - This Comment Response Document includes responses to all comments received on the Draft EIS. For comments that are very similar, DOE developed a summary comment and provided a response to that summary comment.

IX.C (2)

Comment - Commentors state that not enough time was allowed for a meaningful review of the Draft EIS to allow for proper evaluation and comment of such complex issues before the public hearings started. One commentor indicates that the delayed release of the Draft EIS also coincided with the RCRA process on the Advanced Mixed Waste Treatment Project, which further precluded adequate review of the EIS in the time available before the public hearings. Other commentors express appreciation for extension of the public comment period.

Response - The Draft EIS was available 17 days prior to the first public hearing in Idaho Falls. In these public hearings, DOE and State of Idaho officials took time to explain the contents of this EIS and answer questions related to the issues addressed. This would, DOE believed, improve the public's understanding of the document and allow time for the public to develop informed, specific, and detailed comments before the end of the comment period. Further, in response to public requests, DOE agreed to extend the public comment period by 30 days for a total of 90 days.

Release of the EIS during the same period of availability of other documents for public review and attendant public processes of interest to the prospective reviewer of the Draft EIS are unfortunate, yet purely coincidental and unintentional.

IX.C (3)

Comment - Commentors express dissatisfaction with the hearing format. Commentors state that the format should allow more flexibility to accommodate those attending individual hearings because this is a process designed to involve the public. Other commentors expressed appreciation for the conduct of the public meeting as well as the format and support staff.

Response - The public hearings were structured to provide all participants with an equal opportunity to comment or ask questions. The benefit of this kind of format is that everyone has an equal amount of time and one individual cannot, either intentionally or unintentionally, dominate the meeting. The downside is that lengthy comments cannot be made orally. The time limits imposed at the public hearings did not preclude individuals from providing comments, in any number and of any length, in writing. The effectiveness and appropriateness of this format varies from meeting to meeting, but the rules, once adopted, need to be applied consistently at every meeting. The public hearing format used for this EIS may appear too strict and limiting at lightly attended meetings, but at large meetings, its fairness is more apparent because it ensures that all attendees have an equal chance to be heard. All comments received the same level of consideration regardless of how they were received.

IX.C (4)

Comment - Commentors express appreciation for DOE public meetings on the Draft EIS, particularly in Jackson, Wyoming, and at Fort Hall, Idaho, including presentations. Another commentor questions DOE's selection of locations for public hearings on the EIS when there are important regional issues at stake, and specifically why there were not hearings in Montana and Utah.

Response - DOE selected the locations for the public hearings based on its assessment of who would be most impacted by the proposal or would have a high degree of interest. DOE publicized the availability of the Draft EIS and the dates of the associated public hearings in newspapers and distributed the Draft EIS to selected government officials in Montana and Utah. DOE received no inquiries from or requests to hold public hearings in either state, indicating that residents did not have a high degree of interest in this EIS. In addition, based on the information in this EIS, residents in both of those states would be minimally impacted.

IX.C (5)

Comment - A commentor requests information about the cost of the Portland public meeting, including staff and facility costs, which the commentor considers too expensive. The commentor also states that the State of Oregon must participate fully in decisions regarding treatment of Idaho waste at the Hanford Site.

Response - The total cost of supporting the meeting in Portland was approximately $15,000, of which the meeting facility rental cost was $700. The cost of the Portland public hearing is comparable with those of other public hearings held at other locations, and DOE considers those costs reasonable.

DOE welcomes input from the State of Oregon and Oregon stakeholders in all of its processes to comply with the National Environmental Policy Act, including the input received on this EIS. DOE will fully consider any input received from Oregon stakeholders, as it does input from all stakeholders, throughout process of making informed decisions.

IX.C (6)

Comment - Commentors indicate that DOE should do a better job of publicizing hearings in advance.

Response - DOE welcomes suggestions for improving public notification and participation in its National Environmental Policy Act processes. DOE publicized the availability of the Draft EIS and the dates of the associated public hearings using several media outlets, including 26 newspapers in nine states, radio announcements broadcast on 13 stations in four states, and mailings to individuals on DOE's National Environmental Policy Act distribution list. All individuals who submit comments during the scoping period and the public comment period were added to the distribution list for this EIS. In addition, the Notice of Availability of the Draft EIS, which included public hearing dates and locations, was published in the Federal Register 17 days before the first public hearing held in Idaho Falls.

IX.C (7)

Comment - A commentor states that DOE officials can be hostile and arrogant at public hearings.

Response - DOE regrets the commentor's experience. It is the intention of DOE to treat the public with courtesy and respect.

IX.C (8)

Comment - A commentor asks that handouts made available at public meetings contain a more comprehensive list of chemicals and radionuclides so the potential biologic effects and resulting medical costs from implementing alternatives analyzed in the EIS can be evaluated.

Response - Handouts provided for public meetings are intended for general use and attempt to summarize and explain information in this EIS in a general overview format. More detailed information is provided in the appendices in this EIS. Regarding the specific information of interest to the commentor, Appendix C.7 of this EIS provides a "Description of Input and Final Waste Streams" and lists chemicals and radionuclide concentrations. Appendix C.3 of this EIS provides background on assessing health effects for the impacts of these chemicals and radionuclides as discussed in the alternatives. This material is considered too extensive for presentation in a handout, the focus of which is to promote public awareness of, and interest in, this EIS. The displays used in the meetings did contain an abbreviated list of chemicals and radionuclides.

IX.D DOE Credibility and Suggested Forums for Resolution

IX.D (1)

Comment - Commentors state their opinion that DOE has shown through its past technical and policy failures and untrustworthy acts that it cannot be trusted to make good decisions or to carry out this program. Other commentors maintain that DOE has a history of not keeping its commitments and promises.

Response - DOE cannot abdicate its legal responsibility and authority to make and implement responsible decisions regarding this program. The agency is accountable to the public, the Administration, Congress, and regulators to make responsible decisions and to carry out those decisions in accordance with all applicable laws, agreements, and regulations. A major goal of this EIS is to help DOE, with state and public input, make the decisions that would allow DOE to keep its commitments to the State of Idaho to prepare mixed HLW and mixed transuranic waste/SBW at INTEC for shipment out of Idaho.

IX.D (2)

Comment - Commentors state the opinion that DOE should stop perpetuating falsehoods and be honest with the public, such as by:

1. Being open about the agency's past history.

2. Admitting that the job of environmental cleanup most likely will never end.

3. Admitting that mixed HLW will never leave Idaho.

4. Avoiding semantic and political games.

Response - This EIS openly discloses the history of DOE operations at INTEC as well as the regulatory, financial, and technical difficulties of treating and disposing of mixed transuranic waste/SBW and mixed HLW calcine currently stored there. DOE is working with state and federal regulators to effectively treat and dispose of this waste and to remediate contaminated sites. DOE intends to honor the Settlement Agreement/Consent Order target date of December 2035 to prepare its waste to leave the State of Idaho.

DOE regrets the commentors' opinion that DOE lacks credibility. DOE has worked to include the public throughout the development of this EIS. DOE conducted interviews with interested stakeholders prior to and during scoping, and prior to and after the release of the Draft EIS. In addition, DOE conducted public hearings and extended the public comment period. In preparing this EIS, DOE responded to every request for information and comment received on the Draft EIS and remains committed to keeping the public informed and involved.

IX.D (3)

Comment - A commentor states that good science is the result of interaction between opposing points of view. The commentor further suggests that concerned scientists and engineers hold a technical forum with DOE scientists and arrive at the best options through collaboration, rather than opposition. Another commentor suggests that trust between DOE and affected communities could be improved by establishing a committee composed of individuals from those communities, and of scientists with no ties to DOE. The purpose of the committee would be to review DOE activities and decisions.

Response - DOE agrees that good science can result from the interaction between opposing points of view. However, good scientists can also agree. One of the purposes of an EIS is to disclose the scientific analyses that led to environmental impact conclusions so that the public can critically review and comment on their adequacy. In this EIS, DOE considers and responds to opposing points of view expressed in public comments. In addition, DOE has in the past and will likely continue to hold forums to discuss various technical issues and provide recommendations to develop solutions to the problems. For example, the DOE Idaho High Level Waste Program asked the National Research Council to review the Program’s treatment technologies for mixed transuranic waste/SBW and HLW calcine. The commentors suggest the formation of a committee to provide input on DOE activities and decisions. The INEEL Citizen Advisory Board, established in 1994, essentially fulfills this function. The board is composed of 15 individuals from throughout Idaho who provide the perspectives of environmental interests, natural-resource users, health-care professionals, the educational community, business interests, local governments, the Shoshone-Bannock Tribes, site-related workforce, technical experts, and the general public. Representatives of the State of Idaho, the EPA, and DOE are ex-officio board members who attend to provide their agency's perspective, but do not vote. The board operates under the Federal Advisory Committee Act and is funded by DOE. Board meetings are open to the public; in fact, the public is encouraged to attend and participate. The board reviews ongoing and proposed activities and decisions and provides consensus-based recommendations to DOE. The board's technical subcommittees can obtain additional expertise to help members develop recommendations.

IX.D (4)

Comment - A commentor states that DOE should engage the public as a "business partner" if DOE is ever going to get the mess of nuclear waste and contamination at the government's nuclear weapons and storage facilities under some sort of reasonable control, and that the lies of the past are inexcusable and will not be tolerated in the future.

Response - During this NEPA process, DOE sought to obtain and understand the public's views and input because the public's input is important for DOE to make informed decisions. Toward this end, many opportunities for public involvement were provided and DOE reviewed, considered, and responded to all comments received on the Draft EIS. Then, as now, DOE welcomes the public's interest and will continue to provide information upon request. See response to comment summary IX.D (2) regarding DOE's credibility.

IX.D (5)

Comment - A commentor states that all elected officials paid by tax money should use a new level of consciousness to find solutions to these national and worldwide waste problems.

Response - Environmental restoration and waste management at DOE sites such as the INEEL are identified missions of DOE. Implementation of all activities within the DOE mission is subject to congressional review as a part of annual federal budget processes. In addition, DOE consults with state and local elected officials, tribal governments, regulators, and other federal, state, and local agencies in establishing priorities, such as addressing the proposed action of this EIS, within the latitude of DOE's budget and administration policy. Citizens have the right, and are encouraged, to express their concerns and opinions regarding such matters to their elected officials as well as to DOE.

IX.D (6)

Comment - A commentor states that DOE should investigate the conduct of its contractor and make its findings publicly available. Other commentors indicate the need for robust project management controls, strategic oversight of contractors, preparation and compliance with plans and procedures, and the need to avoid another Pit-9 fiasco.

Response - The environment, safety, and health records of contractors conducting work at the INEEL are made a matter of public record. DOE management and operating contractors use proven project management methods and tools to administer DOE programs at the DOE sites and operate facilities in a manner that meets applicable safety and health requirements and State of Idaho milestones. In addition, DOE maintains oversight of the contractor to ensure that all plans and procedures are followed and operations are within scope and budget. Federal employees at the DOE Idaho Operations Office oversee INEEL contractors, and the State of Idaho Department of Environmental Quality and the EPA conduct inspections to enforce compliance with permit requirements. The results of compliance inspections are also publicly available, as are documents that report on emissions and discharges from all site operations. For example, the Annual INEEL Site Environmental Report and the INEEL National Emission Standards for Hazardous Air Pollutants-Radionuclides Annual Report are publicly available. In addition, the State of Idaho, INEEL Oversight Program maintains an independent monitoring program and a non-regulatory oversight presence at the INEEL.

IX.D (7)

Comment - A commentor commends the professionalism and credibility of INEEL employees.

Response - Comment noted.

X COSTS, FUNDING, AND FINANCIAL CONSIDERATIONS

X (1)

Comment - A commentor states that a billion dollars was saved by recovering uranium from spent nuclear fuels, but questions this savings in light of the billions of dollars in resulting waste treatment costs. The commentor requests that complete cost/benefit analyses be conducted before DOE chooses an alternative.

Response - The merits and cost benefits of recovering uranium from spent nuclear fuel are beyond the scope of this EIS. DOE assembled cost information comparing the estimated costs of the alternatives and options evaluated in this EIS and considered cost information along with a number of other factors. For more information regarding cost, see *Cost Analysis of Alternatives for the Idaho High-Level Waste and Facilities Disposition EIS* (DOE/ID 10702, January 2000) Final decisions for waste treatment would consider cost and other relevant factors.

X (2)

Comment - Commentors express concern that without a comparison of costs between alternatives, neither DOE nor the public has the information necessary to prioritize and allocate financial resources on a risk reduction/benefit basis. Commentors state that because cost is a major factor, a comparison of costs should be included in the EIS itself, and not as a separate report. A commentor notes that failing to include discussions of costs in the scope of the EIS gives a false impression that costs and funding are not a consideration.

Response - The Cost Report was prepared to provide information concerning the relative cost of alternatives. The Cost Report is not a cost-benefit analysis used to weigh the merits and drawbacks of the alternatives from an environmental standpoint or compare monetary costs with important qualitative considerations. For this reason the Cost Report was made available separately but is not appended to the EIS.

X (3)

Comment - Commentors state opinions as to how funds have been or should have been spent at the INEEL in areas such as research and development. Other commentors express opinions that the government should appropriate funds to support programs other than those discussed in the Draft EIS.

Response - DOE develops annual funding requests based on the projected project plans and mission needs for the respective fiscal year(s). Those requests are subject to the normal Federal budget process that includes review and approval by the Office of Management and Budget and the U.S. Congress.

For funds that are not specifically allocated to a particular project, DOE uses many factors, including regulatory requirements, public input, and legal agreements in allocating funds to accomplish its multiple missions. Some of the higher priorities are attaining milestones required by consent orders and the Settlement Agreement/Consent Orders, public and worker safety, and compliance with various environmental regulatory requirements. Some of these items are considered enforceable milestones because substantial penalties can be imposed by regulatory agencies for failure to meet the required actions. Although costs are a significant consideration in making decisions among alternatives in this EIS, funding allocations among INEEL initiatives are outside the scope of this EIS.

X (4)

Comment - Commentors assert that the costs of transportation and actual disposal in Yucca Mountain are a small fraction of waste management costs, and that development costs are billions of dollars even if waste is never buried there. One commentor adds that total disposal cost comprises the "sunk" research and development cost of the repository, the cost of treating the waste for disposal (indicating that separations options are higher than non-separations options), and the incremental cost of making room in the repository for each kind of waste form (which would be somewhat higher for non-separations options). The commentor maintains only those costs incurred as a direct consequence of choosing a specific option should be considered when comparing the costs of all options, and that the total cost would be much higher for separations options.

As an example, a commentor says that drilling equipment needed to make room for waste is already paid for. Commentors state that it is misleading to incorporate the projected costs for treated waste disposal when calculating life-cycle costs for the Direct Cement Waste Option and Separations Alternative because these costs are entirely speculative. One commentor states that vitrification treatment is cheaper than separations technologies, yet gets more expensive when speculative disposal costs are added. A commentor says that disposal costs are incremental costs, in that the cost will not be directly proportional to waste form volume.

Response - Costs in the report include the prorated cost for development and operation of the potential HLW geologic repository at Yucca Mountain for alternatives that call for disposal at a geologic repository. These costs are part of life-cycle costs for the potential repository and may be borne by projected users. See responses to comment summaries III.F.2 and III.F.3 for discussion on repository costs.

The cost of transportation of HLW can be calculated several ways depending on the mode of transportation. Transportation costs are relatively small for all of the options, less than 10 percent of any alternative total estimated cost. Life-cycle costs for transportation and disposal of wastes were analyzed in the Cost Report.

X (5)

Comment - A commentor expresses the opinion that the cost of a Maximum Achievable Control Technology upgrade to the New Waste Calcining Facility do not appear justified, nor is there time to do it.

Response - DOE used the same cost estimating methods in the Cost Report as are used for estimating costs of other potential capital project expenditures. Estimates of the cost to upgrade the calciner for compliance with EPA Maximum Achievable Control Technology requirements include, where possible, cost of procurement of commercially available air emission packages that treat offgases to meet the Maximum Achievable Control Technology requirements. Any costs associated with a decision to upgrade the calciner to Maximum Achievable Control Technology requirements, if necessary and the associated benefits of calciner operations would be considered in making a final decision.

X (6)

Comment - Commentors state that the Cost Report was not sufficiently detailed. Similar cost analyses for much smaller CERCLA activities contain more detailed information. Specifically, commentors say that the major elements for capital, operations and maintenance, or contingency are missing (precluding any value engineering by the reader), as is a cost/benefit analysis. Commentors also state that the lack of design-basis documents and functional/operational requirements preclude anything other than a rough order of magnitude estimate or any probabilistic estimate at this time. Commentors further state that the costs of alternatives may be greater than available funding and that only the No Action Alternative is within current funding levels; however, that does not make No Action the solution because it could result in permanent environmental damage.

Response - The Cost Report was provided for information concerning the relative cost of alternatives, not as a cost-benefit analysis to weigh the merits and drawbacks of the alternatives from an environmental standpoint. Uncertainty always exists early in the planning process such as when an EIS is being prepared and before a congressional appropriation. There is now a risk-adjusted cost estimating process under DOE's Project Management and Engineering Order 413.A that integrates the appropriation and project management processes. This means that when congress approves a line item project, such as one included in an alternative analyzed in this EIS, the funds are dedicated. This reduces much of the uncertainty associated with trying to forecast future funding levels.

X (7)

Comment - A commentor expresses the opinion that waste heat load (radionuclide content), and not simply waste volume, should dictate repository capacity and costs, which would make the cost of disposal of grouted calcine not enormously higher than the cost of vitrification.

Response - Basing calculations of the capacity of the proposed HLW geologic repository on mass of spent nuclear fuel processed is an approach that has been evaluated. Section 6.3.2.4 of this EIS describes DOE's current method and rationale for calculating MTHM in HLW. This section also describes an alternative approach that bases the calculation on radionuclide content and not on waste volume.

The State of Idaho's position on calculation of MTHM is described in the State's Foreword to this EIS.

X (8)

Comment - A commentor claims it is a policy of DOE sometimes to translate one thing into another thing where there isn't any correlation whatsoever. The commentor also states that somehow the disposition of this much calcine is going to cost $11 billion, and has to be added to the cheapest and most straightforward way of actually making it suitable for transport, which is the Direct Cement Waste Option.

Response - DOE analyzes EIS alternatives on an equal basis using the same methodology for all alternatives. Accordingly, though in a separate Cost Report, DOE applied a consistent cost estimating methodology for all of the alternatives. Several of the alternatives identified as reasonable for analysis did in fact consist of a low-cost treatment option with a higher unit (and net) cost of disposal under current assumptions.

It was assumed that HLW would be sent to the proposed geologic repository and costs were applied based on the number of canisters that would be produced for each alternative. The Direct Cement Waste Option produces the largest number of canisters; hence, the alternative has the highest total estimated disposal cost.

X (9)

Comment - Commentors express various opinions regarding costs of alternatives, ranging from "cost is no object" to "do only what you can afford to do." Other commentors state that DOE should be concerned about the total ecosystem, and should treat the waste and protect the environment without regard to cost.

Response - The estimated cost of implementing an alternative is important, but it is only one of several factors considered when selecting among reasonable alternatives analyzed in an EIS. For example, potential impacts on human health and the environment, including the total ecosystem, are factors that must be considered in the decision making process. While one factor may be so compelling that it ultimately drives a decision, it is much more common, as in the case of this EIS, to find that the factors associated with each alternative give it a unique set of merits and disadvantages. Under these circumstances, the challenge in making a decision is to determine which of the alternatives provide the best set of benefits, while at the same time posing the fewest disadvantages or if not the fewest, at least disadvantages that can be managed and/or mitigated by agency action.

X (10)

Comment - Commentors state that waste management, monitoring, and cleanup should be funded in lieu of various defense programs such as Star Wars, weapons research, and stockpile maintenance, which are the wrong priorities. Commentors point out that $30 billion should be easily available to clean up the $3,900 billion weapons program legacy. Another commentor indicates that money must be made available if "we" are to survive.

Response - Priorities for funding large federal projects are ultimately determined through the budgets that are approved by Congress. DOE has some limited discretion for how allocated funds are spent for smaller projects within the overall budget appropriation. Congressional decisions as to whether defense and weapons research would have a higher priority for funding than waste treatment and disposal are beyond the scope of this EIS.

Historically, the INEEL HLW program budget has ranged from $50 to $70 million per year. Work at the INEEL will be prioritized to these budgets and requests for additional funding will be made where deemed necessary and appropriate.

X (11)

Comment - A commentor states that more expensive alternatives require either additional funding to INEEL or significant cuts in other INEEL programs that are barely in compliance under current budgets. The commentor adds that additional funding is unlikely and that meeting Settlement Agreement/Consent Order HLW requirements will pose a risk and likely result in noncompliance with other environmental regulations. Another commentor says that each environmental project is bought at the expense of another. Commentors also request that information about the costs of implementing the EIS alternatives, as well as the potential cumulative environmental impacts of not implementing other INEEL compliance activities due to transfer of limited funds to implement selected EIS alternatives, be addressed within the scope of the EIS, or otherwise made available to decision makers and the public.

Response - It is DOE's policy to operate in compliance with all regulatory requirements. Therefore, DOE develops annual funding requests based on the projected project plans and mission needs for the respective fiscal year.

For funds that are not specifically allocated to a particular project, DOE uses many factors, including regulatory, public input, and legal agreements with priorities established in the context of agency coordination in allocating funds to accomplish its multiple missions. Some of the higher priorities are attaining milestones required by consent orders and the Settlement Agreement/Consent Order, public and worker safety, and compliance with environmental requirements. Some of these items are considered enforceable milestones because substantial penalties can be imposed by regulatory agencies for failure to meet the required actions. Although costs are a significant consideration in making decisions among alternatives in this EIS, funding allocations among INEEL initiatives are outside the scope of this EIS. In addition, DOE anticipates that a phased decision could be implemented (and funded) in steps, or in a series of decisions over time. See response to comment summaries VI (1) and VII.D (2).

X (12)

Comment - Commentors express the opinion that DOE should fund research necessary to making sound decisions, stating that:

- Despite the fact that a calcine decision is not pressing, funding must be allocated to continue to obtain technical information necessary to a path-forward decision on calcine disposition.
- Given the multi-billion-dollar cost of implementing alternatives, DOE should fund research necessary to make a sound decision. For example, the Direct Cement Waste Option has had little research funding.
- Money should be put into research until a better solution can be found.

Response - DOE considered available information related to the maturities of technologies associated with alternatives and any additional technology development deemed necessary in identifying the Preferred Alternative, and would consider this information in reaching a Record of Decision on this EIS. DOE recognizes the importance of adequately developing selected technologies before implementing them at production scale. Budget planning for the INEEL includes technology development scopes of work necessary to address preparing the mixed transuranic waste/SBW and calcined mixed HLW for disposal.

DOE is committed to meeting regulatory requirements, as well as agreements with the State of Idaho. These agreements contain milestones for treating waste and preparing it for shipment. DOE anticipates that this EIS may result in a phased decision implemented in steps, or in a series of decisions over time, including further technology development. It is also anticipated that the decision would include milestones, so that actions would be neither premature nor postponed, but planned and implemented as a matter of public record in accordance with the decision.

X (13)

Comment - Commentors offer advice as to how to get alternatives funded. One commentor suggests DOE take out full page ads in national papers discussing contamination at Hanford and risk to the Columbia River, while another suggests asking Congress for funds to convert liquid wastes to a desirable calcine form for now. Another commentor suggests that DOE use money wasted at other sites such as Rocky Flats to fund HLW programs in Idaho.

Response - As a federal agency, DOE must obtain its funds through the established Federal budgeting process. Judgments about how funds are managed, particularly at sites other than Idaho, are outside the scope of this EIS.

X (14)

Comment - A commentor states that it can be deduced from the Cost Report that all alternatives other than No Action and Continued Current Operations have a rough total (transportation and disposal included) cost per cubic meter of HLW of $850,000, which would require funding levels two to eight times larger than current INEEL funding levels. The commentor also cites an article that increases that figure to $2-4 million per cubic meter of HLW, or a total of $75 billion for the three large DOE sites, requiring an increase at INEEL from the current $51 million to $807 million. The commentor maintains that this funding level is not realistic and that DOE should use fiscal common sense in developing alternatives.

Response - Using the estimates from the Cost Report (Table 5) and quantities of expected HLW from Appendix C.7 of the Draft EIS (Table C.7-6), the cost per cubic meter for treatment, storage, and disposal of HLW ranges from $1.2 million to $15.2 million, with the average being $6.3 million per cubic meter. Because the volume of HLW that would be produced is small for the Separations Alternative options (470 cubic meters) compared with the Non-Separations Alternative options (as high as 13,000 cubic meters for the Direct Cement Waste Option), overall disposal cost can vary widely. Under current cost estimates for disposal, it is clear that minimizing volume has significant cost advantages. These estimates are consistent with the article cited by the commentor.

As noted in Appendix E of the Cost Report, the peak annual funding in unescalated dollars ranges from about $150 million to $580 million for the four alternatives evaluated therein (including transportation and disposal). This is substantially lower than the $807 million mentioned by the commentor. DOE has reviewed the article mentioned by the commentor, "Alternatives to High-Level Waste Vitrification: The Need for Common Sense," from the journal Nuclear Technology.

X (15)

Comment - A commentor identifies important components missing from the Cost Report.

Response - DOE acknowledges the limitations of the Cost Report. The report has since been reviewed by the DOE Office of Project Management, and the results of this review are available to DOE decision makers and the public. See also the response to comment summary X (6).

XI ISSUES OUTSIDE THE SCOPE OF THE EIS

XI (1)

Comment - Commentors state that DOE should overcome institutional obstacles identified in the National Academy of Sciences "Barriers to Science" report. One commentor states that the academy members are honest and impartial people. Another commentor states that DOE should use or rely on National Academy of Sciences members to help find solutions to problems such as those analyzed in this EIS.

Response - The commentor references a National Academy of Sciences study, "Barriers to Science." DOE considered this nation-wide study in preparation of the EIS. However, response to comments on the study is beyond the scope of this EIS.

XI (2)

Comment - A commentor asks that DOE stop all plans for the incinerator at INEEL and spend that money on research and development to find other ways to deal with this hazardous waste safely.

Response - DOE believes that the commentor is referring to the incinerator that was proposed as part of the Advanced Mixed Waste Treatment Project that DOE is building to treat transuranic waste. This project is outside the scope of this EIS. However, as discussed in Section 3.1.3 of this EIS, an incinerator was included with Separations Alternatives options that involve the UNEX or TRUEX solvent extraction processes. Under the Separation Alternatives, an incinerator designed to destroy organics was evaluated in this EIS.

XI (3)

Comment - Commentors address subject matter discussed or presented in documents prepared by others, but that is also addressed independently in the Draft EIS. Often, subject matter pertaining both to the Draft EIS and the other documents is integrated within a single comment.

Response - Though the subject matter in documents prepared by others may be referenced in this EIS or relevant to the scope of the analyses, the documents themselves are not part of this EIS. As such, comments specific to these documents should be addressed to the authoring entity for response. DOE carefully evaluated each comment submittal to identify which comments are specific to this EIS and has responded to those accordingly.

XI (4)

Comment - A commentor discusses technical aspects of waste management (including opinions as to how various treatment/handling options should be conducted); however, these opinions are not specifically associated with options, approaches, or alternatives discussed in the Draft EIS.

Response - Such information is unrelated to specific alternatives discussed in the Draft EIS and is considered beyond the scope of this EIS.

XI (5)

Comment - A commentor states that the EIS is inadequate because it fails to fully evaluate the Advanced Mixed Waste Treatment Project as a reasonable waste treatment alternative. Commentors express opinions as to whether or not "the incinerator" (assumed to be the thermal treatment portion of the Advanced Mixed Waste Treatment Project) should be built, permitted, operated, and/or how the flow sheet technology could be improved, in particular expressing concerns as to potential adverse environmental impacts on air quality. Commentors express opinions as to the need for reviews by independent entities, including the EPA and the State of Idaho, of alleged problematic incinerator operations such as the New Waste Calcining Facility before Advanced Mixed Waste Treatment Project permits are issued. Commentors also express opinions as to the lack of involvement of Wyoming residents in decisions regarding the "incinerator" and the processes used by the Idaho Department of Environmental Quality in issuing permits. Commentors state that the lax operation of the calciner without a permit for 18 years should require careful scrutiny by the EPA and this should be resolved before a permit is granted to the Advanced Mixed Waste Treatment Project.

Response - Section 3.3.7 of this EIS discusses this issue and concludes that the Advanced Mixed Waste Treatment Project is not designed to process remote-handled or liquid waste. Thus, it does not present a reasonable treatment option for analysis in this EIS. Decisions regarding the Advanced Mixed Waste Treatment Project and the waste forms that it is being designed to manage are beyond the scope of this EIS. The environmental impacts associated with this project were included in the *Advanced Mixed Waste Treatment Project EIS* (DOE/EIS-0290). However, environmental impacts from operation of the Advanced Mixed Waste Treatment Project are discussed in Section 5.4 and Appendix C.2 of this EIS, insofar as this facility would contribute to cumulative environmental impacts at the INEEL. If implemented, any of the waste treatment facilities evaluated in this EIS would undergo independent review by the EPA and the State of Idaho in accordance with their regulatory authority.

XI (6)

Comment - Commentors express opinions as to the selection, capabilities, and/or past performance of British Nuclear Fuels, Limited.

Response - The perceived or actual performance and awarding of contracts to British Nuclear Fuels, Limited is currently unrelated to the management of mixed transuranic waste/SBW and mixed HLW at INTEC and, therefore, outside the scope of this EIS.

XI (7)

Comment - Commentors rendered opinions as to DOE and/or INEEL programs (or nuclear energy programs in general) unrelated to alternatives discussed in the Draft EIS such as the feasibility, viability, or safety or need for nuclear energy production, weapons programs, Integral Fast Reactor technology, wastes at the Hanford Site, and/or repository programs such as Yucca Mountain, in particular, site characterization issues, pollution issues, and the difficulty of managing associated wastes.

Response - The feasibility, viability, need, and safety of DOE programs other than management of mixed HLW and mixed transuranic waste/SBW at INTEC are beyond the scope of this EIS. Although generation of wastes from activities not discussed in this EIS is out of scope, DOE continues to emphasize waste minimization in all aspects of its operations (both nuclear and otherwise). Issues associated with the siting of federal repositories, such as the Waste Isolation Pilot Plant and the potential Yucca Mountain geologic repository, are addressed in their respective National Environmental Policy Act documents.

XI (8)

Comment - A commentor expresses opinions regarding the role and/or necessity of former INEEL operations that resulted in the generation of wastes being addressed in the EIS. Other commentors express the general opinion that no waste-producing operations should be conducted outside of environmental cleanup and restoration activities.

Response - Although this EIS presents a brief history of the programs that produced the mixed HLW and facilities addressed in this EIS, the purpose and need for such programs is beyond the scope of this EIS. Likewise, decisions to operate facilities (which may or may not produce chemical or radioactive waste streams) beyond those discussed in the alternatives under consideration in this EIS are beyond the scope of this EIS.

XI (9)

Comment - A commentor states that DOE must abandon its disastrous experiment with privatization of treatment facilities.

Response - Privatization (paying for a commercially provided service as opposed to DOE building and operating facilities) is a contracting approach that has been used in the DOE complex, including the INEEL, with varied results. The contractual vehicles used to implement DOE's decisions are beyond the scope of this EIS.

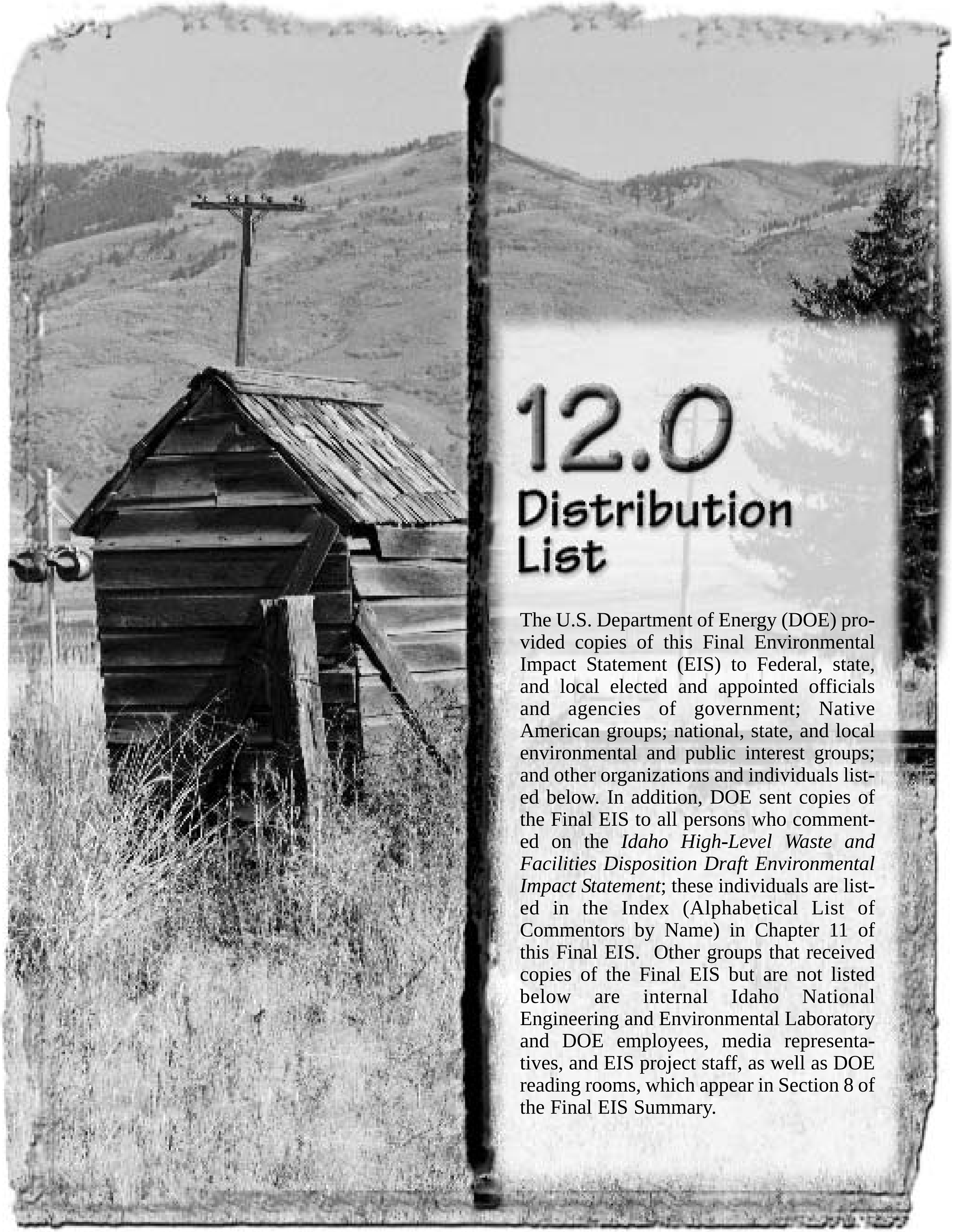
XI (10)

Comment - A commentor requests that minutes of a previous meeting on the Advanced Mixed Waste Treatment Project be included in the record for the public meeting on the Draft EIS.

Response - Including the minutes of meetings concerning the Advanced Mixed Waste Treatment Project would not assist DOE in the analysis of environmental impacts that are within the scope of this EIS. Those minutes are available for review in the Advanced Mixed Waste Treatment Project EIS administrative record files and would be considered in the course of permitting and decisions specific to that project. This EIS analyzes the cumulative environmental impacts of concurrent mixed HLW treatment and Advanced Mixed Waste Treatment Project operations, but does not address the Advanced Mixed Waste Treatment Project public involvement process, nor would the Record of Decision on this EIS address decisions on Advanced Mixed Waste Treatment Project operations.

12.0

Distribution List



12.0

Distribution List

The U.S. Department of Energy (DOE) provided copies of this Final Environmental Impact Statement (EIS) to Federal, state, and local elected and appointed officials and agencies of government; Native American groups; national, state, and local environmental and public interest groups; and other organizations and individuals listed below. In addition, DOE sent copies of the Final EIS to all persons who commented on the *Idaho High-Level Waste and Facilities Disposition Draft Environmental Impact Statement*; these individuals are listed in the Index (Alphabetical List of Commentors by Name) in Chapter 11 of this Final EIS. Other groups that received copies of the Final EIS but are not listed below are internal Idaho National Engineering and Environmental Laboratory and DOE employees, media representatives, and EIS project staff, as well as DOE reading rooms, which appear in Section 8 of the Final EIS Summary.

In preparation for distribution of the Final EIS, DOE mailed postcards to EIS stakeholders, inviting them to request copies of the document in various formats. DOE also issued press releases to Idaho media outlets, announcing the upcoming publication of the Final EIS and describing the document request process. DOE will provide copies to other interested organizations or individuals on request.

12.1 United States Congress

12.1.1 UNITED STATES SENATORS FROM IDAHO

The Honorable Larry Craig
United States Senate

The Honorable Michael Crapo
United States Senate

12.1.2 UNITED STATES SENATORS FROM OTHER STATES

The Honorable Wayne Allard
United States Senate (Colorado)

The Honorable Ben Nighthorse Campbell
United States Senate (Colorado)

The Honorable Max Baucus
United States Senate (Montana)

The Honorable Conrad Burns
United States Senate (Montana)

The Honorable John Ensign
United States Senate (Nevada)

The Honorable Harry Reid
United States Senate (Nevada)

The Honorable Jeff Bingaman
United States Senate (New Mexico)

The Honorable Pete Domenici
United States Senate (New Mexico)

The Honorable Gordon Smith
United States Senate (Oregon)

The Honorable Ron Wyden
United States Senate (Oregon)

The Honorable Robert F. Bennett
United States Senate (Utah)

The Honorable Orrin Hatch
United States Senate (Utah)

The Honorable Maria Cantwell
United States Senate (Washington)

The Honorable Patty Murray
United States Senate (Washington)

The Honorable Michael Enzi
United States Senate (Wyoming)

The Honorable Craig Thomas
United States Senate (Wyoming)

12.1.3 UNITED STATES SENATE COMMITTEES

The Honorable Robert Byrd
Chairman
Committee on Appropriations

The Honorable Ted Stevens
Ranking Minority Member
Committee on Appropriations

The Honorable Carl Levin
Chairman
Committee on Armed Services

The Honorable John Warner
Ranking Member
Committee on Armed Services

The Honorable Jeff Bingaman
Chairman
Committee on Energy and Natural Resources

The Honorable Frank Murkowski
Ranking Member
Committee on Energy and Natural Resources

The Honorable James Jeffords
Chairman
Committee on Environment and Public Works

The Honorable Robert Smith
Ranking Member
Committee on Environment and Public Works

The Honorable Bob Graham
Chairman
Subcommittee on Energy Research, Development, Production, and Regulation
Committee on Energy and Natural Resources

The Honorable Don Nickles
Ranking Minority Member
Subcommittee on Energy Research, Development, Production, and Regulation

The Honorable Harry Reid
Chairman
Subcommittee on Energy and Water Development
Committee on Appropriations

The Honorable Pete Domenici
Ranking Member
Subcommittee on Energy and Water Development
Committee on Appropriations

The Honorable Jack Reed
Chairman
Subcommittee on Strategic
Committee on Armed Services

The Honorable Wayne Allard
Ranking Member
Subcommittee on Strategic
Committee on Armed Services

12.1.4 UNITED STATES REPRESENTATIVES FROM IDAHO

The Honorable C. L. "Butch" Otter
United States House of Representatives

The Honorable Michael Simpson
United States House of Representatives

12.1.5 UNITED STATES REPRESENTATIVES FROM OTHER STATES

The Honorable Diana DeGette
United States House of Representatives
(Colorado)

The Honorable Joel Hefley
United States House of Representatives
(Colorado)

The Honorable Scott McInnis
United States House of Representatives
(Colorado)

The Honorable Bob Schaffer
United States House of Representatives
(Colorado)

The Honorable Tom Tancredo
United States House of Representatives
(Colorado)

The Honorable Mark Udall
United States House of Representatives
(Colorado)

The Honorable Dennis Rehberg
United States House of Representatives
(Montana)

The Honorable Shelley Berkley
United States House of Representatives
(Nevada)

The Honorable Jim Gibbons
United States House of Representatives
(Nevada)

The Honorable Joe Skeen
United States House of Representatives
(New Mexico)

The Honorable Tom Udall
United States House of Representatives
(New Mexico)

The Honorable Heather Wilson
United States House of Representatives
(New Mexico)

The Honorable Earl Blumenauer
United States House of Representatives
(Oregon)

The Honorable Peter DeFazio
United States House of Representatives
(Oregon)

The Honorable Darlene Hooley
United States House of Representatives
(Oregon)

The Honorable Greg Walden
United States House of Representatives
(Oregon)

The Honorable David Wu
United States House of Representatives
(Oregon)

The Honorable Chris Cannon
United States House of Representatives
(Utah)

The Honorable James V. Hansen
United States House of Representatives
(Utah)

The Honorable Jim Matheson
United States House of Representatives
(Utah)

The Honorable Brian Baird
United States House of Representatives
(Washington)

The Honorable Norman Dicks
United States House of Representatives
(Washington)

The Honorable Jennifer Dunn
United States House of Representatives
(Washington)

The Honorable Doc Hastings
United States House of Representatives
(Washington)

The Honorable Jay Inslee
United States House of Representatives
(Washington)

The Honorable Rick Larsen
United States House of Representatives
(Washington)

The Honorable Jim McDermott
United States House of Representatives
(Washington)

The Honorable George Nethercutt
United States House of Representatives
(Washington)

The Honorable Adam Smith
United States House of Representatives
(Washington)

The Honorable Barbara Cubin
United States House of Representatives
(Wyoming)

12.1.6 UNITED STATES HOUSE OF REPRESENTATIVES COMMITTEES

The Honorable C.W. "Bill" Young
Chairman
Committee on Appropriations

The Honorable David Obey
Ranking Minority Member
Committee on Appropriations

The Honorable Bob Stump
Chairman
Committee on Armed Services

The Honorable Ike Skelton
Ranking Minority Member
Committee on Armed Services

The Honorable W. J. "Billy" Tauzin
Chairman
Committee on Energy and Commerce

The Honorable John Dingell
Ranking Minority Member
Committee on Energy and Commerce

The Honorable James V. Hansen
Chairman
Committee on Resources

The Honorable Nick J. Rahall
Ranking Minority Member
Committee on Resources

The Honorable Don Young
Chairman
Committee on Transportation and Infrastructure

The Honorable James L. Oberstar
Ranking Minority Member
Committee on Transportation and Infrastructure

The Honorable Joe Barton
Chairman
Subcommittee on Energy and Air Quality
Committee on Energy and Commerce

The Honorable Rick Boucher
Ranking Minority Member
Subcommittee on Energy and Air Quality
Committee on Energy and Commerce

The Honorable Sonny Callahan
Chairman
Subcommittee on Energy and Water Development
Committee on Appropriations

The Honorable Peter Visclosky
Ranking Minority Member
Subcommittee on Energy and Water Development
Committee on Appropriations

The Honorable Curt Weldon
Chairman
Subcommittee on Military Procurement
Committee on Armed Services

The Honorable Gene Taylor
Ranking Minority Member
Subcommittee on Military Procurement
Committee on Armed Services

12.2 Federal Agencies

Mr. Raphael Daniels
Technical Specialist
Defense Nuclear Facilities Safety Board

Ms. Kimberly DePaul
Head
Environmental Planning and NEPA Compliance
Department of the Navy

Mr. Mark Robinson
Director
Federal Energy Regulatory Commission

Ms. Cynthia Carpenter
Chief
Office of Nuclear Reactor Regulation
Nuclear Regulatory Commission

Ms. Greta Joy Dicus
Commissioner
Nuclear Regulatory Commission

Ms. Karyn Severson
Director, External Affairs
Nuclear Waste Technical Review Board

Mr. Andree Duvarney
National Environmental Coordinator
Ecological Sciences Division
Natural Resources Conservation Service
U.S. Department of Agriculture

Mr. Willie Taylor
Director
Office of Environmental Policy and Compliance
U.S. Department of the Interior

Mr. Steve Grimm
Senior Program Analyst
Federal Railroad Administration
U.S. Department of Transportation

Mr. Robert McGuire
Research and Special Programs Administration
U.S. Department of Transportation

Ms. Camille Mittleholtz
Environmental Team Leader
Office of Transportation Policy
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Mr. Joseph Montgomery
Director
NEPA Compliance Division
U.S. Environmental Protection Agency

Mr. Chris Gebhardt
Region 10 Department of Energy Reviewer
U.S. Environmental Protection Agency

Mr. Richard Major
Advisory Committee on Nuclear Waste
U.S. Nuclear Regulatory Commission

Mr. Martin Virgilio
U.S. Nuclear Regulatory Commission

Department of Energy Advisory Boards

Mr. Jim Melillo
Executive Director
Environmental Management Advisory Board

Mr. Doug Sarno
Contractor Technical Liaison
c/o Fernald Citizens Advisory Board
Phoenix Environmental Corporation

Ms. Tammie Holm
Phoenix Environmental Corporation
SSAB Administrator
Hanford Site Advisory Board
c/o EnviroIssues

Ms. Wendy Green Lowe
SSAB Administrator
Idaho National Engineering and Environmental
Laboratory Citizens Advisory Board
c/o Jason Associates Corporation

Ms. Menice Santistevan-Manzanares
SSAB Administrator
Northern New Mexico Citizens Advisory Board

Ms. Kay Planamento
SSAB Administrator
Nevada Test Site Programs (NTS-CAB)
c/o PAI

Ms. Sheree Black
SSAB Administrator
Oak Ridge Reservation Environmental
Management Site-Specific Advisory Board

Mr. Ken Korkia
SSAB Administrator
Rocky Flats Citizens Advisory Board

Ms. Dawn Haygood
SSAB Administrator
Savannah River Site Citizens Advisory Board
c/o Westinghouse Savannah River Company

Ms. Stacey Young
SSAB Adminstrator
Paducah Gaseous Diffusion Plant Citizens
Advisory Board
c/o Bechtel Jacobs Company

12.3 State of Idaho

12.3.1 STATEWIDE OFFICES AND LEGISLATURE

The Honorable Dirk Kempthorne
Governor
State of Idaho

The Honorable Jack Riggs
Lt. Governor
State of Idaho

The Honorable Frank Bruneel
Majority Floor Leader
Idaho House of Representatives

The Honorable Wendy Jaquet
Minority Floor Leader
Idaho House of Representatives

The Honorable Jack Barraclough
Representative
Idaho House of Representatives

The Honorable Lenore Barrett
Representative
Idaho House of Representatives

The Honorable Roger Chase
Representative
Idaho House of Representatives

The Honorable Lee Gagner
Representative
Idaho House of Representatives

The Honorable J. Steven Hadley
Representative
Idaho House of Representatives

The Honorable Margaret Henbest
Representative
Idaho House of Representatives

The Honorable Kent A. Higgins
Representative
Idaho House of Representatives

The Honorable Tom Moss
Representative
Idaho House of Representatives

The Honorable Bruce Newcomb
Speaker of the House
Idaho House of Representatives

The Honorable J. Stanley Williams
Representative
Idaho House of Representatives

The Honorable Jo An Wood
Representative
Idaho House of Representatives

The Honorable James Risch
Majority Leader
Idaho Senate

The Honorable W. Clint Stennett
Democratic Leader
Idaho Senate

The Honorable Don Burtenshaw
Senator
Idaho Senate

The Honorable Denton Darrington
Senator
Idaho Senate

The Honorable Bart Davis
Senator
Idaho Senate

The Honorable Evan Frasure
Senator
Idaho Senate

The Honorable Robert L. Geddes
Senator
Idaho Senate

The Honorable Cecil Ingram
Senator
Idaho Senate

The Honorable Robert Lee
Senator
Idaho Senate

The Honorable Laird Noh
Senator
Idaho Senate

The Honorable Melvin Richardson
Senator
Idaho Senate

The Honorable Ralph Wheeler
Senator
Idaho Senate

The Honorable Lin Whitworth
Senator
Idaho Senate

The Honorable Alan G. Lance
Attorney General
State of Idaho

Mr. Michael Nugent
Legislative Services Office
State of Idaho

Mr. James C. Baker
Idaho Department of Agriculture

12.3.2 STATE AND LOCAL AGENCIES AND OFFICIALS

Mr. John J. Cline
Idaho Bureau of Disaster Services

Mr. Mary Halverson
Idaho Bureau of Hazardous Materials

Mr. Gary Mahn
Idaho Department of Commerce

Mr. Steve Allred
Idaho Department of Environmental Quality

Mr. Rick Denning
Idaho Department of Environmental Quality

Mr. Orville Green
Idaho Department of Environmental Quality

Mr. Robert Guenzler
Idaho Department of Environmental Quality

Mr. Karl Kurtz
Idaho Department of Health and Welfare

Mr. Manuel Leon
Idaho Department of Labor

Mr. Lin J. Campbell
Idaho Department of Water Resources

Mr. Bill Eastlake
Idaho Public Utilities Commission

Mr. Raymond Burstedt
Idaho Small Business Development Center

Mr. Bryan Smith
Idaho Transportation Department

Mr. Clive Strong
Natural Resources Division, Idaho Department of Health and Welfare

Mr. Duane Sammons
Department of Law Enforcement

Mr. Dan Kriz
District 5 Office, Idaho Department of Health and Welfare

12.4 Other States

12.4.1 GOVERNORS

The Honorable Bill Owens
Governor
State of Colorado

The Honorable Judy Martz
Governor
State of Montana

The Honorable Kenny Guinn
Governor
State of Nevada

The Honorable Gary Johnson
Governor
State of New Mexico

The Honorable John Kitzhaber
Governor
State of Oregon

The Honorable Michael Leavitt
Governor
State of Utah

The Honorable Gary Locke
Governor
State of Washington

The Honorable Jim Geringer
Governor
State of Wyoming

The Honorable Paul Patton
Chairman
National Governors Association

The Honorable Judy Martz
Chairman
Western Governors Association

Mr. Raymond Scheppach
Executive Director
National Governors Association

Mr. Rich Halvey
Program Manager
Western Governors Association

12.4.2 OTHER OFFICIALS

Ms. Jane Norton
Colorado Department of Public Health and Environment

Mr. Bob Loux
Nevada Agency for Nuclear Projects

Mr. Michael Turnipseed
Nevada Department of Conservation and Natural Resources

Mr. Thomas Stephens
Nevada Department of Transportation

Ms. Jeanne-Marie Crockett
New Mexico Environment Department

Mr. Pete Rahn
New Mexico State Highway and Transportation Department

Ms. Betty Rivera
New Mexico Energy, Minerals and Natural Resources Department

Ms. Stephanie Hallock
Oregon Department of Environmental Quality

Mr. Bruce Warner
Oregon Department of Transportation

Mr. Ken Niles
Oregon Office of Energy

Mr. Milton H. Hamilton, Jr.
Tennessee Department of Environment and Conservation

Mr. William E. Monroe
Tennessee Department of Environment and Conservation

Mr. Tom Fitzsimmons
Washington State Department of Ecology

Mr. Eric Slagle
Washington State Department of Health

Mr. Doug Sutherland
Washington State Department of Natural Resources

Mr. Doug MacDonald
Washington State Department of Transportation

The Honorable Bob Peck
Senator
Wyoming State Senate

12.5 Native American Tribes and Organizations

Ms. Jeinene Big Day
Shoshone-Bannock Tribes

Ms. Valerie R. Devinney Bighorse
Ft. Hall Air Quality Program
Shoshone-Bannock Tribes

Mr. Lionel Boyer
Chairman
Shoshone-Bannock Tribes

Mr. Joe Cajero
Governor
Pueblo of Jemez

Mr. Ken Camel
NEPA Plan Coordinator
Confederated Salish and Kootenai Tribal Council

Mr. Joseph Chavarria
Director
Santa Clara Pueblo

Mr. Randy Connolly
Superfund Coordinator
STOI

Mr. Nelson Cordova
Governor
Taos Pueblo

Mr. Harry Early
Governor
Pueblo of Laguna

Mr. Blaine Edmo
Chairman
Shoshone-Bannock Tribes

Mr. Chuck Galloway
Shoshone-Bannock Tribes

Mr. Denny Guiterrez
Governor
Santa Clara Pueblo

Ms. Susan Hanson
Shoshone-Bannock Tribes

Ms. Barbara Harper
Yakama Indian Nation

Mr. Russell Jim
Director
Yakama Indian Nation

Mr. Alvino Lucero
Governor
Pueblo of Isleta

Mr. Perry Martinez
Governor
Pueblo of San Ildefonso

Mr. Joe McConnell
Chairman
Fort Bellknap Community Council

Mr. Antone Minthorn
Chairman
Confederated Tribes of the Umatilla Indian Reservation

Mr. Jacob Pecos
Director
Pueblo De Cochiti

Mr. Regis Pecos
Governor
Pueblo De Cochiti

Mr. Samuel N. Penny
Chairman
Nez Perce Tribal Executive Committee

Mr. David Perez
Governor
Nambe Pueblo

Mr. Joe Richards
Acting Director
Confederated Tribes of the Umatilla Indian Reservation

Mr. Lonnie Selam, Sr.
Chairman
Yakama Tribal Council

Ms. Sheryll Slim
Shoshone-Bannock Tribes

Mr. Patrick Sobota
Manager
Nez Perce Tribe

Mr. Ernest Stensgar
Chairman
Coeur D'Alene Tribal Council

Ms. Jannette Taylor
Career Training Coordinator
Coeur D'Alene Tribe

Mr. A. Brian Wallace
Chairman
Washoe Tribal Council

Mr. Neil Webber
Director
Pueblo of San Ildefonso

Mr. William Whatley
Director
Pueblo of Jemez

Mr. Wilbur Woods
Chairman
Elko Band Council

Ms. Diana Yupe
Tribal-DOE-ID Project Office
Shoshone-Bannock Tribes

Ms. Joann Chase
Executive Director
National Congress of American Indians

Mr. Jesse Leeds
Organization Chairperson
Las Vegas Indian Center

Mr. Jerry Pardilla
Director
National Tribal Environmental Council

Ms. Gail Small
Executive Director
Native Action

Ms. Grace Thorpe
President
National Environmental Coalition of American Indians

12.6 Environmental and Public Interest Groups

12.6.1 NATIONAL

Mr. Jim Bridgman
Alliance for Nuclear Accountability

Mr. Tom Clements
Greenpeace

Mr. Thomas Cochran
Director
Nuclear Programs
National Resources Defense Council, Inc.

Ms. Maggie Coon
Director, External Affairs
The Nature Conservancy

Mr. Steven Dolley
Nuclear Control Institute

Ms. Libby Fayad
Counsel
National Parks and Conservation Association

Mr. Robert Hill
Executive Director
American Association of Blacks in Energy

Mr. Seth Kirshenberg
Executive Director
Energy Communities Alliance

Mr. Fred Krupp
Environmental Defense Fund

Dr. Arjun Makhijani
President
Institute for Energy and
Environmental Research

Mr. Robert K. Musil
Executive Director
Physicians for Social Responsibility

Mr. Eric Pica
Friends of the Earth

Mr. Richard Sawicki
The Wilderness Society

12.6.2 REGIONAL, STATE, AND LOCAL

Ms. Kaitlin Backland
Executive Director
Citizen Alert

Mr. Fritz Bjornsen
Snake River Alliance

Ms. Beatrice Brailsford
Program Director
Snake River Alliance

Mr. Chuck Broscious
Executive Director
Environmental Defense Institute

Ms. Helen Buehler
League of Women Voters of Teton County

Mr. Robert Bullard
Director
Environmental Justice Resource Center

Ms. Jackie Cabasso
Executive Director
Western States Legal Foundation

Mr. Tom Carpenter
Director
Government Accountability Project

Ms. Lois Chalmers
Institute for Energy for Environmental
Research

Ms. Christine Chandler
Responsible Environmental Action League

Ms. Dianne Ciarlette
Assistant to the Executive Director
American Nuclear Society

Mr. John Commander
Idaho Falls Chamber of Commerce INEEL
Committee

Mr. D. H. "Doc" Detonancour
INEEL PACE Local 8-0652

Ms. Jean Elle
League of Woman Voters

Mr. George Freund
Coalition 21

Ms. Susan Gordon
Director
Alliance for Nuclear Accountability

Ms. Janet Greenwald
Program Director
Citizens for Alternatives to Radioactive Dumping

Mr. Bernhard Hall
Associate State Director
The Nature Conservancy, Montana Field Office

Mr. Don Hancock
Southwest Research and Information Center

Mr. Russell Hoeflich
State Director
The Nature Conservancy, Oregon Field Office

Mr. Richard Kenney
Coalition 21

Mr. Richard Lindsay
Coalition 21

Mr. Werner Lutze
Director
Center for Radioactive Waste Management

Dr. Mildred McClain
Citizens for Environmental Justice, Inc.

Mr. Scott McDonald
Association of Idaho Cities

Ms. Margaret McDonald-Stewart
Snake River Alliance

Mr. Doug Meiklejohn
New Mexico Environmental Law Center

Mr. Richard Moore
Southwest Network for Environmental and Economic Justice

Mr. W. Greg Nelson
Idaho Farm Bureau

Mr. Geoff Pampush
State Director
The Nature Conservancy, Idaho Field Office

Mr. Gerald Pollet
Executive Director
Heart of America Northwest

Ms. Nicole Ray
North State Legal Services, Inc.

Mr. Gary E. Richardson
Executive Director
Snake River Alliance

Dr. Peter Rickards
Vote on INEEL

Mr. Eric Ringleberg
Keep Yellowstone Nuclear Free

Mr. Michael Scott
Executive Director
Greater Yellowstone Coalition

Mr. John Tanner
Coalition 21

Ms. Kaylynda Tilges
Citizen Alert

Mr. Sam Volpentest
Tri-Cities Development Council

Mr. Bill Waldman
State Director
The Nature Conservancy, New Mexico Field Office

Mr. Kafi Watlington-Macleod
Natural Resources Defense Council

Mr. Chris J. Wentz
Radioactive Waste Task Force

12.7 Other Groups and Individuals

Mr. Jess Aguirre
Aguirres Sharpening Sales and Services

Ms. Joanna Allen
Portage Environmental, Inc.

Mr. Navroze D. Amaria
Washington Group International

Mr. Dave Amsden

Ms. Lillis Connery Anderson

Ms. Marina Anderson
Beatty Yucca Mountain Science Center

Mr. Scott Anderson

Mr. Aran Armstrong
Northwind Environmental, Inc.

Ms. Charlotte Arnold
Shelley High School

Mr. J. Paul Bacca

Mr. B. R. Baldwin

Mr. Alan Barber
Jenkins Law Office

Mr. Martin Barela

Mr. James R. Barrett
B and W Services, Inc.

Mr. Jerry C. Batie

Ms. Phyllis Beard
Amalgamated Sugar Co.

Mr. Bruce Begg
Australian Nuclear Science and Technology
Organization - Materials Division

Mr. David Bennert
Innova Tech Services

Mr. Julius Berreth

Mr. Chris Best
Twin Falls Christian Academy

Ms. Lindsey Bierer
General Atomics

Mr. Lou Bink

Ms. Roseanne Black
WPI

Ms. Mary L. Blair

Mr. Colin Boardman

Mr. J. P. Bollinger

Ms. Sharon Boltz

Ms. Page Boyce

Ms. Brenda Boyle

Mr. Louis M. Boyle
J. and L. Properties, Inc.

Ms. Karen Bradley

Ms. Joy K. Brandt
Lander County Yucca Mountain Information
Office

Mr. Bryan Brooks
KPMG

Mr. Pete Brownlee
Marietta College

Mr. Kenneth Bulmahn

Mr. Dewey Burbank

Mr. Ken Burgard
CH2MHill

Mr. Blaine Burkman

Mr. Ronald Bush
Hawley, Troxell, Ennis and Hawley

Mr. Ron Calmus

Mr. Al Campbell

Mr. Curtis Cannell
Magic Valley Regional Medical Center

Ms. Bonnie Cannon

Mr. John Capek

Mr. Ernie Carter
Carter Technologies Company

Mr. Paul Childress
Eurotech

Mr. James Christian
Palmetto Systems Integration, Inc.

Mr. Ronald Claussen
LATA

Ms. Jennifer Clay

Mr. Eric Cole
National Elk Refuge

Mr. Rodger Colgan

Mr. John X. Combo, Esq.
Woolf, Combo and Thompson

Mr. L. Cooper

Ms. Robert D. Copp
Scientech, Inc.

Mr. John C. Courtney
Louisiana State University

Mr. Grady Cox

Mr. Mike Crane

Mr. Dwayne Crumpler
Jacobs Engineering Group

Mr. Bruce Culp
PS2 Associates

Dr. Maxine Dakins
University of Idaho

Mr. Edward Dal Lago

Mr. R. Danford
International Research and Evaluation

Mr. Tim Dart

Mr. Kreg Davis
Electrical Wholesale Supply Co.

Mr. Keith Davis
Jason Associates Corporation

Ms. Rita Davis
Nuclear Fuel Services, Inc.

Mr. Charles DeWolf

Ms. Candace Dillman
WPI

Mr. John Dimarzio

Mr. Terrell Donicht
Idaho School District 411

Mr. Kevin Doyle
Tetra Tech

Mr. Les Dugay

Mr. F. J. Dunhour

Mr. John R. Duray

Mr. Tom Enyeart
SAIC

Mr. George Erb

Ms. Susan Evans
Q. Environmental

Mr. John V. Evans, Sr.
D. L. Evans Bank

Mr. Michael Fellows
Montgomery Watson

Mr. Alberto Ferreli
ANPA

Mr. Mark Fetzer

Mr. Phillip Fineman

Mr. J. A. Finlinson

Mr. Kevin Folk

Mr. Stanley Fong
Erin Engineering Research

Mr. Robert C. Forney
National Research Council

Mr. Charles Forseberg
Oak Ridge National Laboratory

Mr. Howard Forsythe

Mr. David Fortier

Mr. Brian Fourr

Mr. Douglas Gail
S. M. Stoller Corp.

Mr. Ben Gannon

Mr. John Geddie

Mr. Tom Gesell
Idaho State University

Mr. James Giansiracusa
Technology Visions Group, Inc.

Mr. Roger Gilchrist
PNNL/TFA

Mr. Marshall Gingery

Mr. Tom Glaccum

Mr. Walter T. Greaves

Mr. Gary Hagen

Mr. Gregory Hall

Mr. Walter L. Hampson

Mr. John Harbour
Savannah River Technology Center

Mr. Michael Harker
Jacobs Engineering Group

Mr. John Harkness

Mr. Grant Haroldsen

Mr. Bill Harris
Sepradyne Corp.

Dr. Kaye Hart
Embassy of Australia

Mr. Mike Hart
Communication Designs

Ms. Lisa Hayden
Australian Nuclear Science and Technology Organization

Ms. Hilde Heckler

Mr. Paul V. Hehn

Mr. Colin Henderson
Jacobs Engineering Group

Mr. Richard Henry
Grant Environmental

Mr. Joe Henscheid

Ms. Blanche Herrick

Ms. Kristie Hicks
CH2MHill

Mr. Gene Hill

Mr. George Hinman
Washington State University

Mr. Eugene Hochhalter

Mr. Bob Hockett

Mr. Robert Hoffman
SAIC

Mr. Bob Holmes
BNFL, Inc.

Mr. Tom Hopkins
IHI Environmental

Mr. Dean Howell

Ms. Gretchen Hurley
Hot Springs Conservation District

Mr. Nick Hutson
Savannah River Technology Center

Mr. Neil Hutten

Mr. Leonard Hutterman

Mr. Tracy A. Ikenberry
Dade Moeller and Associates

Mr. John A. James
Western Wyoming High School

Mr. Arvid Jensen
Cogema

Mr. Chris Jensen

Mr. John D. Jensen

Mr. Neal Johnson

Ms. Alison Joiner
BNFL, Inc.

Mr. Adam Jostsons
Australian Nuclear Science and Technology Organization

Mr. H. Jeffrey Kahle
Container Products Corp.

Mr. Roy Karimi

Mr. Joseph Kartawich
Illinois Power Company

Mr. John W. Kaser
Idaho State University

Mr. Devin Kennemore
The Louis Berger Group, Inc.

Mr. Peter Kiang
QTS, Inc.

Mr. Ronald Kilz

Mr. John J. King

Kiwanis Club of Burley

Dr. Dieter A. Knecht

Ms. Paula Knighton

Mr. Ken Koller
Koller Associates

Ms. Stephanie Kukay
Idaho State Library

Mr. Stephen Laflin
International Isotopes Idaho, Inc.

Mr. James Lahey
Technology Visions Group, Inc.

Mr. Robert Lanza
ICF Kaiser

Mr. Dewey E. Large
Aidel Enterprises

Mr. Jim Law

Mr. Jim Laybourn

Mr. M. A. Lee

Mr. Mark Lehman
Pacific Group, LLC

Mr. J. K. Lemley
Lemley and Associates

Mr. Vern Lenz

Mr. Solomon Leung
Idaho State University

Mr. Mark Linick

Mr. Jeff Long

Mr. Mark Lusk

Mr. Randy Macmillan
Clear Springs Trout

Mr. Anjan K. Majumder

Ms. Karen Malone
West Valley Nuclear Services

Office Manager
Vic's Truck and Auto Repair

Store Manager
Ferrells Department Store

Ms. Sally Martin Lewis
Mactec, Inc.

Mr. Brad Mason
Studsvik, Inc.

Mr. Roger Mayes
LATA

Mr. David McCoy

Mr. Mike McGarry

Mr. Michael McKenzie-Carter
SAIC

Mr. Roy McKinney
IT Corporation

Mr. Donald McMurrian

Ms. Mary McNeil
AAA Auto Club

Dr. Doug Mercer
Consortium for Risk Evaluation with
Stakeholder Participation

Mr. T. J. Meyer

Mr. James Migaki

Mr. Chris Miller

Mr. W. J. Mings

Mr. Steven Mirsky
SAIC

Mr. Doug Mlsin

Mr. Collin Moller

Mr. Terry Monasterio

Mr. Willie Most
Westinghouse TRU Solutions

Mr. George Murgel
Boise State University

Ms. Nancy B. Myers
Bechtel Hanford, Inc.

Mr. Hereschell Mynarcik

Mr. Lee Nelson

Mr. Gene Newsome

Ms. Gloria Newton

Mr. C. R. Nichols

Mr. Dave Nichols
Jacobs Engineering Group

Mr. Warren Niemi
Oregon Department of Environmental Quality

Mr. Bob Nitschke

Mr. John Notar
U. S. National Parks Service

Mr. James Oliver

Mr. Brady Orchard
Portage Environmental

Mr. Richard F. Orthen
Earth Sciences Consultants

Mr. Ron Paarmann

Ms. Kristin Painter

Ms. Susan Panzitta
The Environmental Company, Inc.

Mr. Charles Park

Mr. Paul Pater
San Diego State University

Mr. John Pawlak
Pahrump Yucca Mountain Science Center

Ms. Valerie Peery
Washington Department of Ecology

Mr. J. R. Pelton

Mr. Larry Penberthy
Penberthy Vitrification Associates

Mr. R. A. Peralta

Mr. J. H. Phillips
Duke Engineering and Services, Inc.

Mr. Jim Pike
Albertson College

Mr. Scott Ploger

Mr. James S. Poles
TEC

Mr. C. F. Poor
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Mr. Kevin Poor
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Ms. Debra J. Wilcox

Mr. Richard P. Wilde
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Ms. Bonnie Williams
Pacific Northwest National Laboratory

Mr. James M. Williams

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Innovawest

Mr. Monte Wilson

Mr. Gerry Winter

Mr. Gene Wisniewski
Liberty Christian Academy

Mr. John R. Witteman
Upper Deer Flat Fire Department

Ms. Roberta Witteman
Upper Deer Flat Fire Department

Mr. Ralph Wolter
Ace Printing

Mr. Paul A.Worth

Mr. John Yacovelle

Mr. Greg Yaskot

Mr. Dan Yurman

Mr. Abe Zeitoun
ATL International

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Mr. Larry Zuck

12.8 State Contacts for National Environmental Policy Act Documentation

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Mr. Todd Everts
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Montana Legislative Environmental Quality Council

Mr. Peter Maggiore
Secretary
New Mexico Environment Department

Mr. Joe Strolin
Clearinghouse Coordinator
Nevada Agency for Nuclear Projects

Oregon Office of the Governor
NEPA Point of Contact

Ms. Barbara Ritchie
NEPA Coordinator
Washington Department of Ecology

Ms. Carolyn Wright
State NEPA Point of Contact
Utah Planning and Budget Office

Ms. Julie Hamilton
Clearinghouse Coordinator
Wyoming State Lands and Investments Office

12.9 Information Locations

Idaho Department of Health and Welfare
Boise, Idaho

Idaho State Library
Boise, Idaho

Cambridge Community Library
Cambridge, Idaho

Eastern Idaho Technical College Library
Idaho Falls, Idaho

Lewiston Tseminicum Library
Lewiston, Idaho
Clearwater Library
Orofino, Idaho

McKay Library
Rexburg, Idaho

Weiser Public Library
Weiser, Idaho

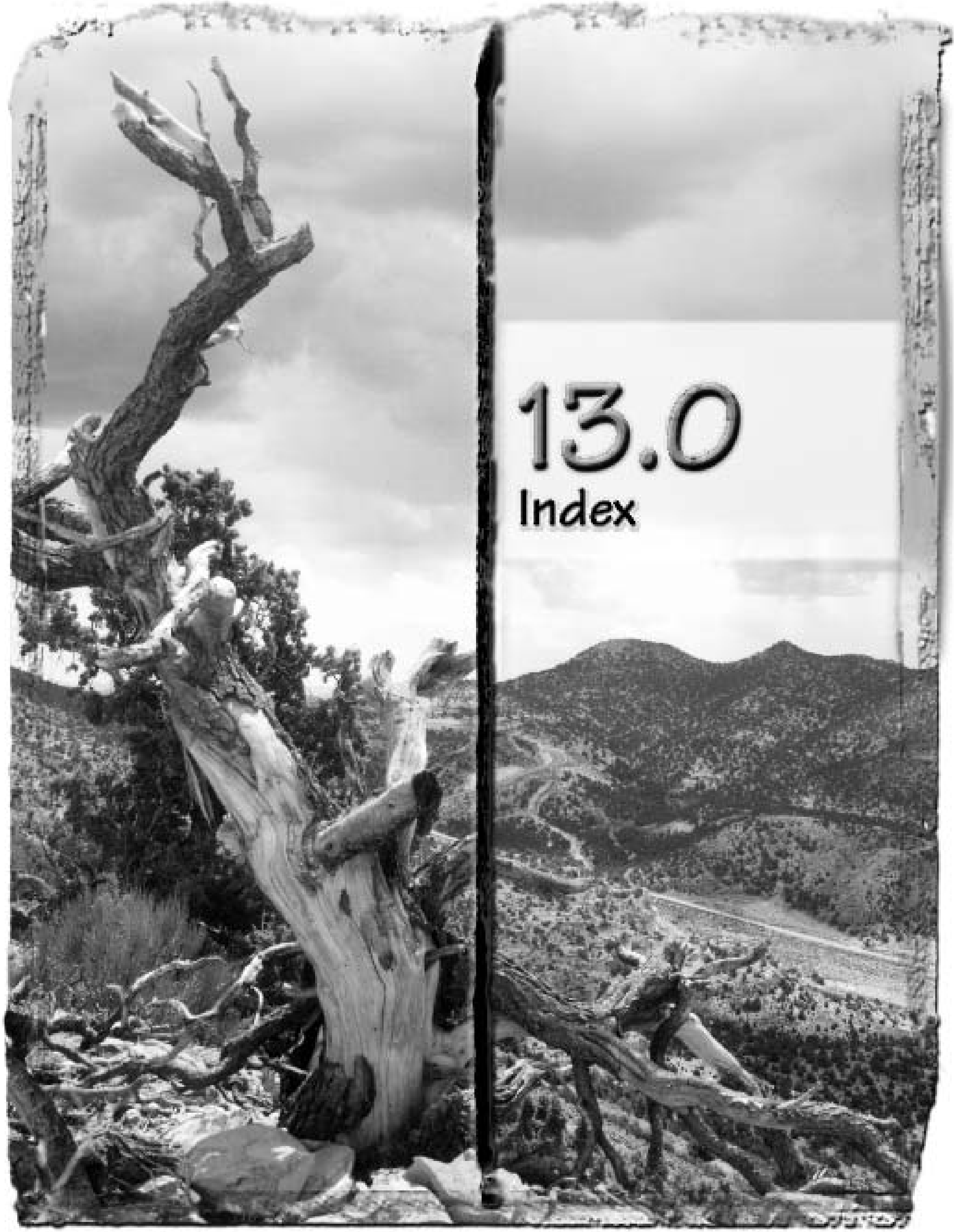
Hazardous Waste Library
Champaign, Illinois

WIPP Technical Library
Carlsbad, New Mexico

Yucca Mountain Site Characterization Office
Las Vegas, Nevada

13.0

Index



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Index