Idaho High-Level Waste & Facilities Disposition

FINAL ENVIRONMENTAL IMPACT STATEMENT

SEPTEMBER 2002 DOE/EIS-0287

SUMMARY

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 (NEPA) provides Federal agency decision-makers with a process to consider potential environmental consequences (beneficial and adverse) of proposed actions before agencies make decisions. An important part of this process is the opportunity for the public to learn about and comment on proposed agency actions before a decision is made.

Passed by Congress in 1969, NEPA 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 (EIS).

Environmental Impact Statement:

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

Scoping:

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

Alternatives:

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

Comment Period:

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

Record of Decision:

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

Copies of the Idaho High-Level Waste and Facilities Disposition Final Environmental Impact Statement are available at the locations listed at the end of this document. The EIS also will be available on the internet at http://tis.eh.doe.gov/nepa/documentspub.html.

To request a copy of this EIS, please call 1-208-526-0833 or send a note electronically to Brad Bugger at: buggerbp@id.doe.gov

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.

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

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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.

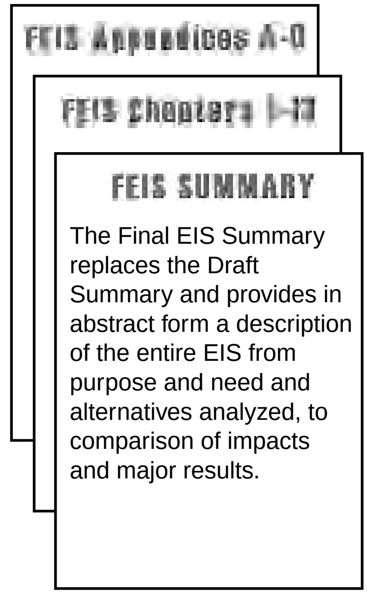


FIGURE 1

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:

- 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 mixed transuranic waste/sodium bearing waste 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.

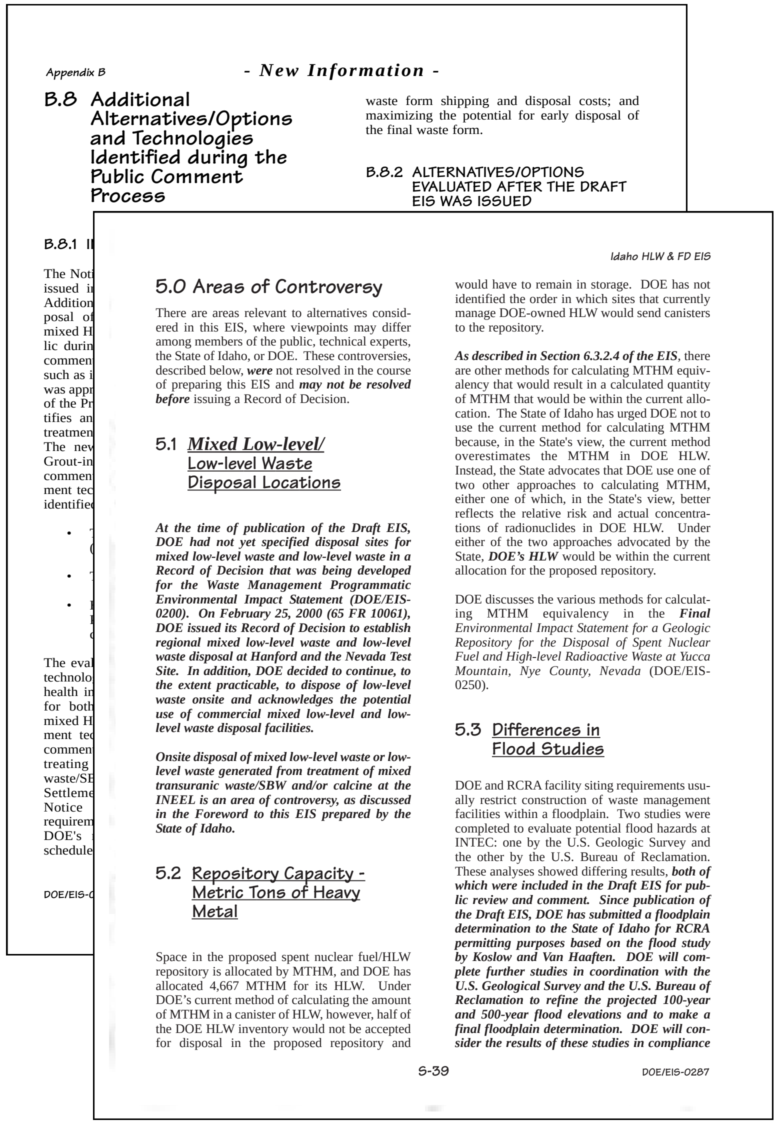
- Tables 3-1 and 3-3 and Tables 3-2 and 3-5 were combined. Table 3-5 was added to summarize the impacts associated with the facility disposition alternatives evaluated in the Draft EIS as well as the State of Idaho and DOE Preferred Alternative for facility disposition.

- 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***

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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.

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Acronyms and Abbreviations

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

CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
DOE	U.S. Department of Energy
EIS	environmental impact statement
EPA	U.S. Environmental Protection Agency
ERPG	**Emergency Response Planning Guideline**
HLW	high-level waste
INEEL	Idaho National Engineering and Environmental Laboratory (formerly known as the Idaho National Engineering Laboratory or INEL)
INTEC	Idaho Nuclear Technology and Engineering Center (formerly known as the Idaho Chemical Processing Plant or ICPP)
LCF	latent cancer fatality
LLW	low-level waste
MTHM	metric tons of heavy metal
NEPA	National Environmental Policy Act
RCRA	Resource Conservation and Recovery Act
ROD	Record of Decision
SBW	sodium-bearing waste
SNF and INEL EIS	U.S. Department of Energy Programmatic Spent Nuclear Fuel Management and Idaho National Engineering Laboratory Environmental Restoration and Waste Management Programs EIS
WIPP	Waste Isolation Pilot Plant

What is ...

High-level waste?

High-level waste (HLW) is the highly radioactive material resulting from reprocessing spent nuclear fuel, including liquid waste produced directly in reprocessing and any solid material derived from the liquid waste that contains fission products in sufficient concentrations, and other highly radioactive material that is determined, consistent with existing law, to require permanent isolation. HLW stored at the Idaho Nuclear Technology and Engineering Center (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. 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 Environmental Impact Statement (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. 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.***

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.

What is
(continued)

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*** **r**adioactive 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.

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. This could be the tank heel or the amount of radioactive waste remaining after additional removal using other methods than the existing transfer equipment.

Summary

1.0 Purpose and Need for Agency Action

1.1 *Purpose and Need*

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 (Figure S-1). 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 the nation through both peaceful and defense-related missions.

Reprocessing operations at INTEC used solvent extraction systems to remove ***primarily*** uranium-235 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 generated mixed HLW.*** Subsequent extraction cycles, treatment processes, and follow-up decontamination activities generated ***liquid mixed transuranic waste/sodium-bearing waste, referred to as mixed transuranic waste/SBW. Newly generated liquid waste results from a variety of sources not associated with spent fuel reprocessing at INTEC.*** At INTEC these wastes ***are*** stored in ***ten of the*** eleven 300,000-gallon ***capacity below grade storage*** tanks ***(the eleventh tank is a spare), known as the "Tank Farm."***

> **Regional Setting**
>
> *The INEEL occupies approximately 890 square miles (570,000 acres) of high desert sagebrush steppe in Bingham, Bonneville, Butte, Clark, and Jefferson counties in southeastern Idaho. Approximately 2 percent of this land (11,400 acres) has been developed to support INEEL facility and program operations associated with energy research, defense missions, and waste management activities.*
>
> *Smaller communities and towns near the INEEL include Mud Lake and Terreton to the east; Arco, Butte City, and Howe to the west; and Atomic City to the south. Larger communities and towns near the INEEL include Idaho Falls, Rexburg, Rigby, Blackfoot, Pocatello and the Fort Hall Indian Reservation to the east and southeast.*

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

Since 1963, much of the liquid waste was fed to a treatment facility and converted to a dry granular substance called calcine. The calcine, which is stored in ***large bin sets***, is a more stable waste form that poses less environmental risk than storing liquid radioactive waste in ***below grade*** tanks. ***All the calcine currently in the bin sets is mixed HLW. Presently***, the calcine does not meet ***expected waste acceptance criteria for the proposed repository at Yucca Mountain.*** Further treatment ***may*** be necessary to convert the mixed HLW ***calcine*** into a waste form acceptable for disposal in ***the*** repository.

Spent nuclear fuel reprocessing was discontinued at INTEC in 1991, so liquid ***mixed*** HLW ceased to be generated. However, since that time, mixed transuranic waste/SBW has continued to accumulate in the tanks from calcine operations, decontamination, and other activities. In 1995, DOE and the State of Idaho reached an agreement, called the Idaho Settlement Agreement/Consent Order, as to when the liquid waste would be ***calcined*** and set a target date of ***December 31,*** 2035 for all of the mixed HLW and mixed transuranic waste/SBW

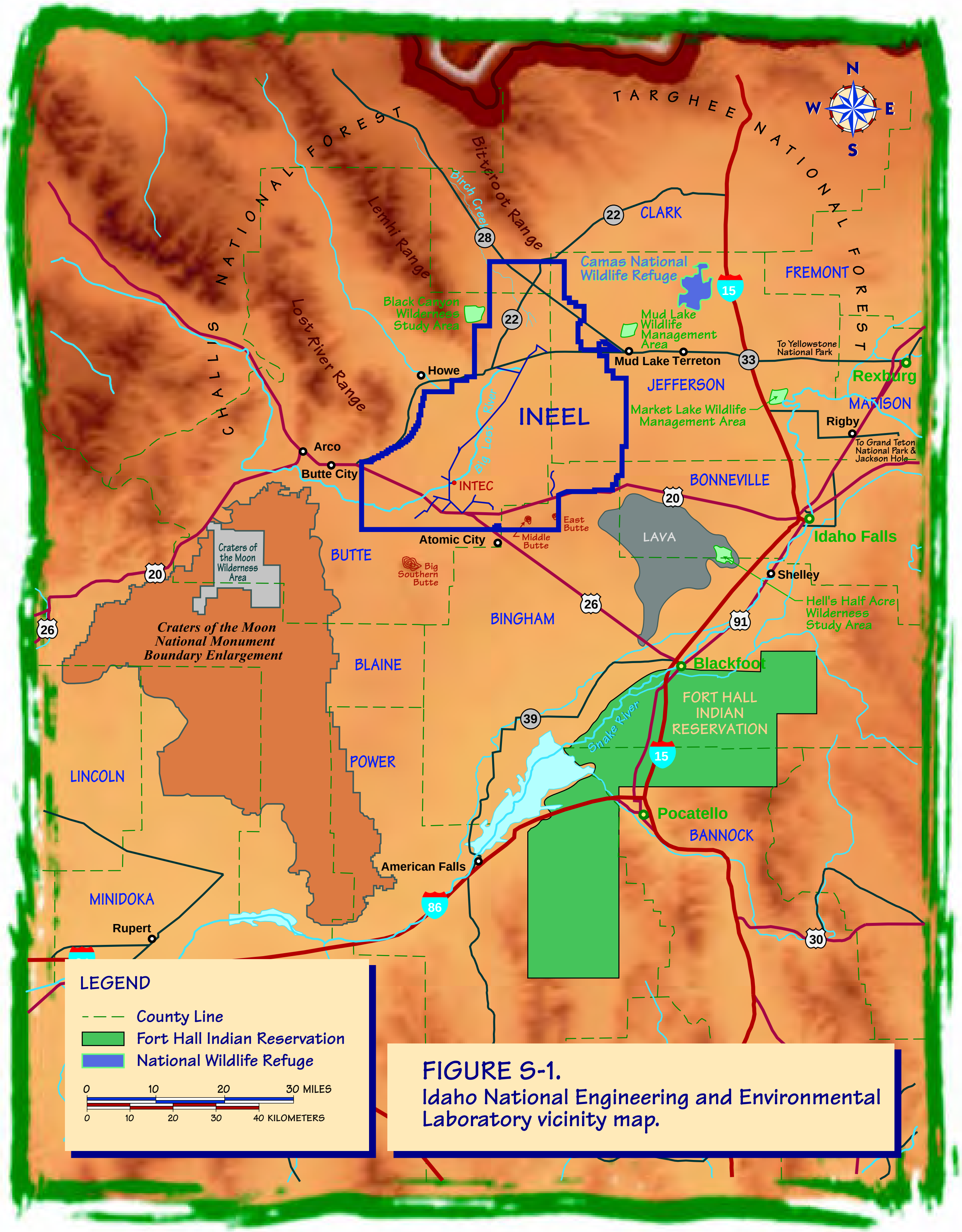


FIGURE S-1.
Idaho National Engineering and Environmental Laboratory vicinity map.

to have been treated and made road-ready for shipment out of Idaho.

Consistent with this agreement, DOE completed calcining all of the liquid mixed HLW in 1998. At present, approximately ***4,400*** cubic meters of mixed HLW calcine remain stored in bin sets, and ***1*** million gallons of mixed transuranic waste/SBW remain in the ***below grade*** tanks. ***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 proposed national geologic repository, and how to disposition facilities at INTEC involved in HLW treatment. DOE has prepared this EIS to inform agency officials and the public of the environmental impacts of alternatives, including the no-action alternative, available for consideration in the decision making process.***

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

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

1.2 Role of this EIS in the Decision-making Process

This EIS describes the environmental impacts of the range of reasonable alternatives for meeting DOE's purpose and need for action. 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.

1.3 Proposed Action

To meet the purpose and need for agency action, 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 Timing and Regulatory Considerations for this EIS

Some INTEC wastes (mixed transuranic waste/SBW) are stored as liquids in 300,000-gallon tanks that do not meet current hazardous waste management standards. ***Five of the eleven tanks currently in use are known as "pillar and panel" tanks.*** DOE's objective is to cease use of ***the five pillar and panel tanks by June 30, 2003 and all remaining tanks by December 31, 2012 in compliance with the 1998 Modification to the Notice of Noncompliance Consent Order.*** Previously, DOE's plan was to cease use of the tanks by calcining all the liquid waste as described in the following documents:

- Record of Decision (ROD) for the *Programmatic Spent Nuclear Fuel Management and Idaho National Engineering Laboratory Environmental Restoration and Waste Management Programs EIS* (SNF and INEL EIS) ***(June 1995)***
- Idaho Settlement Agreement/Consent Order (October 1995)
- INEEL Site Treatment Plan/Consent Order (November 1995).

However, ***because of new technologies and changes in regulatory requirements*** DOE is now reconsidering this plan ***by evaluating various waste processing alternatives. This EIS has been prepared as part of the evaluation and decision making process.***

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

- ***Data are needed on the cumulative impacts associated with cleanup activities at INTEC that are carried out under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA).***

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

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

  This EIS is being prepared sooner than required by the Idaho Settlement Agreement/Consent Order in order to accommodate time estimates ***to obtain project approval and funding, and to complete treatment/storage facility design, construction, and operation.*** This should make it possible for DOE to meet the target ***dates*** of ***December 31, 2012 for ceasing use of the Tank Farm and*** December 31, 2035, for having the treated waste ready to leave Idaho.

2.0 Activities since the Issuance of the Draft EIS

2.1 Summary of Public Comments and Agency Responses

The Draft EIS was mailed to the public and made available on the Internet (http://tis.eh.doe.gov/nepa/) in January 2000. A Notice of Availability was published by the U.S. Environmental Protection Agency (EPA) (65 FR 3448, January 21, 2000) formally initiating the public comment period. DOE also published a Notice of Availability (65 FR 3432, January 21, 2000) that provided information on how the public could obtain copies of the Draft EIS and encouraged comments on the Draft EIS via mail, electronically by the World Wide Web, or at public hearings during a 60-day public comment period. Public hearings were held in: Idaho Falls, Pocatello, Twin Falls, and Boise, Idaho; Jackson, Wyoming; Portland, Oregon; and Pasco, Washington. DOE subsequently extended the public comment period to 90 days (65 FR 9257, February 24, 2000) and added another public hearing in Fort Hall, Idaho.

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 and DOE responses include:

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

  DOE and the State of Idaho have identified their preferred alternatives for treating calcine and mixed transuranic waste/SBW. DOE carefully considered comments received on the Draft EIS in the process of identifying a Preferred Alternative. DOE also considered a variety of factors such as environmental impacts, programmatic needs, safety and health, technical viability, ability to meet regulatory milestones and agreements, and cost. In addition, information received after the Draft EIS was published was considered (see Section 2.2 of this Summary). Each of the treatment alternatives and options offers advantages and disadvantages, which are presented in this EIS.

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

  DOE considered all comments regarding the use of the calciner and thermal and non-thermal treatment technologies as well as their relative advantages and disadvantages for treatment of mixed HLW and mixed transuranic waste/SBW. The alternatives evaluated in this EIS include thermal treatment technologies, such as calcination and vitrification (which are not considered incineration), and non-thermal treatment technologies, such as direct cement and separations. In addition, Steam Reforming, a thermal treatment technology similar to calcination, was also considered. The result of this evaluation process was the addition of a Steam Reforming Option, including shipment of the calcine to the repository, and a Direct Vitrification Alternative with two options: vitrification of the mixed transuranic waste/SBW and vitrification with or without separations for the mixed HLW calcine.

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

  DOE recognizes there are risks associated with liquid waste storage, and over the years converted millions of gallons of mixed HLW and mixed transuranic waste/SBW into calcine, a more stable solid form. Though wastes in liquid form are not necessarily the most hazardous, they tend to be more difficult to contain and also represent the greatest potential threat to the aquifer, if storage facilities are not properly maintained or were to fail unexpectedly.

  DOE considered these risks and as a result included the treatment of liquid waste before processing the calcine. Such an approach will also enable DOE to meet stipulations of the Settlement Agreement/Consent Order and Notice of Noncompliance Consent Order, which require DOE to treat all the liquid in the tanks and cease use of the eleven Tank Farm tanks by December 31, 2012.

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

  In developing the waste processing alternatives analyzed in the EIS, DOE made certain assumptions about how the radioactive waste streams associated with treatment would be classified. In all cases, wastes would be classified in accordance with the requirements of the DOE Order 435.1 and its companion manual. Where appropriate, DOE will use the waste incidental to reprocessing process described in that manual to determine if a waste is high-level, transuranic, or low-level. The objective is not reclassification of the waste but a method to ensure proper treatment and disposal, consistent with DOE requirements. For example, DOE is currently conducting a waste incidental to reprocessing evaluation for the SBW to determine whether it is transuranic waste or HLW. If it is determined to be transuranic waste then it may be treated and disposed of at the Waste Isolation Pilot Plant in New Mexico. Otherwise, it would be made ready for disposal in a HLW repository such as the one currently proposed at Yucca Mountain, Nevada. Under current requirements, this would require the mixed HLW to be delisted under the Resource Conservation and Recovery Act (RCRA).

- ***Repository issues - Commentors expressed concerns about the methods of calculating metric tons of heavy metal (MTHM), and DOE's current policy that would preclude repository acceptance of RCRA listed waste, such as INEEL's mixed HLW.***

  DOE recognizes that several methods exist to calculate MTHM equivalency, each of which would affect the amount of INEEL HLW that could be disposed of in the proposed repository at Yucca Mountain. However, a final determination of the method used for calculating MTHM for the purposes of disposal in a repository is outside the scope of this EIS. MTHM equivalency is addressed 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).

  Under the Nuclear Waste Policy Act, as amended, the Secretary of Energy has recommended that the President approve Yucca Mountain for development of a geologic repository. The President and Congress have approved the site. Nevertheless, Nuclear Regulatory Commission approval must be obtained to construct and operate the facility. Consequently, a schedule for the disposal of INEEL mixed HLW remains uncertain.

  Lastly, DOE's current approach to address RCRA-regulated HLW includes implementation of the delisting process as discussed in this EIS (see Section 4.1 of this Summary, for example). Given the uncertainties of whether the delisting process would enable the disposal of mixed HLW in the proposed repository at Yucca Mountain, DOE may consider alternative strategies under initiatives such as EPA's Project XL or pursue a strategy that would exclude the treated mixed HLW from regulation under RCRA as discussed in Chapter 6.

- ***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.***

  The EIS addresses the potential impacts to the environment, and specifically to the Snake River Plain Aquifer, from the range of reasonable alternatives and No Action. Storage facilities that could fail from natural phenomena could potentially result in releases to the environment. Concerns such as these underlie the purpose and need for this EIS, which will enable DOE to select processing technologies for preparing the waste for disposal so that it poses less risk to the environment and is ready to leave Idaho.

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

  DOE is committed to ensuring that the public continues to have opportunities to provide input to Departmental decision-making. In the context of environmental reviews such as this EIS, DOE follows the Council on Environmental Quality and DOE regulations for public involvement, participation, and disclosure. This included opportunities for the public to participate in the development of the scope of the environmental review, and to comment on the Draft EIS. Outside of this context, DOE maintains other avenues of communication with the public that are germane to cleanup and waste management activities and decisions. 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, and the public is encouraged to attend and participate. DOE also routinely interacts with the media and other stakeholders to help keep the public informed of new initiatives, significant issues, and upcoming decisions of public interest.

- ***Decision-making and obligations to states versus funding constraints - Commentors submitted a range of comments relating to the costs of implementing the EIS alternatives. Some commentors 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 reprioritize cleanup and waste management activities because of budget shortfalls.***

  DOE acknowledges in this EIS that costs are a factor in its decision-making. DOE remains committed to meeting its obligations to the state. Nevertheless, in establishing commitments and in determining the mechanism to meet its commitments, DOE needs to be cognizant of funding availability. Thus, while costs are not an over-riding factor, as a practical matter they are a real issue that DOE must consider as part of the process of making reasonable and informed decisions.

  DOE bases its funding requests for cleanup and waste management on addressing risk and meeting compliance requirements. There are opportunities for public involvement under NEPA, RCRA, and CERCLA which DOE considers in setting priorities.

- ***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 technically sound.***

  DOE considered the maturity of the technologies in identifying the range of reasonable alternatives analyzed in this EIS. The potential environmental impacts, health and safety, regulatory and Settlement Agreement/Consent Order milestones, and estimated cost will be balancing factors DOE will use in making a decision.

  DOE also recognizes additional technology refinement, engineering studies, proof of process and scale-up demonstrations could be required to implement any of the action alternatives analyzed in this EIS. In anticipation of this situation, DOE could issue an EIS record of decision to implement an alternative in phases that may include interim decision points or amend the record of decision, if necessary. In this way DOE could address its commitments without prematurely committing to a single course of action.

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

  DOE recognizes the concerns of the Shoshone-Bannock Tribes and thus involved them early and frequently during the preparation of this EIS to ensure that tribal concerns and issues were considered. This involvement included hearings before and during the 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 NEPA, and DOE conducted consultations 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.

2.2 Other Considerations for EIS Alternatives

Information was received after the Draft EIS was approved for publication in response to DOE's requests to the National Academy of Sciences' National Research Council and DOE's Tanks Focus Area to conduct separate, independent reviews of treatment technologies. DOE has considered the results of these independent reviews as part of its analyses of the alternatives and in its identification of the Preferred Alternative.

National Academy of Sciences Assessment of Alternatives

In January 1998, DOE requested that the National Academy of Sciences' National Research Council review the technologies being considered for treatment of the mixed HLW calcine and the mixed transuranic waste/SBW. The National Academy of Sciences issued its review of the technologies in its document *Alternative High-Level Waste Treatments at the Idaho National Engineering and Environmental Laboratory* in December 1999.

Tanks Focus Area Assessment of Technologies

In June 2000, the DOE Tanks Focus Area was requested to review waste treatment technologies that were under consideration for this EIS. The Tanks Focus Area assessed the technical maturity and status of research and development, and identified technology gaps and uncertainties for each treatment technology.

The Tanks Focus Area also conducted a follow-up independent technical review of a proposed steam reforming treatment process for mixed transuranic waste/SBW. The purpose of this review was to determine the feasibility, applicability, and cost of this treatment option.

2.3 Changes from the Draft EIS

This EIS responds to public comments and reflects modifications from the Draft EIS in response to comments, and includes refined or new information and analyses that became available after the Draft EIS was published.

Modifications include:

- **Description of the Preferred Alternative.** DOE and the State of Idaho identified their Preferred Alternatives based on consideration of public comments and other information, including environment, safety, and health, schedule commitments, cost, technical risk, and disposal.

- **Analysis of the new Direct Vitrification Alternative and the Steam Reforming Option.** This alternative and option are described in Chapter 3. Impacts from these new analyses are included in tables and discussion in Chapter 5. As a component of the Steam Reforming Option, calcine would be retrieved from the bin sets and packaged for shipment to a HLW repository for disposal.

- **Refined air dispersion modeling results.** "CALPUFF", an air dispersion model, was used to estimate potential air quality impacts at more distant points from the INEEL within national parks that are characterized by Class I airsheds (see Section 5.2.6 and Appendix C.2).

- **Discussion of additional technologies and variations on alternatives.** As part of the analyses of the alternatives and process used to identify the Preferred Alternative, DOE assessed other technologies and options recommended by the public and the National Academy of Sciences (see Section 3.3, Alternatives Eliminated from Detailed Analysis, and Appendix B).

- **Increased waste volumes.** Five times higher waste volumes would be generated from vitrification of calcine at the Hanford Site than those analyzed under the Minimum INEEL Waste Processing Alternative in the Draft EIS. This increase was due to updated information regarding the process at the Hanford Site. This increased waste generation led to changes in the impacts for this alternative (see Section 5.2.9 and Appendix C.8).

- **Refined source term information.** Using updated source terms (see Appendix C.7), facility accident analysis (see Appendix C.4 and Section 5.2.14) and long-term facility disposition analysis (see Appendix C.9 and Section 5.3.5) were performed to provide more refined estimates of potential impacts.

- **Sensitivity analyses.** The results of quantitative sensitivity analyses from the effects of changes in time of grout failure, infiltration rates, and distribution coefficients on the resulting impacts to human receptors have also been updated (see Appendix C.9).

- **Relevant discussion regarding the DOE Record of Decision for waste management.** DOE issued its Record of Decision to establish regional low-level and mixed low-level waste disposal at the Hanford Site and the Nevada Test Site. The Record of Decision also addressed the continuation of disposal of these wastes at the INEEL (see Section 2.3.1).

- **Waste Incidental to Reprocessing.** Information about the status of the waste incidental to reprocessing determination process under DOE Order 435.1 has been expanded (see Chapter 2, Section 2.2.2), and the possible designation and disposal destination of wastes under this procedure are reflected in more detail throughout the text of this EIS.

- **Updated affected environment.** Chapter 4, Affected Environment, has been updated by adding information to Sections 4.2, Land Use; 4.7, Air Resources; 4.8, Water Resources; 4.9, Ecological Resources; and 4.11, Health and Safety.

3.0 Alternatives

For purposes of analysis, DOE used a modular approach in developing alternatives for this EIS. Under this approach, DOE identified a series of discrete projects, which ***can be linked together in different combinations to*** achieve the goals of the proposed action. Thus, some projects are included in more than one waste processing alternative. This modular approach provides DOE flexibility in analyzing waste processing alternatives and treatment options and in selecting the preferred alternative.

The facility disposition alternatives analysis considers all of the facilities that would be required to implement each waste processing alternative.

3.1 Identifying Alternatives

DOE undertook ***and*** documented ***a*** process to identify the range of reasonable alternatives for ***this*** EIS that would satisfy the purpose and need ***and proposed action*** to manage wastes at INTEC.

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

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

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

Institutional controls...

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

Further, although accident impacts discussed in Section ***6*** of this Summary do not include mitigation, the Federal government is required to respond to any radiological emergency at the INEEL. DOE and other Federal agencies would be available to provide resources to assist in the evaluation of any accident, mitigate potential long-term exposure pathways to humans, and direct subsequent clean-up activities to decontaminate affected areas and reduce radiation levels.

3.2 EIS Alternatives

3.2.1 WASTE PROCESSING ALTERNATIVES

The EIS analyzed the following ***six*** waste processing alternatives:

- No Action
- Continued Current Operations
- Separations
  (with three treatment options)
- Non-Separations
  (with ***four*** treatment options)

- Minimum INEEL Processing

- ***Direct Vitrification Alternative (with two treatment options)***

Figures (S-2 through S-13) are provided for each waste processing alternative or treatment option to help clarify the basic processes. DOE developed these alternatives using a modular approach, in which each alternative is comprised of specific projects analyzed in this EIS. This approach permits projects within an alternative to be combined with projects of other alternatives. The resulting creation of hybrid alternatives can increase DOE's flexibility for decision-making. ***For example, the EIS analyzes treatment of post-2005 newly generated liquid waste as mixed transuranic waste/SBW for comparability of impacts between alternatives. Under any alternative, 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.***

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

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

A key element in the Settlement Agreement/Consent Order that is relevant to this EIS is the commitment to have all calcine treated and ready for shipment out of Idaho by a target date of December 31, 2035. A separate Notice of Noncompliance Consent Order with the State of Idaho requires DOE to cease use of the Tank Farm by December 31, 2012. Based on the analysis in this EIS, DOE expects that all alternatives, except for No Action and Continued Current Operations, would meet the 2035 target date. However, the analysis also indicates that under some alternatives it would be difficult to treat all the waste by 2012 so DOE can cease use of the Tank Farm unless remaining waste is transferred to RCRA-compliant tanks. 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, and funding would have to be available, so that conceptual design could begin, followed by accelerated permitting, procurement, and construction.

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

Modular Approach

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

WASTE MANAGEMENT ELEMENTS

Alternatives and Options	Pre-treatment Storage		Treatment Process									Post-treatment storage on the INEEL	Post-treatment Disposal Destinations			
	Waste in tanks[1]	Calcine in bin sets	Permitted Calciner	Vitrification	*Steam Reforming*	Separations			Grout/cement ceramic				NGR HLW	WIPP TRU	Near surface landfill options for LLW	
						Cs	Sr	TRU	HLW	LLW	TRU				On INEEL	Off INEEL
NO ACTION ALTERNATIVE	●	●														
CONTINUED CURRENT OPERATIONS ALTERNATIVE		●	●													
SEPARATIONS ALTERNATIVE																
· FULL SEPARATIONS	●	●		●		●	●	●		●		●	●		●	●
· PLANNING BASIS		●	●	●		●	●	●		●		●	●			●
· TRANSURANIC SEPARATIONS	●	●						●		●	●	●		●	●	●
NON-SEPARATIONS ALTERNATIVE																
· HOT ISOSTATIC PRESSED WASTE		●	●						●			●	●			
· DIRECT CEMENT WASTE		●	●						●			●	●			
· EARLY VITRIFICATION	●	●		●							●[2,3]	●	●	●		
· STEAM REFORMING	●	●			●						●		●	●		
MINIMUM INEEL PROCESSING ALTERNATIVE	●	●		●[4]		●[3]		5	5		●[3]	●	●	●	5	5
DIRECT VITRIFICATION ALTERNATIVE																
· VITRIFICATION WITHOUT CALCINE SEPARATIONS	●	●		●								●	●[7]	●[8]		
· VITRIFICATION WITH CALCINE SEPARATIONS	●	●		●		●[6]	●[6]	●[6]		●		●	●[7]	●[8]	●	●

LEGEND

Cs	Cesium
LLW	Low-level waste
NGR	National geologic repository
Sr	Strontium
TRU	Transuranic waste
WIPP	Waste Isolation Pilot Plant
WIR	Waste Incidental to Reprocessing

1. DOE must cease use of five pillar and panel vault tanks by *June* 2003 (these are single-shell tanks with an external secondary contaminant structure that is not expected to meet seismic design criteria). Except for the No Action Alternative, DOE would cease use of the monolithic vault tanks by *December 2012* (these are single-shell tanks with a external secondary contaminant structure that is more likely to meet seismic design criteria than the pillar and panel tanks).
2. These waste management elements are currently not included in the alternatives or treatment options but could be considered for development of hybrid alternatives.
3. Mixed transuranic waste/SBW in underground tanks at INTEC would be treated and sent to WIPP. In the Minimum INEEL Processing Alternative, cesium would be separated and sent to Hanford to be treated with INTEC HLW.
4. Vitrification of calcine would be performed at Hanford.
5. Hanford's design decision *process* would determine if these separation technologies would be used and, therefore, what waste fractions will be generated.
6. *Options for calcine treatment.*
7. *If SBW is managed as HLW.*
8. *If SBW is managed as transuranic waste.*

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

NO ACTION ALTERNATIVE

Council on Environmental Quality regulations require analysis of a No Action Alternative (Figure ***S-2***) as a baseline for comparison to other alternatives. Under this alternative:

- ***The New Waste Calcining Facility calciner would remain in standby (placed in standby in May 2000).*** It would not undergo upgrades and no liquid mixed transuranic waste/SBW would be calcined.

- The ***Process Equipment Waste and*** High-Level Liquid Waste Evaporators would continue to operate to reduce the liquid mixed transuranic waste/SBW volume and enable DOE to cease use of the five pillar and panel tanks by 2003. Newly generated liquid waste would accumulate in the Tank Farm until 2017, at which time DOE assumes that ***the five*** remaining tanks would be full.

- The mixed HLW calcine from bin set 1 would be transferred to bin set 6 or 7 as discussed in the SNF and INEL EIS, but bin set 1 would not be closed. ***DOE is continuing to evaluate the structural integrity of bin set 1.***

Implementation of this alternative would not enable DOE to cease use of the Tank Farm by ***December 31,*** 2012 nor make its mixed HLW ready for shipment to a storage facility or repository outside of Idaho by a target date of 2035.

CONTINUED CURRENT OPERATIONS ALTERNATIVE

This alternative (Figure ***S-3***) involves calcining the liquid mixed transuranic waste/SBW and adding it to the bin sets, where it would be stored with mixed HLW calcine. Under this alternative:

- The New Waste Calcining Facility calciner would ***remain in standby***, pending receipt of a RCRA permit from the State and upgrades to air emission controls required by EPA.

- The ***calciner*** would operate from 2011 through 2014 to calcine the remaining mixed transuranic waste/SBW, which would be stored in the bin sets. After 2014, the calciner would operate as needed until the end of 2016.

- Beginning in 2015, Tank Farm heels (material left in the tanks after initial processing) and newly generated liquid waste would be processed through an ion exchange column. Low-level waste would be grouted for disposal at the INEEL, and transuranic wastes would be disposed of at the Waste Isolation Pilot Plant.

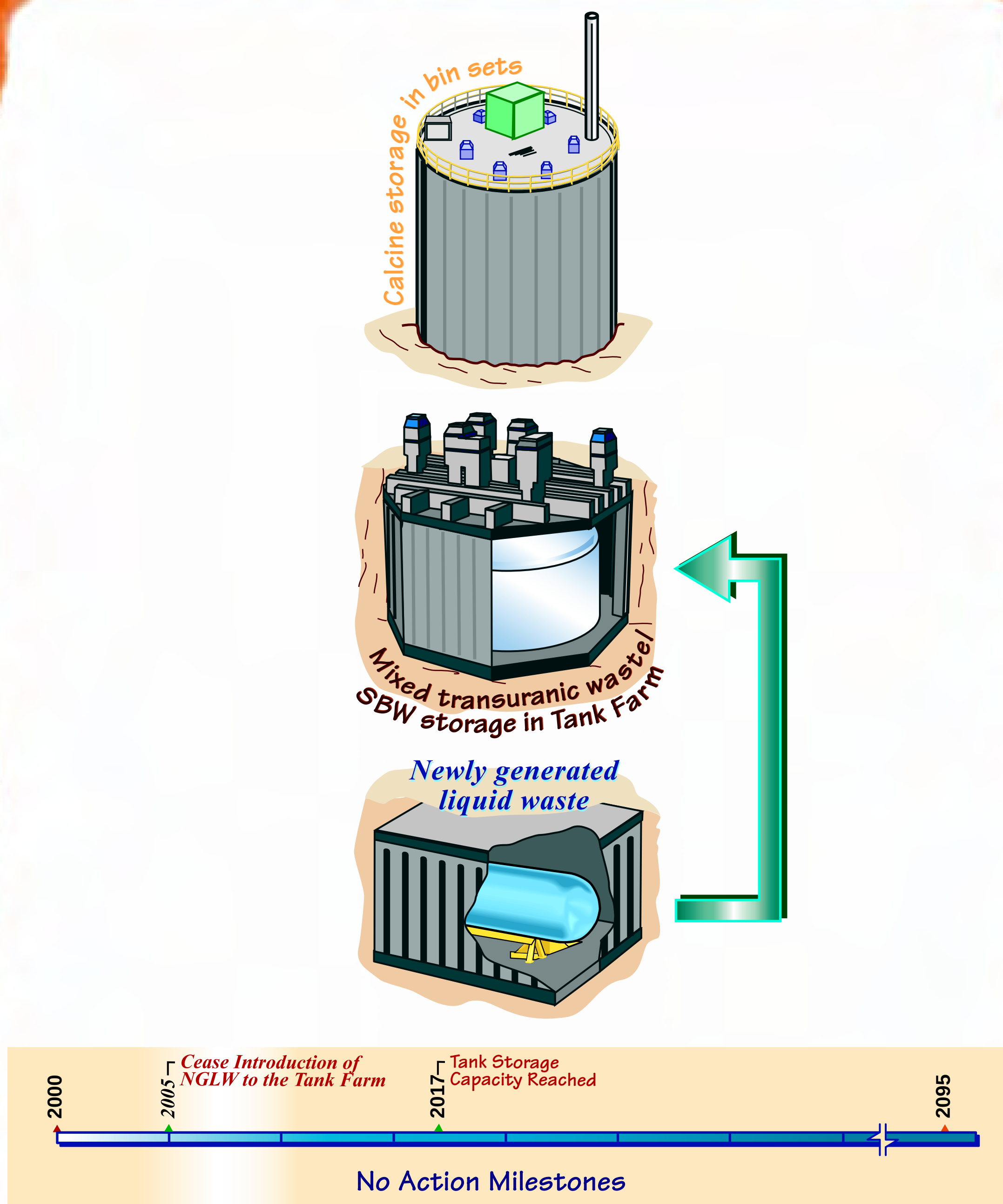
- The mixed HLW calcine in bin set 1 would be transferred to bin set 6 or 7 as discussed in the SNF and INEL EIS, and bin set 1 would be closed in accordance with RCRA regulations. The calcine would be stored in the bin sets indefinitely.

Implementing this alternative would ***not*** enable DOE to cease use of the Tank Farm by ***December 31, 2012, and*** it would not enable DOE to make its mixed HLW ready for shipment to a storage facility or repository outside of Idaho by a target date of 2035.

SEPARATIONS ALTERNATIVE

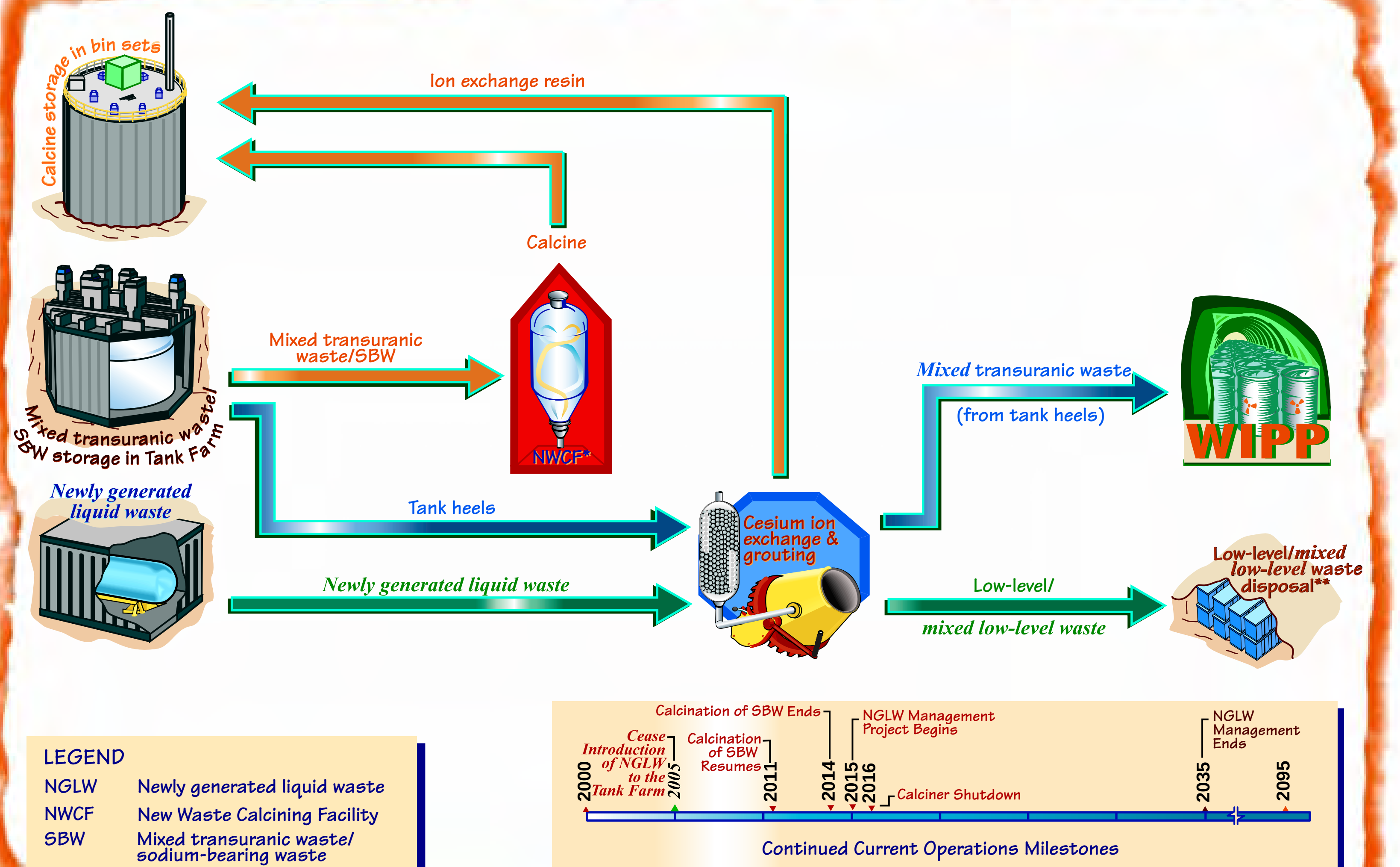
The Separations Alternative comprises three options, each of which uses a chemical separations process, such as solvent extraction, to divide the waste into waste fractions suitable for disposal in ***either*** a ***HLW*** repository ***or the Waste Isolation Pilot Plant in New Mexico or*** at ***a low-level waste disposal facility, depending on the characteristics of the fractions***. Separating the radionuclides in the waste into fractions would decrease the amount of waste that would have to be shipped to a repository, saving needed repository space and reducing disposal costs.

Because HLW would be separated into fractions, before undertaking the separation process DOE would ***follow the waste incidental to reprocessing determination process*** to determine whether any of the fractions would be managed as transuranic or low-level waste rather than HLW. The waste streams that meet the requirements of the waste incidental to reprocessing determination process ***established by DOE Order 435.1 and Manual 435.1-1***, either by ***the*** citation or by



LEGEND
NGLW Newly generated liquid waste

FIGURE S-2.
No Action Alternative.



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 S-3.
Continued Current Operations Alternative.

the evaluation ***method***, are excluded from HLW ***management requirements***.

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

Full Separations Option

This option (Figure ***S-4***) would separate the most highly radioactive and long-lived radioisotopes from both mixed HLW calcine and the mixed transuranic waste/SBW, ***resulting in a mixed HLW fraction and a mixed low-level waste fraction***. Under this option:

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

- The mixed HLW fraction would be vitrified in a new facility ***at INTEC, placed in stainless steel canisters,*** and stored onsite until shipped to a storage facility or ***geologic*** repository.

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

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

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

Planning Basis Option

This option (Figure ***S-5***) reflects previously announced DOE decisions and agreements regarding the management of mixed HLW and mixed transuranic waste/SBW with the State of Idaho. It is similar to the Full Separations Option except that, prior to separation, the mixed transuranic waste/SBW would be calcined and stored in the bin sets along with the mixed HLW. Under this option:

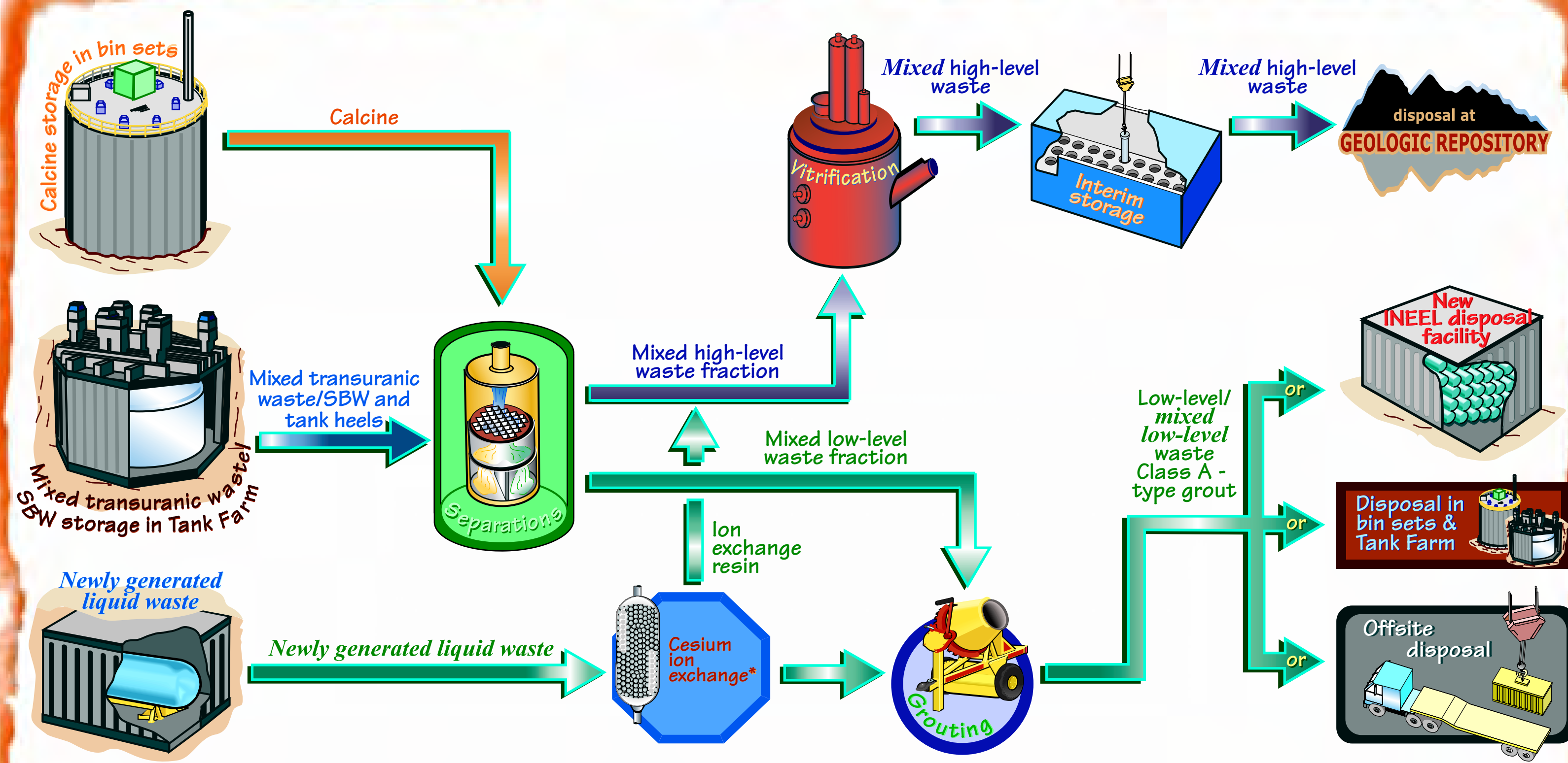
- The New Waste Calcining Facility calciner would ***remain in standby***, pending receipt of a RCRA permit from the State and upgrades to air emission controls required by EPA.

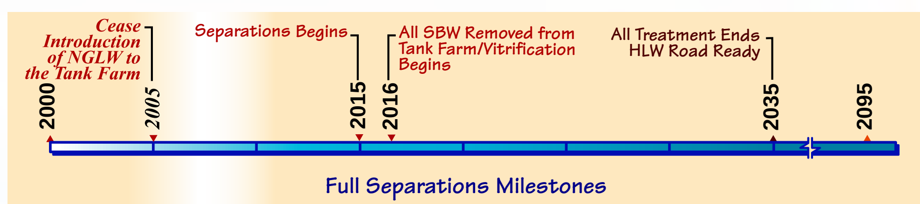
- Under an accelerated schedule, DOE could complete calcining by ***December 31,*** 2012 and meet the Settlement Agreement/Consent Order.

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

- ***The high-level*** fraction would be vitrified to form HLW glass ***and placed in stainless steel canisters***. The vitrified HLW fraction would be ***stored*** in a ***new*** storage facility at the INEEL until shipped to a storage facility or repository outside of Idaho.

- The mixed low-level waste fraction would be grouted to form a waste stream that meets the Nuclear Regulatory Commission's defi-





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 S-4.
Full Separations Option.

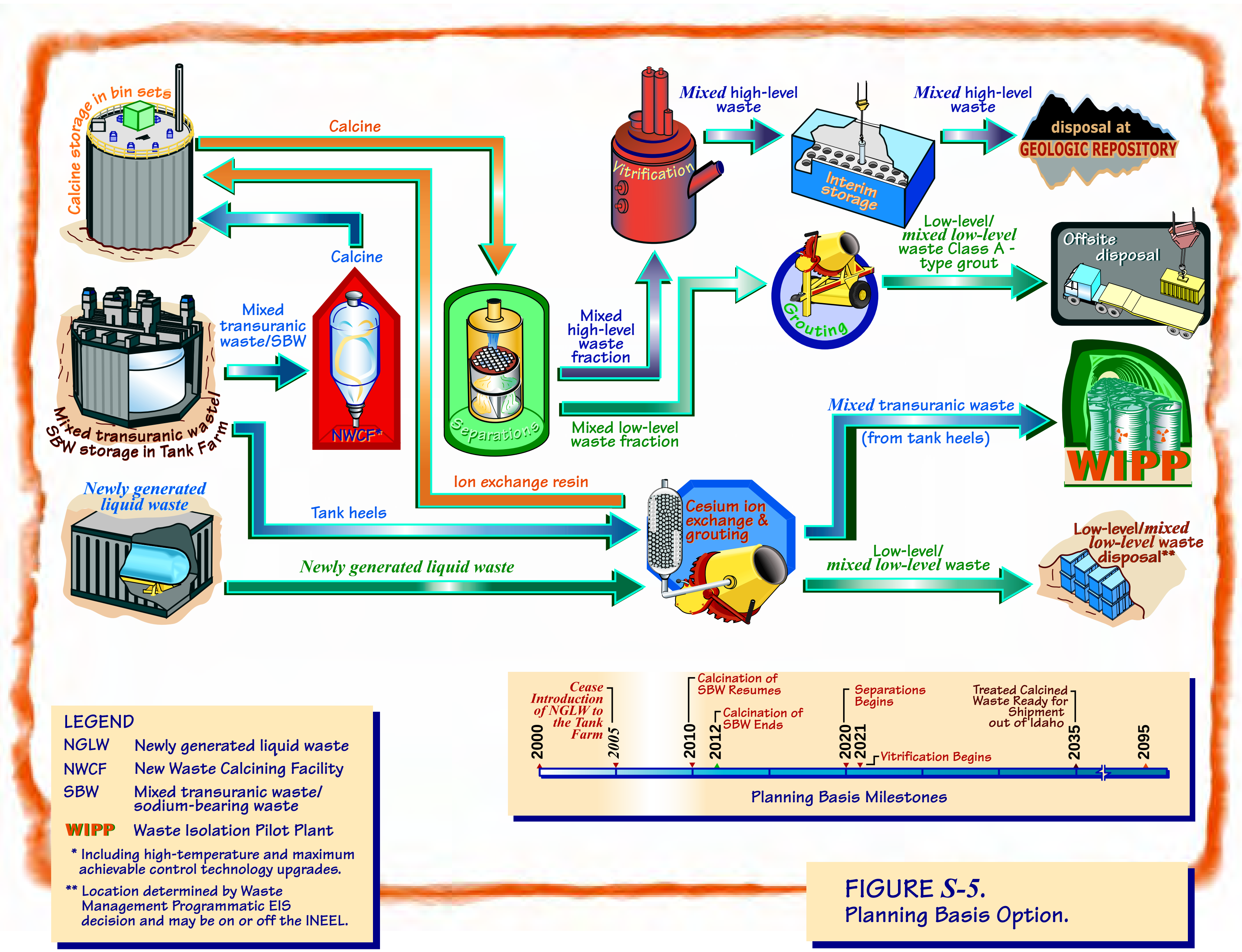


FIGURE S-5.
Planning Basis Option.

nition of a Class A low-level waste. Under ***the Planning Basis*** Option, DOE would dispose of the Class A-type grout in an offsite low-level waste disposal facility.

- Tank heels would be flushed out of the ***Tank Farm*** tanks, dried ***in a new facility***, packaged, and sent to the Waste Isolation Pilot Plant for disposal.

Under this option DOE ***would be able*** to cease use of the Tank Farm by ***December 31***, 2012 ***(using an accelerated schedule)*** or 2014 and ***would be able*** to make its mixed HLW ready for shipment to a storage facility or repository outside of Idaho by a target date of 2035.

Transuranic Separations Option

There would be no ***mixed*** HLW after ***separations*** under this option (Figure ***S-6***). Rather, the resulting ***fractions*** would be managed as ***mixed*** transuranic waste ***and mixed low-level waste***. Under this option:

- DOE would retrieve the calcine and mixed transuranic waste/SBW ***and treat the waste in*** a new chemical separations facility. The process would remove transuranics, resulting in ***a mixed*** transuranic ***waste fraction*** and ***remaining mixed*** low-level waste fraction.

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

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

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

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

NON-SEPARATIONS ALTERNATIVE

The Non-Separations Alternative ***includes four options for solidifying*** mixed HLW and mixed transuranic waste/SBW. ***These four*** treatment options ***are***:

- Hot Isostatic Pressed Waste Option

- Direct Cement Waste Option

- Early Vitrification Option

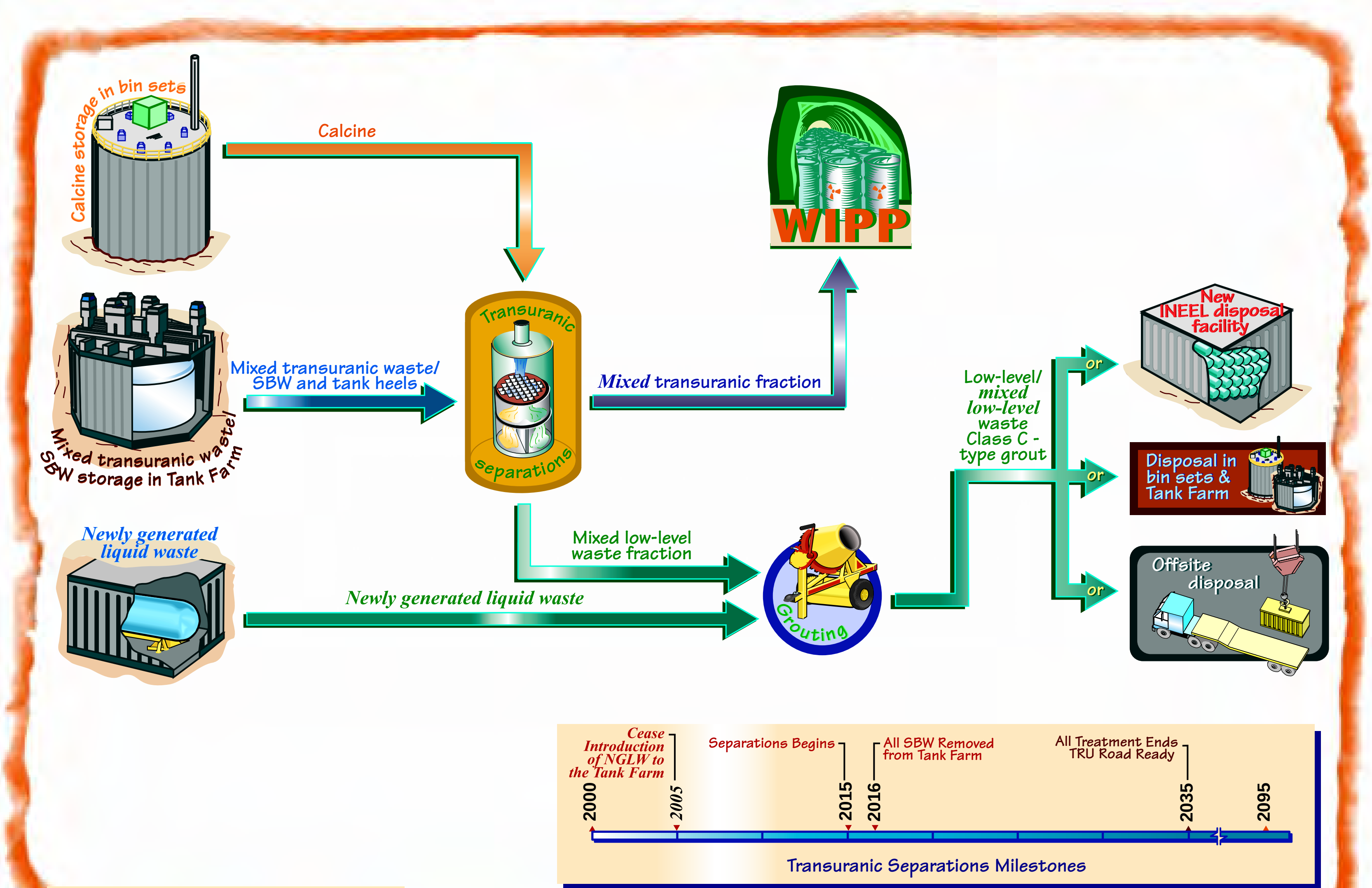
- ***Steam Reforming Option***

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

Hot Isostatic Pressed Waste Option

This option (Figure ***S-7***) would calcine the liquid mixed transuranic waste/SBW and add the calcine to the mixed HLW calcine. All ***of the*** calcine would then be ***treated in a high pressure, high temperature process that would convert the calcine*** to an impervious, non-leaching, glass-ceramic waste form. ***This process has the capability to reduce*** waste ***volumes by*** about 50 percent. Under this option:

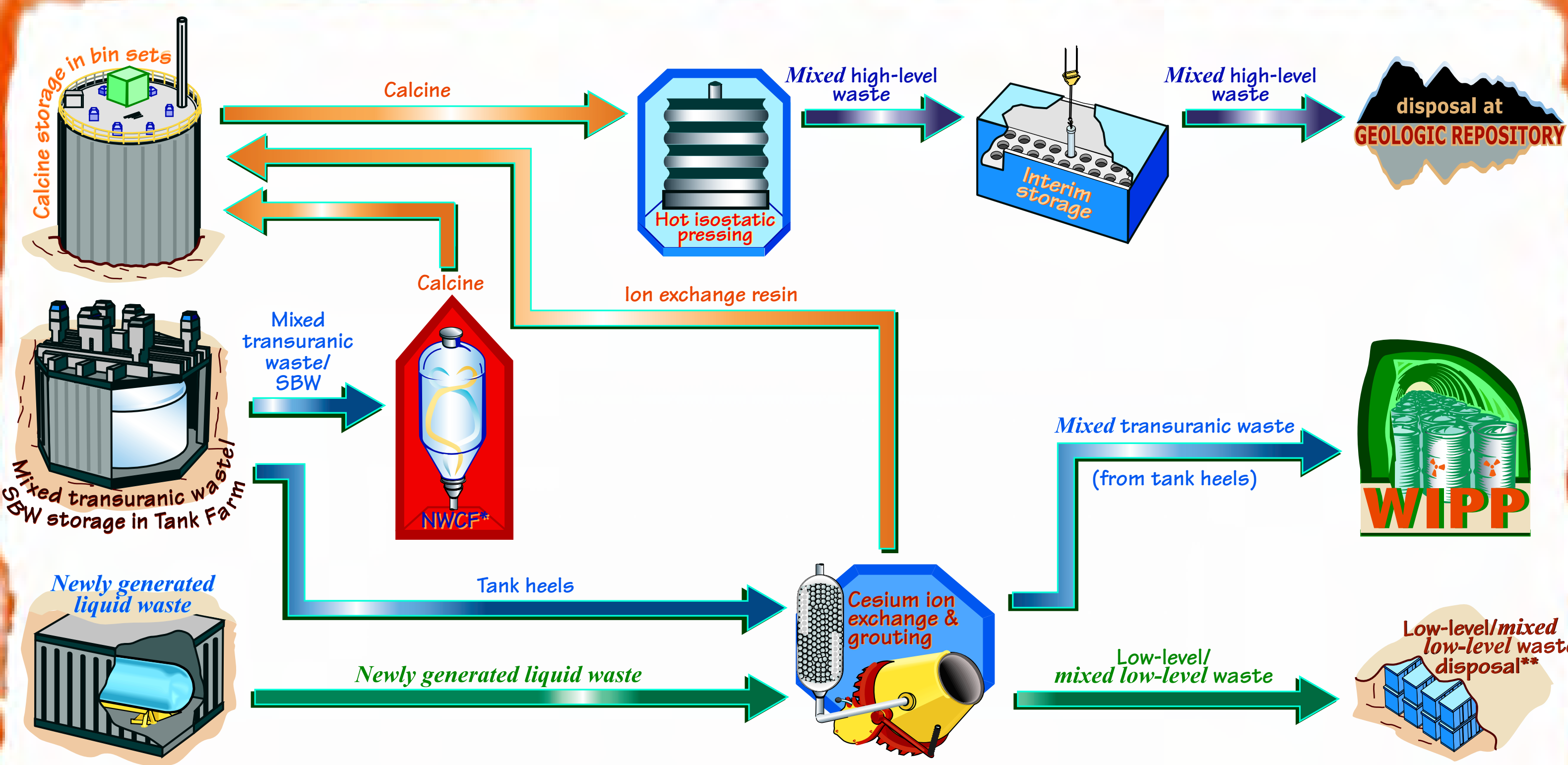
- ***After*** receipt of a RCRA permit from the State and upgrades to air emission controls

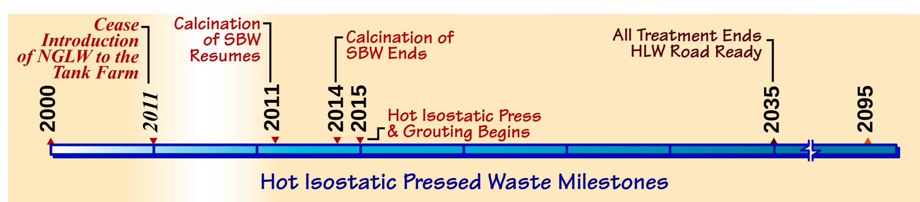


LEGEND

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

FIGURE S-6.
Transuranic Separations 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 S-7.
Hot Isostatic Pressed Waste Option.

required by EPA, the calciner would operate from 2011 through 2014 to calcine the remaining liquid mixed transuranic waste/SBW, which would be stored in the bin sets. After 2014, the calciner would operate as needed until the end of 2016 ***to treat newly generated liquid waste.***

- The calcine would be retrieved from the bin sets, blended with silica and titanium powder, ***added to special cans,*** and subjected to high temperature and pressure in ***a hot isostatic press*** to form a glass-ceramic product.

- The final product would be packaged in canisters for storage and subsequent disposal in a ***HLW*** repository.

- Before 2015, newly generated liquid waste would be concentrated, the effluents stored in new ***RCRA-compliant*** tanks, and then calcined with the mixed transuranic waste/SBW in the New Waste Calcining Facility. Starting in 2015, newly generated liquid waste would be processed through ***a cesium*** ion-exchange column, evaporated, and grouted as ***mixed low-level waste or*** low-level waste for disposal at the INEEL or offsite.

- Tank heels would be flushed out of the ***Tank Farm*** tanks, dried ***in a new facility***, packaged, and sent to the Waste Isolation Pilot Plant for disposal.

This option would require a determination of equivalent treatment from EPA ***since in this case the final waste form (glass ceramic) is not currently an approved RCRA treatment process for HLW exhibiting the hazardous characteristics of corrosivity and toxicity for certain metals*** (as discussed in ***Section 6.2.5*** of the EIS). ***Under this option,*** DOE ***would be able*** to cease use of the Tank Farm by 2014 and make mixed HLW ready for shipment to a storage facility or repository outside of Idaho by a target date of 2035.

Direct Cement Waste Option

This option (Figure ***S-8***) would involve calcining the liquid mixed transuranic waste/SBW and adding the calcine to the mixed HLW calcine. All calcine would be converted to a cement-like solid. Under this option:

- ***After*** receipt of a RCRA permit from the State and upgrades to air emission controls required by EPA, the ***calciner*** would operate from 2011 through 2014 to calcine the remaining ***liquid*** mixed transuranic waste/SBW, which would be stored in the bin sets. After 2014, the calciner would operate as needed until the end of 2016 ***to treat newly generated liquid waste***.

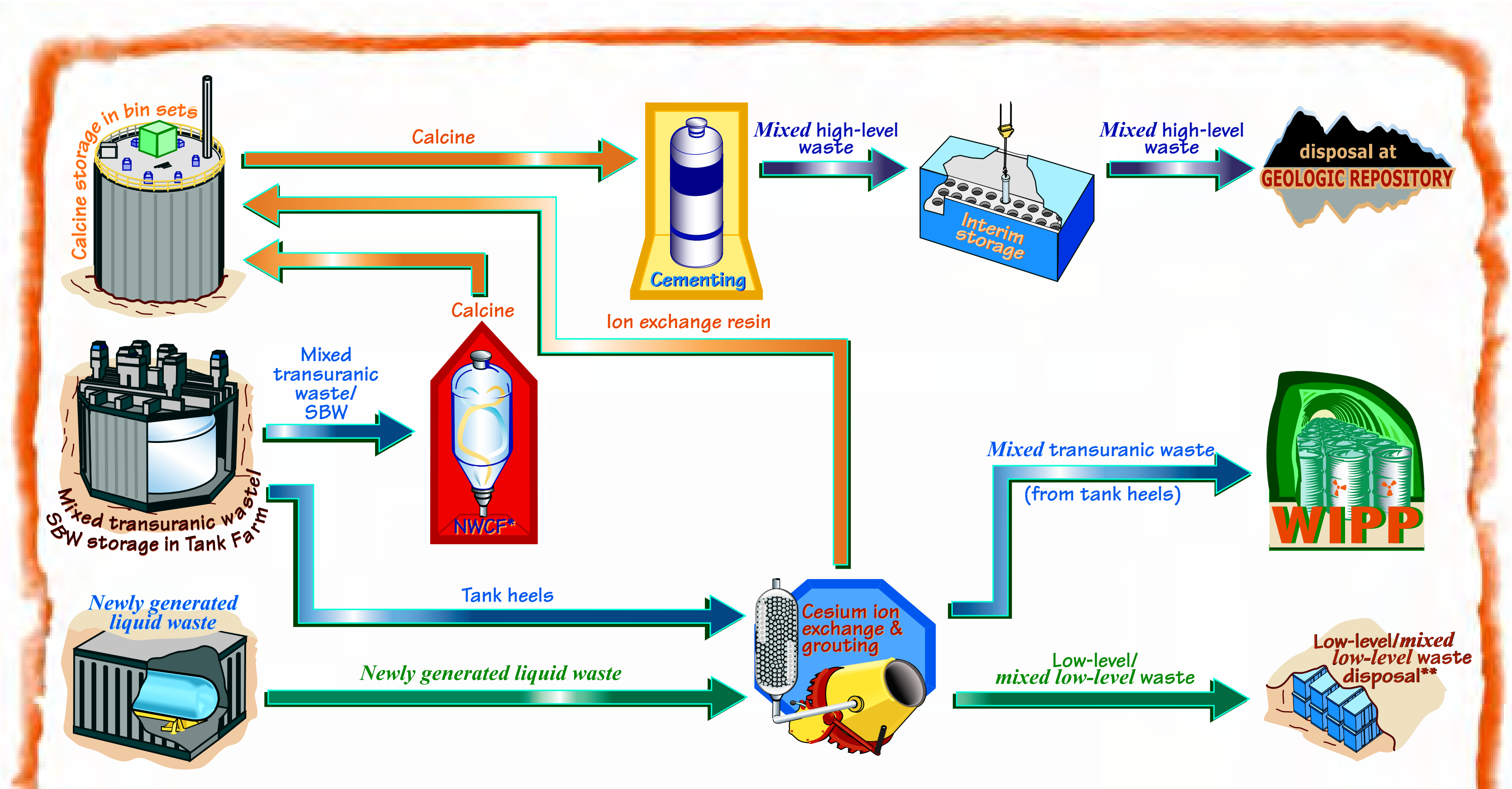
- The calcine would be retrieved and blended with clay, blast furnace slag, caustic soda, and water and the resulting grout would be poured into stainless-steel canisters. The grout would be cured at elevated temperature and pressure.

- ***The final product would be packaged in canisters for storage and subsequent disposal in a HLW repository.***

- Before 2015, newly generated liquid waste would be concentrated, the effluents stored in new ***RCRA-compliant*** tanks, and then calcined with the mixed transuranic waste/SBW in the New Waste Calcining Facility. Starting in 2015, newly generated liquid waste would be processed through ***a cesium*** ion-exchange column, evaporated and grouted as ***mixed low-level waste or*** low-level waste ***for disposal*** at the INEEL or offsite.

- Tank heels would be flushed out of the ***Tank Farm*** tanks, dried ***in a new facility***, packaged, and sent to the Waste Isolation Pilot Plant for disposal.

This option would require a determination of equivalent treatment from EPA ***since in this case the final waste form (cement) is not currently an approved RCRA treatment process for HLW exhibiting the hazardous characteristics of corrosivity and toxicity for certain metals*** (as discussed in ***Section 6.2.5*** of the EIS). ***Under this option,*** DOE ***would be able*** to cease use of the Tank Farm by 2014 and make mixed HLW ready for shipment to a storage facility or repository outside of Idaho by a target date of 2035.



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 S-8.
Direct Cement Waste Option.

Early Vitrification Option

This option (Figure ***S-9***) would involve vitrifying both the mixed HLW calcine and the mixed transuranic waste/SBW into a nonleaching, glass-like solid. Under this option:

- DOE would construct a vitrification facility that would process the mixed transuranic waste/SBW from the Tank Farm and the mixed HLW calcine stored in the bin sets into borosilicate glass suitable for disposal in a repository.
- The mixed transuranic waste/SBW and mixed HLW calcine would be treated in separate vitrification campaigns.
- Mixed transuranic waste/SBW would be blended with one type of glass frit to form a slurry that would be fed to the melter. Glass produced from the mixed transuranic waste/SBW would be ***poured into suitable containers and*** disposed of at the Waste Isolation Pilot Plant as remote-handled transuranic waste, ***provided a waste incidental to reprocessing determination confirms that this waste could be managed as transuranic***.
- Mixed HLW calcine would be blended with another type of glass frit and fed to the melter in a dry state. Glass produced from the mixed HLW calcine would be poured into stainless steel canisters and stored until shipped to a HLW storage facility or repository.
- Newly generated liquid waste would be sent directly to the ***vitrification facility***, bypassing calcination. Glass produced from newly generated liquid waste would be disposed of at the Waste Isolation Pilot Plant ***as remote-handled transuranic waste***.

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

Steam Reforming Option

This option (Figure S-10) would involve treatment of mixed transuranic waste/SBW by steam reforming to a calcine-like powder for subsequent shipment to the Waste Isolation Pilot Plant and packaging of mixed HLW calcine for shipment to the geologic repository. Under this option:

- ***DOE would construct a steam reforming facility that would process the mixed transuranic waste/SBW (including tank heels) from the Tank Farm for shipment to the Waste Isolation Pilot Plant for disposal.***
- ***The calcine would be retrieved from the bin sets and packaged in HLW canisters for ultimate shipment to the geologic repository.***
- ***Newly generated liquid waste would be processed with the mixed transuranic waste/SBW while the steam reformer was operating. When the steam reformer completed its mission for mixed transuranic waste/SBW, the newly generated liquid waste would be grouted for shipment to the Waste Isolation Pilot Plant for disposal.***

This option would require a determination of equivalent treatment from EPA since in this case the final waste form (calcine) is not currently an approved RCRA treatment process for HLW exhibiting the hazardous characteristics of corrosivity and toxicity for certain metals (as discussed in Section 6.2.5 of the EIS). Under this option, DOE would be able to cease use of the Tank Farm by 2013 and make the mixed HLW ready for shipment to a storage facility or repository outside of Idaho by a target date of December 31, 2035.

MINIMUM INEEL PROCESSING ALTERNATIVE

The Minimum INEEL Processing Alternative (Figure ***S-11***) ***involves*** the minimum amount of ***waste treatment*** at the INEEL, ***by including the***

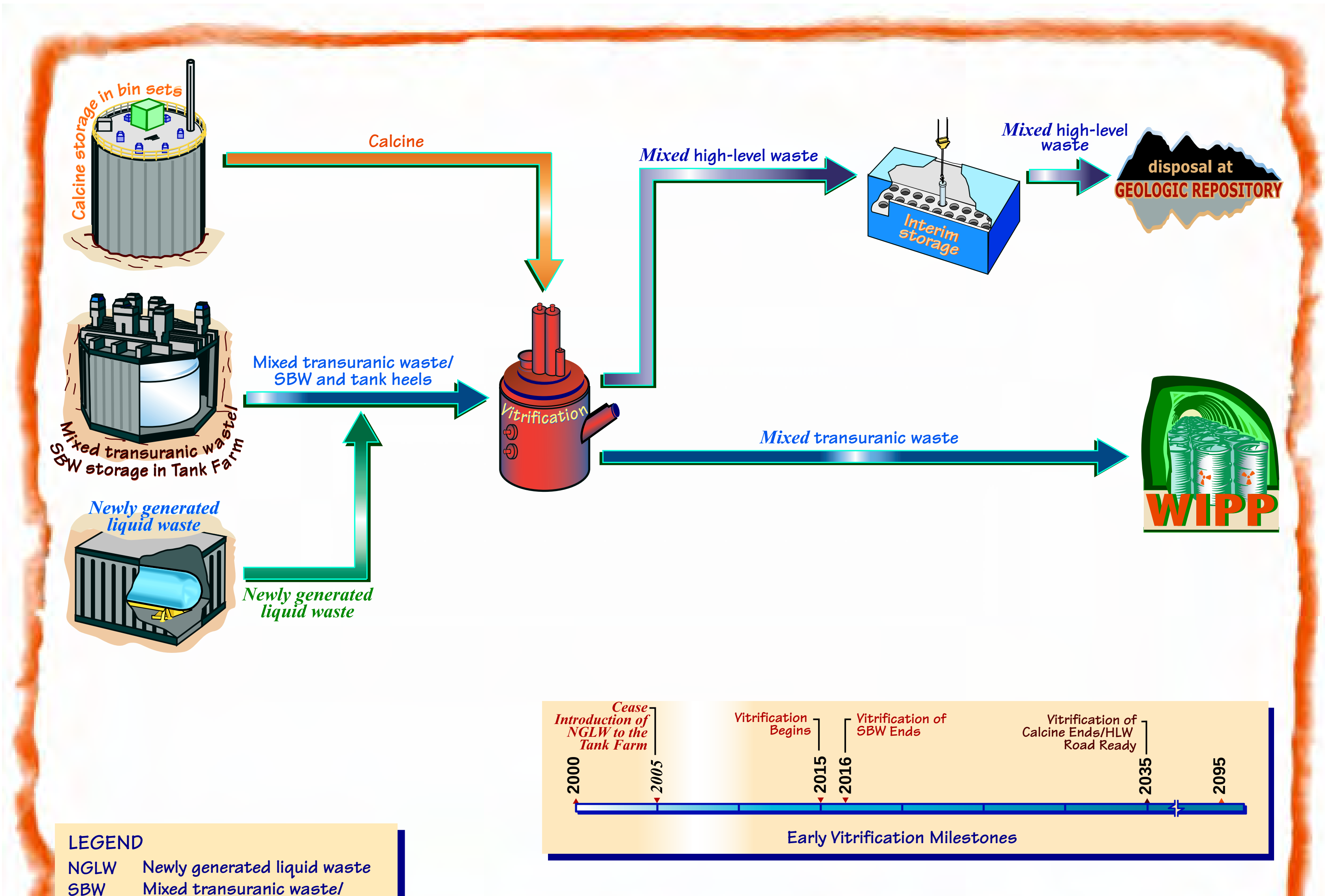
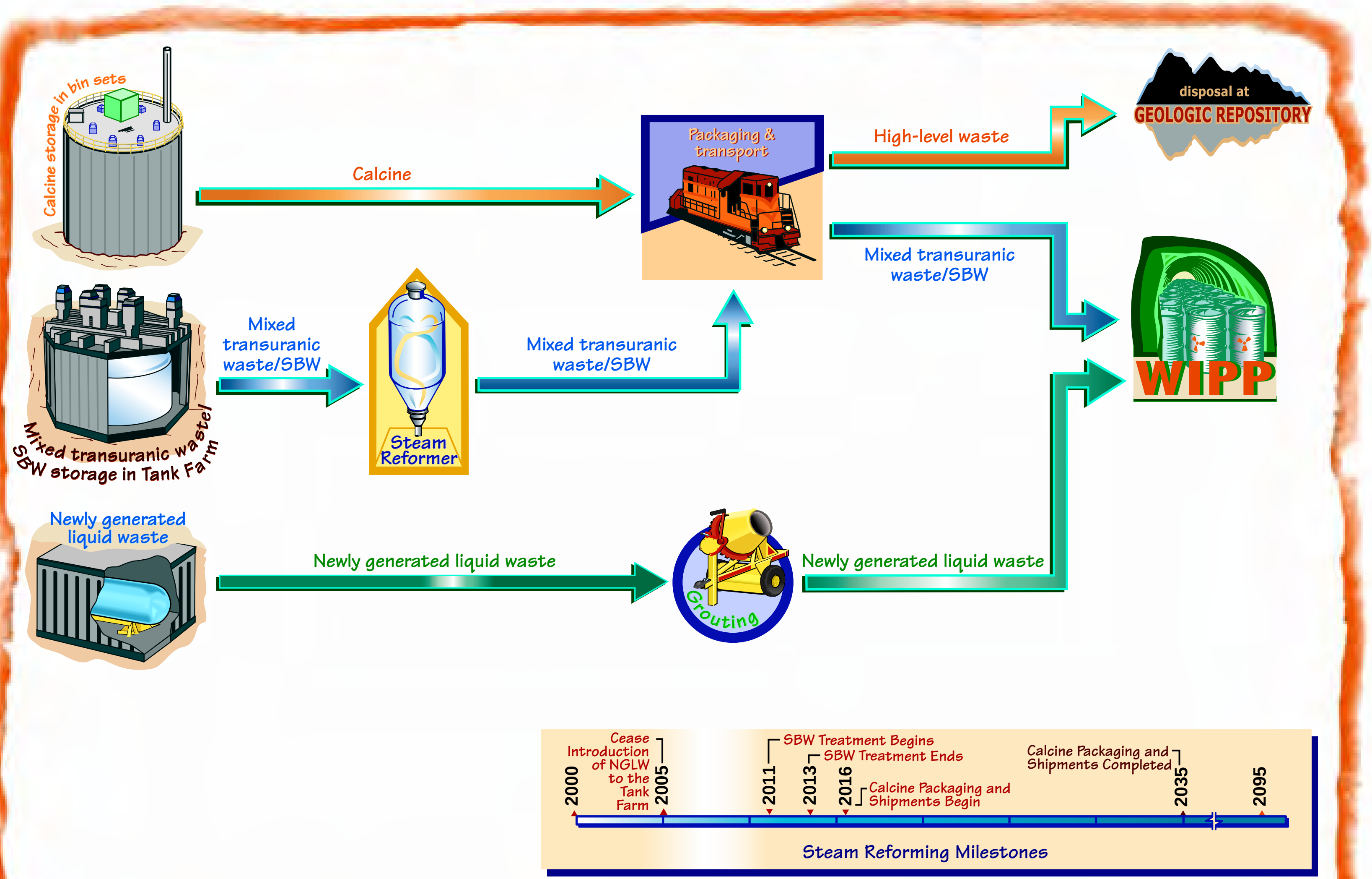


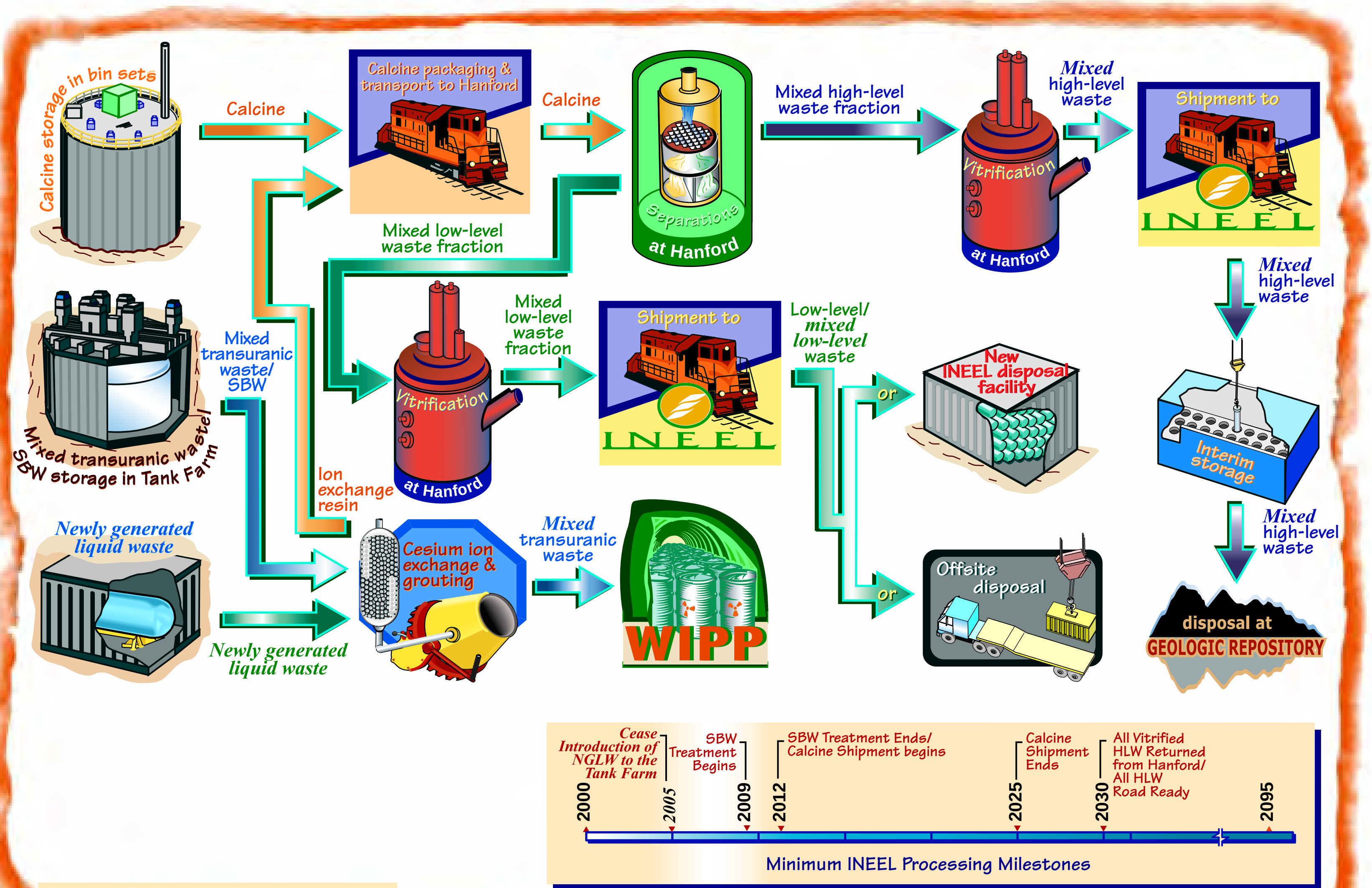
FIGURE S-9.
Early Vitrification Option.



LEGEND

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

FIGURE S-10.
Steam Reforming Option.



LEGEND

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

FIGURE S-11.
Minimum INEEL Processing Alternative.

> ***The Minimum INEEL Processing Alternative***
>
> ***would involve the treatment of INEEL mixed HLW at the Hanford Site near Richland, Washington. Appendix C.8 describes the Hanford Site, focusing on the 200-East Area, where INEEL mixed HLW would be treated under this alternative.***

use of a vitrification facility planned for the Hanford Site in the State of Washington. This alternative could substantially reduce the amount of construction, handling, and processing of mixed HLW at the INEEL. ***However, shipment of mixed HLW to the Hanford Site and back to the INEEL adds a transportation component not present in other waste processing options.*** This alternative presents a representative analysis of offsite transport of mixed HLW calcine followed by a return of treated HLW and low-level waste to the INEEL for storage pending disposal. Under this alternative:

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

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

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

- The treated ***mixed*** HLW would be stored ***at the INEEL*** until it is shipped to a storage facility or repository.

- The treated ***mixed*** low-level waste ***fraction*** would be disposed of ***at the*** INEEL or shipped to an offsite low-level waste disposal facility.

- The mixed transuranic waste/SBW and newly generated liquid waste, including tank heels, would be retrieved, filtered, and transported to a treatment facility on the INEEL, where it would be processed through an ion exchange column to remove cesium. ***The HLW fraction would be packaged and sent to the Hanford Site. The remaining fraction would be grouted,*** packaged in 55-gallon drums, and transported to the Waste Isolation Pilot Plant for disposal as contact-handled transuranic waste.

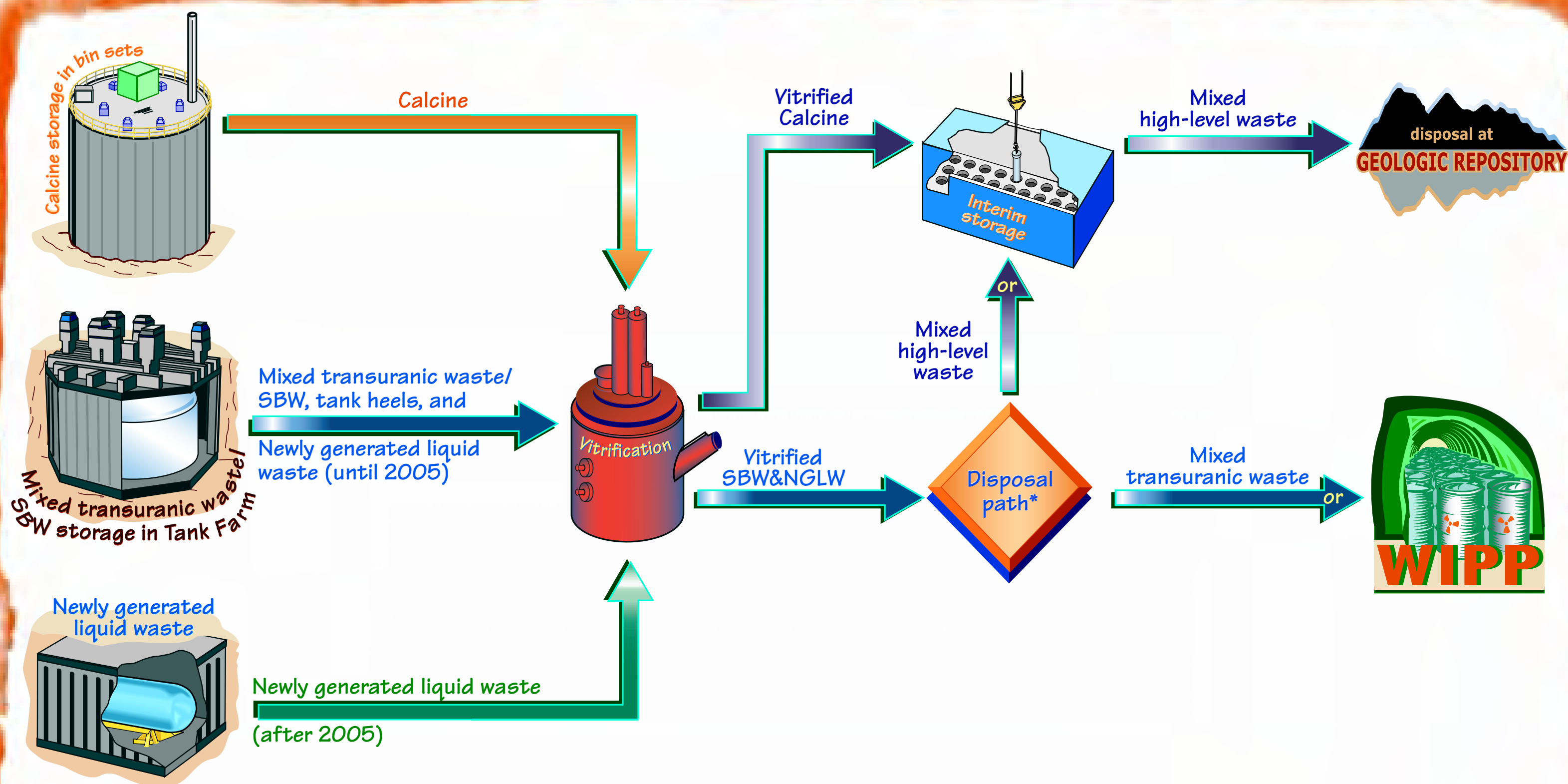
DOE cannot determine at this time whether treating INEEL mixed HLW calcine in Hanford facilities would be technically feasible or cost effective. Even if it were feasible to process INEEL mixed HLW at the Hanford Site, DOE would have to consider the potential regulatory implications and any impacts to DOE commitments regarding completion of Hanford tank waste processing. ***Before making a decision to pursue the Minimum INEEL Processing Alternative, DOE would determine if additional NEPA documentation were needed associated with treatment of INEEL mixed HLW calcine at the Hanford Site.***

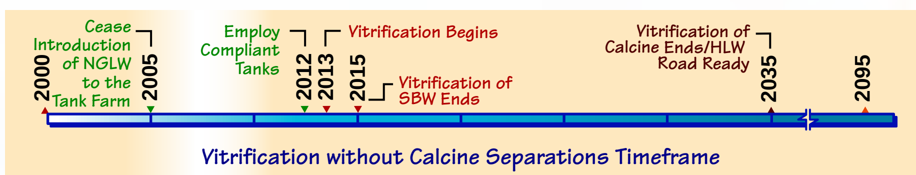
Under this alternative ***DOE*** would ***be able*** to cease use of the ***INTEC*** Tank Farm by ***December 31,*** 2012 and make mixed HLW ready for shipment to a storage facility or repository outside of Idaho by a target date of 2035.

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 this alternative: Vitrification without Calcine Separations (Figure S-12) and Vitrification with Calcine Separations (Figure S-13).

The option to vitrify the mixed transuranic waste/SBW and calcine without separations



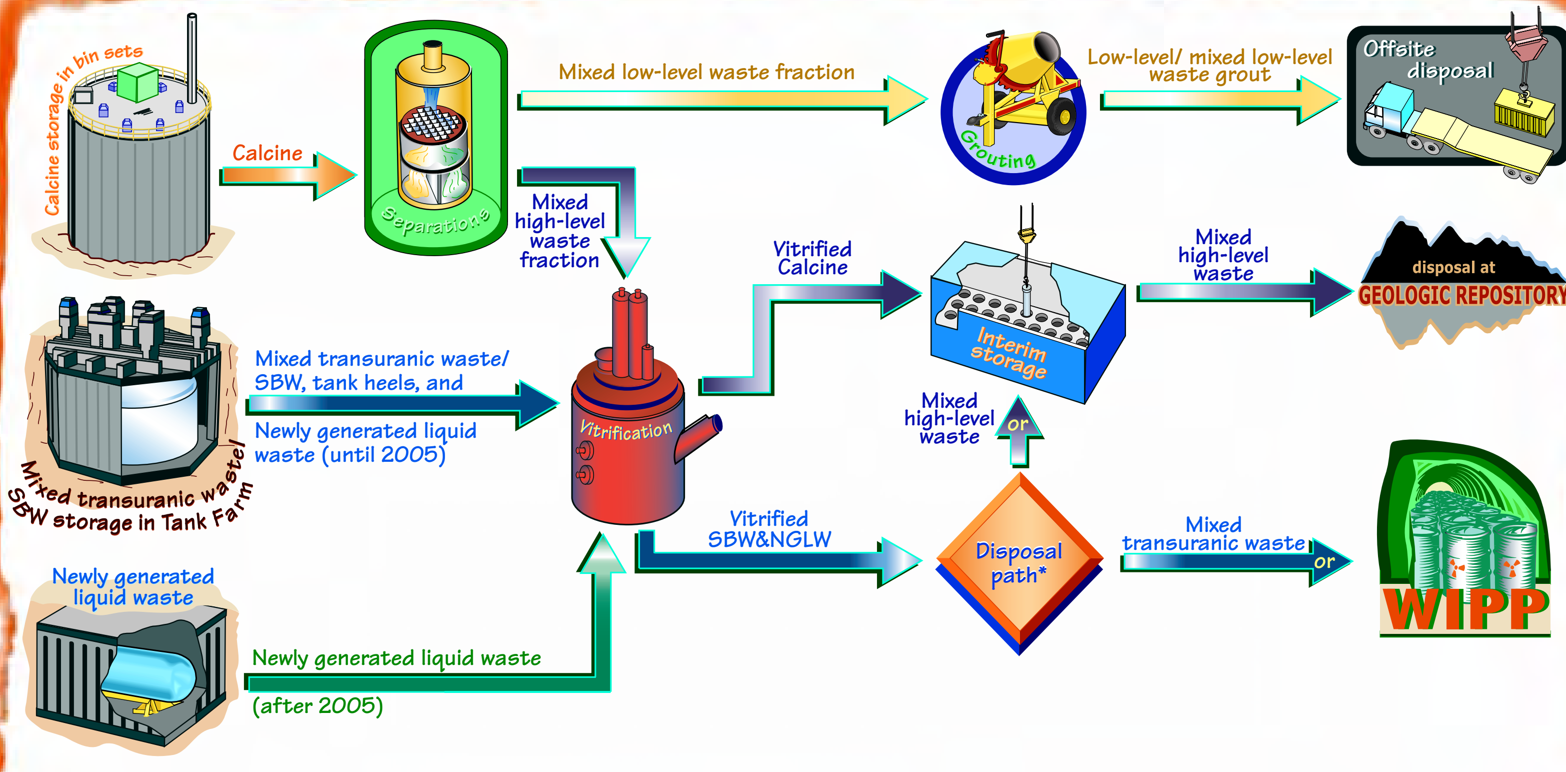


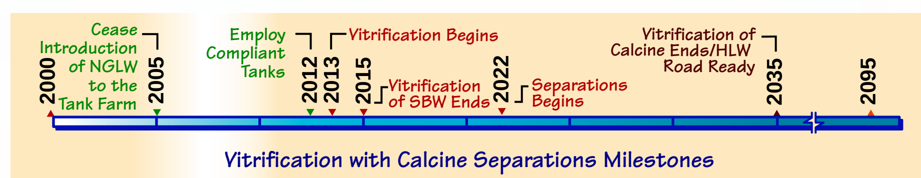
LEGEND

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 S-12.
Vitrification without Calcine Separations.





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 S-13.
Vitrification with Calcine Separations Option.

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. 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 31, 2012 in order to meet the Notice of Noncompliance Consent Order requirement to cease use of the HLW Tank Farm 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.

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.

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 HLW geologic repository. If a repository were 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.

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 costs and engineering designs. Conditioned on the outcome of future technology development and resulting treatment decisions, DOE could design and construct the appropriate calcine separations capability at the INEEL.

For calcine vitrification at the 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 the INEEL, DOE could decide to send the HLW fraction to Hanford for vitrification. DOE would evaluate the advantages of this option as the Hanford treatment facility is being developed (see Appendix C.8).

If separations technologies were 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, packaged, 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 Waste Management Programmatic EIS (65 FR 10061, February 25, 2000). For purposes of assessing risks associated with transportation of low-level waste, DOE used the commercial radioactive waste disposal site operated by Envirocare of Utah, Inc., located 80 miles west of Salt Lake City.

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. This 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).

PREFERRED ALTERNATIVE

DOE and the State of Idaho have jointly undertaken a process to select the Preferred Alternative for waste processing and have reached separate conclusions. Consequently, this EIS presents two Preferred Alternatives: one for DOE and one for the State of Idaho. The Preferred Alternatives were developed after consideration of public comment; factors such as environmental impacts, programmatic needs, safety and health, technical viability, ability to meet regulatory milestones and agreements, and cost; and information received after the Draft EIS was published. This information included the National Research Council report on *Alternative High-Level Waste Treatments at the Idaho National Engineering and Environmental Laboratory*, DOE Tanks Focus Area findings, DOE Office of Project Management review of the *Cost Analysis of Alternatives for the Idaho High-Level Waste and Facilities Disposition EIS*, and public comments from the commercial sector supporting various treatment technologies.

Among the choices from which the preferred waste processing alternatives were selected are the five alternatives (comprised of nine major choices including the options) identified in the Draft EIS, a new option under the Non-Separations Alternative called Steam Reforming, and a new alternative called Direct Vitrification, which is comprised of two options: Vitrification without Calcine Separations and Vitrification with Calcine Separations.

The Direct Vitrification Alternative was ultimately selected by the State of Idaho as its Preferred Alternative for waste processing. DOE's preferred waste processing alternative is to implement the proposed action (see text box on next page) by selecting from among the action alternatives, options and technologies analyzed in this EIS based on the criteria dis-

cussed below. Options excluded from 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.

3.2.2 FACILITY DISPOSITION ALTERNATIVES

The waste processing alternatives and treatment options described in the ***Draft*** EIS do not include disposition options for specific facilities except when they are ***part of treatment and disposal options*** (e.g., disposal of Class A-type or Class C-type low-level waste grout in the Tank Farm and bin sets). The facility disposition alternatives address the final risk component of ***actions DOE could take after waste processing missions are complete***. The facility disposition alternatives are as follows:

- 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.

Implementing any of the waste processing alternatives would involve a variety of different facilities ***that will need to be properly closed when missions are complete***. Chapter 5 of the EIS identifies ***any*** major new facilities and ***any*** existing facilities that would be needed for each waste processing alternative, all of which would be closed in accordance with regulatory requirements.

> **Proposed Action**
>
> - ***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.*

Except for the No Action Alternative, the rest of the facility disposition alternatives can be implemented in accordance with regulatory requirements. Clean Closure and Performance-Based Closure methods are based on how much contamination can be left in the environment. With Clean Closure, contaminated residuals must be at or below background levels; with Performance-Based Closure, residual contaminant levels are based on risk. Closure to Landfill Standards differs from Performance-Based in that design, construction and operation of the landfill is dictated by specified requirements rather than risk calculations that determine how much can be left in the environment. Regulations require that monitoring be conducted to ensure contaminants have not migrated to the environment at levels that exceed established standards.

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

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

3.2.2.1 RCRA Closure of Facilities

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

3.2.2.2 CERCLA Coordination

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

3.2.2.3 Facility Disposition Identification

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

1. Performed a complete inventory of all INTEC facilities

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

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

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

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

3.2.2.4 ALTERNATIVE DESCRIPTIONS

NO ACTION ALTERNATIVE

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

CLEAN CLOSURE ALTERNATIVE

Under ***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.

PERFORMANCE-BASED CLOSURE ALTERNATIVE

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 RCRA/CERCLA 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 ALTERNATIVE

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.***

PERFORMANCE-BASED CLOSURE WITH CLASS A GROUT DISPOSAL ALTERNATIVE

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

PERFORMANCE-BASED CLOSURE WITH CLASS C GROUT DISPOSAL ALTERNATIVE

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

PREFERRED ALTERNATIVE

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, not including the No Action Alternative, 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 missions. Disposition actions would be systematically planned, documented, executed, and evaluated to ensure public, worker, and environmental protection in accordance with applicable regulations.

4.0 Areas of Uncertainty

This section discusses uncertainties associated with alternatives and options that are outside the scope of this EIS ***and that remain unresolved at the time of Final EIS issuance.*** DOE will appropriately factor these uncertainties into decisions made pursuant to this EIS.

4.1 Waste Acceptance Criteria

The disposal facility operator or regulator determines what materials can be received for disposal by establishing waste acceptance criteria. These criteria define ***parameters such*** as packaging requirements, waste form requirements, acceptable radiation levels, and limits on radionuclide content.

HLW REPOSITORY

DOE has identified preliminary waste acceptance criteria for disposal of HLW at the proposed Yucca Mountain repository. DOE has used these preliminary criteria in the design of its vitrification facilities at the Savannah River Site and the West Valley Demonstration Project. However, until such time as the criteria are

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PERFORMANCE-BASED CLOSURE WITH CLASS C GROUT DISPOSAL ALTERNATIVE

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

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finalized, some uncertainties remain that could affect process design and system operation of the treatment options for INEEL mixed HLW.

TRANSURANIC WASTE FRACTION

Some of the waste processing alternatives and treatment options (e.g., Transuranic Separations Option) would produce transuranic waste for potential disposal in the Waste Isolation Pilot Plant. The transuranic waste that would be produced by processing INTEC ***mixed*** HLW may contain hazardous constituents currently not ***covered*** in the Waste Isolation Pilot Plant ***RCRA Part B permit. In that case***, additional waste codes would need to be included in ***that permit*** before the ***mixed*** transuranic waste fraction would be acceptable for disposal. ***Alternatively, DOE may consider demonstrating through the delisting process that the treated transuranic waste would not pose a hazard to human health or the environment, and therefore no longer merit regulation under RCRA.***

DETERMINATION OF EQUIVALENT TREATMENT

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

DELISTING

INTEC's mixed HLW calcine and mixed transuranic waste/SBW contain listed hazardous ***wastes*** that are ***regulated*** under RCRA. ***The treated waste forms produced*** under the various alternatives in this EIS would continue to be regulated as mixed wastes under RCRA, ***unless they are delisted or otherwise excluded from the regulatory requirements of RCRA.***

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

Not knowing whether a delisting petition would be approved for treated mixed HLW introduces another uncertainty. ***Under DOE's current waste acceptance criteria, RCRA-regulated HLW would not be accepted at the proposed geologic repository at Yucca Mountain. For this reason, DOE may consider alternative strategies to delisting, under initiatives such as EPA's Project XL (a program that offers flexibility to develop alternative strategies that replace or modify regulatory requirements, on the condition that they produce greater environmental benefits) or pursue a strategy that would exclude the treated mixed HLW from regulation under RCRA.***

4.2 Waste *Incidental to Reprocessing*

Some waste streams associated with HLW generation, treatment, and storage may be managed as transuranic or low-level waste. DOE Order 435.1, *Radioactive Waste Management,* ***and its associated manual provide criteria and a process, called a waste incidental to reprocessing determination, that DOE will use to determine if waste streams associated with HLW can be managed as transuranic or low-level waste.***

A waste incidental to reprocessing determination is being developed to decide whether the final waste form resulting from treatment of the SBW should be managed and disposed of as transuranic waste. At DOE's request, the Nuclear Regulatory Commission performed a technical review of the draft waste incidental to reprocessing determination before DOE makes its decision, which is anticipated in 2002. Until the outcome of the waste incidental to reprocessing process is complete, uncertainties in final waste classification will remain.

4.3 Technical Maturity of Alternative Treatment Processes

Production scale experience in the operation of mixed HLW treatment processes specific to INTEC waste is ***limited to calcination***. Because of differences in waste characteristics among DOE sites, knowledge gained at one site ***may*** not apply to others. Some proposed mixed HLW treatment processes are only in a preliminary stage of technology development; the viability of others has not been demonstrated beyond the bench scale or pilot stage. ***Thus, there is uncertainty regarding technical viability and implementation.*** Although ***selection*** of any of the mixed HLW treatment technologies will require additional technology development ***and demonstration-scale proof of process before implementation, DOE considers vitrification to be a more mature technology to produce a final waste form than others evaluated in this EIS, requiring considerably less investment in development.***

4.4 *Timeframes*

Under all waste processing and facility disposition alternatives there are some uncertainties related to the timeframes for implementation. These uncertainties include:

- ***the technical maturity of technologies and how much development would be necessary before design and construction could begin***
- ***the possibility that new regulatory requirements may be promulgated, which could introduce delays by affecting the design and cost of selected technologies***
- ***the length of time it will take to get agency approvals for actions such as permits to operate, determinations of equivalency, and delisting petitions***
- ***the availability of a geologic repository for INTEC's HLW, which will determine whether DOE will be able to ship this waste out of Idaho or have to store it indefinitely at the INEEL***
- ***the timely appropriation of funds by Congress so that DOE can implement waste processing and facility disposition decisions***

Each of these uncertainties is addressed in this EIS.

4.5 Costs

Although NEPA ***and the Council on Environmental Quality regulations do*** not require agencies to address costs in an EIS, Federal agencies must identify the considerations, including factors not related to environmental quality, that are likely to be relevant and important to a decision. To support the decision process, ***DOE will take into consideration the costs of implementing the alternatives.***

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***

with its floodplain environmental review requirements (10 CFR Part 1022), and in compliance with the State of Idaho RCRA regulations, as appropriate.

6.0 *Conclusions* of Analysis

6.1 Overview

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

For this EIS, DOE assessed the environmental impacts for 14 areas of interest for the waste processing alternatives and the facility disposition alternatives. ***A comparison of impacts for the five key areas of interest discussed in this section is provided in Table S-2 following Section 6.5 of this Summary***. In 9 of the 14 areas, the results indicate little or no impacts as follows:

Land Use – Estimated land use would be consistent with the *INEEL Comprehensive Facility and Land Use Plan*. The maximum additional amount of land that would be converted to industrial use at the INEEL ***under the alternatives analyzed in this EIS*** would be 22 acres. At Hanford, ***approximately 50*** additional acres could be converted to industrial use in the 200 East Area. At both sites, this additional disturbance would be less than 1 percent of the area currently used for industrial purposes.

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

Cultural Resources – The majority of INEEL activities resulting from the Proposed Action would occur in previously disturbed areas. ***Standard*** measures are in place to help prevent impacts to cultural resources that may be discovered during site development.

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

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

Water Resources (Usage) – Total INEEL water consumption ***from activities resulting from the bounding alternative (Hot Isostatic Pressed Waste Option) could increase by as much as 93 million gallons per year during operations.*** This usage represents an increase of ***20*** percent of water withdrawn by the INEEL from the Snake River Plain Aquifer relative to ***1996*** usage. ***INEEL water use would be well below the consumptive use water rights of 11.4 billion gallons per year.***

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

Environmental Justice – Impacts from proposed waste processing alternatives and treatment options, under all alternatives, would not result in high and adverse impacts on the population as a whole. Further, DOE did not identify means

with its floodplain environmental review requirements (10 CFR Part 1022), and in compliance with the State of Idaho RCRA regulations, as appropriate.

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Environmental Justice – Impacts from proposed waste processing alternatives and treatment options, under all alternatives, would not result in high and adverse impacts on the population as a whole. Further, DOE did not identify means

Populations

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

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

for minority or low-income populations to be disproportionately affected. Accordingly, no disproportionately high and adverse impacts would be expected for minority or low-income populations.

Utilities and Energy - ***Annual use of fossil fuel could increase by as much as 6.3 million gallons and electricity use could increase by as much as 52,000 megawatt-hours.*** Annual usage of electricity in ***megawatt-hours*** per year could increase by ***59*** percent relative to the 1996 INEEL baseline. This increase and the baseline together are less than one-third of the INEEL electric system capacity.

6.2 Impacts of the Waste Processing Alternatives

Most of the actions to implement the waste processing alternatives would occur before 2035, as would many of their associated impacts. After 2035, environmental impacts would result mainly from storing waste. In 5 of the 14 areas analyzed, the results indicate some impacts, although they are generally small. These areas include air, traffic and transportation, health and safety, waste and materials, and facility accidents.

6.2.1 AIR RESOURCES

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

Construction

The primary impact of construction activities would involve the generation of fugitive dust, which would include respirable particulate matter. While dust generation would be mitigated by the application of water and soil additives, relatively high levels of particulates could still occur in localized areas. ***The annual average concentrations are estimated to be as high as 1 and 5 percent of the applicable standard for respirable particulate matter at the INEEL boundary nearest to the construction site and at public road locations, respectively.*** Levels of all other criteria pollutants are predicted to be small fractions of applicable standards.

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

Normal Operations

Waste processing and related activities would result in emissions through filtered exhaust systems at INTEC. ***Table S-2*** compares total radiological air impacts to the maximally exposed offsite individual, ***noninvolved worker, and to the general population.*** The annual collective dose to the surrounding population (persons residing within a 50-mile radius of INTEC) is estimated ***to*** be ***0.11*** person-rem per year ***or less*** under all alternatives. Offsite doses would be mainly attributable to the intake of iodine-129 through the food-chain pathway.

Nonradiological air emissions would be highest for the Full Separations, Planning Basis, Hot Isostatic Pressed Waste, ***and Vitrification with Calcine Separations*** Options. These emissions would result from fossil fuel consumption to meet the energy requirements (steam) of the waste processing facilities. All levels would be well below applicable standards. Prevention of Significant Deterioration regulations require that agencies evaluate new projects to see if they increase air pollution levels. These regulations apply to radioactive and nonradioactive ***pollutants***. The Planning Basis Option poses the highest impact due to emissions of sulfur dioxide, which would use up ***40*** percent of the release increment allowed for this pollutant in a 24-hour period ***at Class I areas*** under the regulations. This includes baseline sources and planned future projects. Concentrations would be well within allowable limits for all waste processing alternatives.

Emissions of fine particulate matter and nitrogen dioxide can also affect visual resources. Conservative screening-level analyses were applied to estimate potential impacts related to visibility degradation at the Craters of the Moon Wilderness Area, about ***27*** miles ***west***-southwest of the ***INTEC***. The results indicate that there would be no perceptible changes in contrast for all alternatives, but potential changes related to color shift could result. These would be well within the acceptable visibility criteria for a Class I area. ***For the Final EIS, a different method was used to model visibility impacts at Craters of the Moon Wilderness Area and Yellowstone and Grand Teton National Parks. With these new methods, the Planning Basis Option (a bounding option for air quality impacts) could result in a small exceedance of the 5 percent acceptance criterion for the light extinction change for 8 days in a 5-year period. Based on recommendations from the National Park Service, DOE used the CALPUFF model to assess long-range impacts (for 50 kilometers and beyond of the release).***

What is a rem?

A unit of radiation dose.

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

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

What is a person-rem?

A unit of collective radiation dose.

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 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.

6.2.2 TRAFFIC AND TRANSPORTATION

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

During incident-free transportation of radioactive waste, the population living and traveling along the transport route and the transportation workers would be exposed to radiation from the shipments. The total latent cancer fatalities for the shipments would be the sum of the estimated number of radiation-related latent cancer fatalities for transportation workers and the general population. ***Table S-2*** compares the estimated latent cancer fatalities to transportation workers and the public for truck transportation of radioactive materials over the life of the alternatives. Rail shipment impacts for transportation of radioactive materials are about 10 times lower than truck transportation-related impacts.

Table S-2 compares the estimated total fatalities due to vehicle accidents assumed to occur during shipment of radioactive wastes. ***New information indicates that vitrification of INEEL mixed HLW at the Hanford Site would result in a larger volume of HLW glass than was analyzed in the Draft EIS. Table S-2 presents the revised transportation impacts for the Minimum INEEL Processing Alternative associated with this larger vitrified waste volume.***

6.2.3 HEALTH AND SAFETY

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

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

Construction Impacts

All alternatives would result in some amount of radiation exposure to construction workers. Most of the waste processing alternatives and treatment options would result in similar levels of total collective worker dose ranging from an estimated ***37*** to ***200*** person-rem. The highest collective dose would occur under the ***Planning Basis and Direct Cement Waste Options***. DOE estimates that this would result in ***0.078*** latent cancer fatality for these ***options***.

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

The highest total number of total recordable cases ***(includes work-related death, illness, or injury)*** during construction is estimated at ***230 for the Minimum INEEL Processing Alternative (at Hanford), 200*** for the Planning Basis Option, ***and 190*** for the Full Separations Option, because of the large number of total worker hours associated with these options.

Normal Operations

During normal operations, waste processing and related activities at INTEC would result in releases of radionuclides to the atmosphere, but there would be no discharge of radioactive liquid effluents under any of the waste processing alternatives or treatment options that would result in offsite radiation doses. Therefore, DOE only

What is a latent cancer fatality (LCF)?

Normal operations and accidents that could result in a release in radioactivity pose a hazard to the population exposed to such a release. LCFs measure the expected number of additional cancer deaths in a population as a result of a given exposure to ***cancer causing agents such as*** radiation. Death from cancer as a result of exposure to radiation may occur at any time after the exposure takes place. Other health effects that could result from exposure to radiation include non-fatal cancers and genetic defects in the future population. This EIS focuses on LCFs as the primary health risk from radiation exposure and estimates LCFs as the basis for comparing radiation-induced impacts among alternatives.

How is an LCF calculated?

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

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

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

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

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

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

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

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

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

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

calculated potential health effects from airborne releases of radioactivity. ***Based on the annual air impacts data, the health effects over the life of each alternative, in terms of latent cancer fatalities, were estimated. These calculated results are provided in Table S-2.***

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

The highest carcinogenic air pollutant impacts are projected for those options that involve the greatest amount of fossil fuel combustion, most notably the Planning Basis Option. For this option, nickel concentrations are estimated to be as high as ***10*** percent of the State of Idaho standard at the INEEL boundary. All other carcinogens are expected to be at very low levels and would have correspondingly low health impacts.

The highest total number of total recordable cases (includes work-related death, illness, or injury) during operations is estimated at 480 for the Planning Basis Option and 400 for the Full Separations Option, because of the large number of total worker hours associated with these options.

6.2.4 WASTE AND MATERIALS

This EIS examines impacts associated with the generation of both radioactive and nonradioactive wastes resulting from construction and waste processing operations. ***Process waste streams may include industrial waste, hazardous waste, mixed low-level waste, and low-level waste.*** Industrial wastes are neither radioactive nor hazardous and are disposed of onsite.

Construction activities produce relatively little radioactive and hazardous waste. The greatest construction impacts for a waste processing alternative would ***depend on the process waste type considered. For industrial waste and hazardous waste, the Planning Basis Option produces the most waste at 6.0×10⁴ and 880 cubic meters, respectively. For low-level waste, the Vitrification with Calcine Separations Option generates the most at 1,700 cubic meters. For mixed low-level waste, nearly all alternatives and options produce the same amount at 1,100 cubic meters. Table S-2*** presents the total process waste volumes that would result for the operations period for all waste processing alternatives.

The No Action Alternative would leave approximately ***4,400*** cubic meters of mixed HLW calcine in the bin sets and ***1.0*** million gallons of mixed transuranic waste/SBW in the Tank Farm. The Continued Current Operations Alternative would calcine the mixed transuranic waste/SBW and empty the Tank Farm tanks down to the heels. This alternative would leave approximately 6,000 cubic meters of calcine in the bin sets.

Product wastes are the manufactured product resulting from treating and preparing the INTEC wastes for disposal. Product wastes may include grouted low-level waste, transuranic waste, canned calcine, or treated HLW. Table S-2 presents and compares the total product waste volumes that would result from each of the waste processing alternatives. DOE obtained updated information indicating that vitrification of INEEL mixed HLW at the Hanford Site would result in a larger volume of HLW glass than was analyzed in the Draft EIS. Under the Minimum INEEL Processing Alternative, DOE had estimated that 730 cubic meters of vitrified mixed HLW would be produced and transported back to the INEEL. After the Draft EIS was issued, DOE Richland identified that their process for treating the INTEC HLW calcine would change. This change included dissolution of the calcine and raising the pH to 12 to be compatible with their process. This change resulted in an increase of the vitrified product. Based on this information, DOE now estimates that 3,500 cubic meters of vitrified mixed HLW would be produced under that alternative. Table S-2 presents revised product waste volumes for the Minimum INEEL Processing Alternative.

<u>Accident</u>

An unplanned, unexpected, and undesired event ***that can*** occur during ***or as a result of implementing an EIS alternative and*** that has the potential to ***impact human health*** and the environment.

<u>Accident Scenario</u>

A set of ***causal*** events starting with an ***accident*** "initiating event" that ***can*** lead to ***a*** release of radioactive or hazardous materials with the potential to cause injury or death.

<u>Reasonably Foreseeable Accident</u>

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

<u>Bounding Accident</u>

The reasonably foreseeable accident ***with*** the ***largest*** impact ***on*** human health ***in each frequency category*** for ***each*** alternative.

<u>Bounding Accident Risk Estimation</u>

Risks due to accidents are estimated very conservatively in this EIS. In estimating the frequency and severity of bounding accidents, no credit was taken for engineered safety systems and design features that would be incorporated in an actual facility, ***nor for other mitigating measures such as emergency response or personnel evacuations.***

Likewise, human health impacts from releases of radioactivity were ***conservatively*** estimated ***by locating hypothetical receptors close to sources and by*** using very ***conservative*** meteorological assumptions. 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 viable basis for comparing one alternative to another.

6.2.5 FACILITY ACCIDENTS (OFF-NORMAL OPERATIONS)

A potential exists for accidents at facilities associated with the treatment, storage, and disposal of radioactive and hazardous materials. Accidents can be categorized into events that occur (a) more frequently than once in a thousand years (abnormal event), (b) less frequently than once in a thousand years but more frequently than once in a million years (design basis event), or (c) less frequently than once in a million years (beyond design basis events).

Two events involving the long-term degradation and eventual failure of the underground tanks and a calcine bin set ***could occur under*** the No Action and Continued Current Operations Alternatives. Under these alternatives, mixed transuranic waste/SBW and/or mixed HLW calcine are stored indefinitely and it can be assumed that over time the radioactive and hazardous materials would be released into the environment. However, there are also bounding accident scenarios ***(see definition in text box)*** associated with these alternatives, including the seismic rupture of an underground tank or bin set and the failure of a bin set due to flooding, which are discussed below with other selected waste processing alternative accidents.

In discussing anticipated risks posed by potential accidents, it should be noted that the longer an operation continues, the longer the window of vulnerability and the larger the probability that the accident will eventually occur. Therefore, No Action and Continued Current Operations Alternatives that do not result in road-ready waste and involve the storage of this waste at INTEC for an indefinite period of time, exhibit the longest window of vulnerability and therefore the highest anticipated risk. In fact, the probability of the bounding ***abnormal*** accident for the No Action and Continued Current Operations Alternatives ***is*** a factor of ***nine*** more likely than the comparable ***abnormal*** accidents for other alternatives that place waste in a road-ready form over ***a 35-year period.***

Bounding accidents for the No Action and Continued Current Operations Alternatives also produce large releases due to long-term degradation impacts on facility safety features.

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

- ***An external event results in a release from the Vitrification Facility (Beyond Design Basis Event).***

  The overall bounding accident involves ***an external event resulting in a release from*** the Vitrification Facility that would be built and operated as part of the Full Separations and Planning Basis Options. For this event, the analysis predicted a dose of ***150,000*** person-rem to the offsite population within 50 miles of INTEC. This could result in up to ***76*** latent cancer fatalities due to air impacts for the exposed population. ***Should this accident occur under the Direct Vitrification Alternative (Vitrification with Calcine Separations), the results would be equivalent.***

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

  Another design basis accident, an external event associated with a calcine bin set, could result in a bin set failure. The analysis predicts that this accident would result in less severe consequences than the above event.

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

  The No Action Alternative would continue to store mixed transuranic waste/SBW in the underground storage tanks at INTEC. For purposes of analysis, this EIS conservatively assumes that an earthquake occurs in the year ***2001***, rupturing a full storage tank. (In actuality, the likelihood of this design basis accident is less than once in 10,000 years.) The analysis for a single tank failure predicts a release of iodine-129 to the groundwater that is estimated ***to reach 13 percent of*** the EPA maximum contaminant level (i.e., as allowed for drinking water resources) assuming no mitigation takes place.

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

  This accident is assumed to cause failure of a bin set and release stored calcine to the environment. For this postulated event, the estimated dose to the population within 50 miles of INTEC is ***57,000*** person-rem. This could result in ***29*** latent cancer fatalities.

- ***A degraded bin set fails in a seismic event after 500 years (Abnormal Event).***

  This accident is assumed to cause failure of a bin set and release stored calcine directly to the environment. For this postulated event, the estimated dose to the population within 50 miles of INTEC is 530,000 person-rem. This could result in 270 latent cancer fatalities. The accident is more likely than either of the design basis events or the beyond design basis event described above. Further, the impacts are larger than the above events due to the amount of material assumed to enter the environment during the accident.

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

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

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

- ***A 15,000 gallon inventory of stored kerosene located at INTEC to support operations of the New Waste Calcining Facility is spilled (Abnormal Event).***

This event is estimated to cause peak benzene groundwater concentrations of 24 times the EPA maximum contaminant level, or 120 micrograms per liter. Such a release would also be the maximum reasonably foreseeable hazardous material accident, but no fatalities would be expected. The benzene component of the kerosene could reach the groundwater under normal precipitation conditions in about 200 years. A less probable occurrence would be an ***external event affecting*** both kerosene storage tanks ***creating a 30,000-gallon spill.*** This beyond design basis event is estimated to cause a peak benzene groundwater contamination of 180 micrograms per liter.

In both of these cases the ***15,000-gallon tank of*** kerosene was assumed to spill and form a pool about 3 inches deep. After pooling, the kerosene could seep into the available soil pore space to a depth of about 16 inches and could cover an area about 100 to 150 feet in diameter. It is estimated that the soil concentration could approach 100 milligrams of kerosene per kilogram of soil. If the kerosene spill were not remediated, it could move through the soil toward the aquifer. However, since INTEC would be operational during a kerosene spill, emergency crews would take immediate action to stop the spill, halt the spread of kerosene, and dispose of contaminated soil.

- ***Failure of ammonia tank connections (Beyond Design Basis Event).***

This event is the bounding release scenario for hazardous chemicals with the greatest potential consequences to workers. The event assumes that ammonia tank connections fail resulting in a spill of the entire contents of the 3,000-gallon ammonia tank at a rate 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 and would not enter the groundwater. For this event, the peak atmospheric concentration is estimated to be much greater than Emergency

Response Planning Guideline-2 (ERPG-2) at 3,600 meters. Exposure to airborne concentrations greater than ERPG-2 values for a period of 1 hour would result in a 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 would require evacuation of workers at INTEC and nearby facilities.

6.3 Impacts of the Facility Disposition Alternatives

This EIS also evaluates the impacts of the facility disposition alternatives. Disposition of new and existing facilities could have both short-term and long-term impacts. The following subsections highlight the major impacts identified in air, traffic and transportation, health and safety, waste and materials, and accidents.

6.3.1 AIR RESOURCES

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

6.3.2 TRAFFIC AND TRANSPORTATION

Based on estimated levels of INEEL employment for facility disposition activities, DOE would expect that traffic flows for Highway 20 would be virtually unaffected during disposition activities of new facilities for any of the waste processing alternatives or ***existing facilities associated with HLW management.*** The level of service would remain essentially unchanged.

6.3.3 HEALTH AND SAFETY

Health and safety ***impacts to workers and the public*** could ***potentially*** result from disposition of either new facilities constructed to implement the waste processing alternatives or existing HLW management facilities at INTEC.

Disposition of New Facilities Associated with Waste Processing Alternatives

No disposition activities would be associated with the No Action Alternative; ***however, for all other waste processing alternatives, the new facilities would be designed for clean closure.*** The highest total collective dose to involved workers for the entire disposition period for new facilities would occur ***under*** the ***Hot Isostatic Pressed Waste and Vitrification with Calcine Separations Options, corresponding to 0.12 latent cancer fatality (See Table S-2). Offsite radiation impacts are estimated to be very small for all alternatives.***

DOE also evaluated the potential for occupational injuries. The highest impacts for the entire disposition period for new facilities would be associated with ***the Hot Isostatic Pressed Waste and Vitrification with Calcine Separations Options: 79 total recordable injury cases. The impacts for these options are similar to the impacts predicted for*** the Full Separations, Planning Basis, ***Early Vitrification and Vitrification without Calcine Separations*** Options, which are estimated to result in ***68 to 74*** total recordable injury cases.

Disposition of Existing Facilities Associated with HLW Management

The collective involved worker dose would be highest for the Clean Closure Alternative due to the extensive decontamination efforts required for removing contaminated materials in order to reduce radioactivity to minimum detectable levels. DOE estimates that the maximum total collective worker dose would be ***2,300*** person-rem with a corresponding estimated health impact of ***0.91*** latent cancer fatalities for the period of disposition (approximately for the years 2035 to 2095).

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

DOE also estimated the occupational safety impacts and has ***estimated*** values for lost workdays and total recordable cases. DOE expects the highest number of lost workdays and total recordable cases to occur ***under*** the Clean Closure Alternative due to the larger number of workers and duration of disposition activities associated with that alternative. For that alternative, the total lost workdays and recordable injuries are estimated to be ***2,500*** and ***340***, respectively. Worker occupational health and safety impacts for all other facility disposition alternatives would be much lower.

Long-term Impacts from Facility Disposition

The largest source of contamination that could reach the public through a groundwater pathway would result from the No Action Alternative, where mixed transuranic waste/SBW is left in the underground storage tanks ***and calcine is left in the bin sets. DOE's analysis assumes that after 500 years the Tank Farm and bin sets would begin releasing their contents to the soil beneath them.*** The primary means by which contamination could reach the public would be by leaching through the soil into the aquifer near the facilities. DOE assumes that the maximum individual dose ***under*** the No Action Alternative would be incurred by a hypothetical future INTEC ***maximally exposed*** resident who is assumed to obtain ***drinking*** water from a well drilled into the contaminated aquifer. The level of groundwater contamination could be as high as ***2,600*** picocuries per liter of ***technetium-99, resulting in a total lifetime dose from all pathways and all radionuclides of 490 millirem, with a probability of*** $\boldsymbol{2.5\times10^{-4}}$ ***latent cancer fatality.***

6.3.4 WASTE AND MATERIALS

Waste would be generated from disposition of ***both the*** new facilities built to support the waste processing alternatives ***and the existing facilities used in the HLW program. For new facilities,*** decontamination operations would generate as much ***as 95,000 cubic meters of industrial waste for the Direct Cement Waste Option and 2,600 cubic meters of hazardous waste under the Steam Reforming Option, and as much as 80,000 cubic meters of low-level waste under the Direct Vitrification Alternative, and 900 cubic meters of mixed low-level waste under the Full Separations and Vitrification with Calcine Separations Options.*** For disposition of existing HLW facilities, the Clean Closure Alternative would generate the largest estimated volumes ***for 3 of 4 waste types***: industrial waste (***180,000*** cubic meters); low-level waste (***5,700*** cubic meters); ***and*** mixed low-level waste (***11,000*** cubic meters). The Performance-Based Closure Alternative would generate the largest volume of hazardous waste (500 cubic meters).

6.3.5 FACILITY DISPOSITION ACCIDENTS

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

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

6.4 Cumulative Impacts

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

6.4.1 AIR RESOURCES

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

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

6.4.2 WATER RESOURCES

Past activities have contaminated soils and groundwater under INTEC. The CERCLA process is currently underway to ***investigate and remediate*** the risks posed by these contaminants. ***Although the waste processing alternatives do not significantly contaminate groundwater, some facility disposition alternatives leave contamination that could eventually migrate to groundwater.*** Therefore, any facility disposition alternative presented in this EIS that leaves contaminants in place must be evaluated in the context of the cumulative risk of contaminant loading to the groundwater. The important consideration in such an evaluation is the time it will take contaminants to reach the groundwater and whether or not concentrations will exceed drinking water standards.

The No Action and Continued Current Operations Alternatives and any alternative that disposes of Class A or Class C-type grout near INTEC have the potential to add contamination to that already existing. Cumulative impacts that could occur under those alternatives are described below.

No Action Alternative - This alternative would leave mixed transuranic waste/SBW in the tanks indefinitely. If the tanks ***were to*** leak, contaminants could migrate to the groundwater and add cumulatively to any concentrations present from historical contributions. The degree of cumulative impact would depend on when the leak occurs and how much ***waste*** is released. ***For example, if all the contents of a single tank were to leak to the soil column in 2001, the cumulative peak concentration of iodine-129 from the tank and from historical contributions to the aquifer would be approximately 0.13 picocuries per liter in the year 2075. Another radionuclide of concern, technetium-99, would provide a cumulative peak concentration of 100 picocuries per liter, or 11 percent of the drinking water standard. This peak would occur in 2095. Total plutonium for the tank release would peak at 1.1 picocuries per liter in the year 6000. There would be no cumulative effect since the plutonium from historic sources would have dispersed by that time.*** Although such a leak can be postulated during the period of assumed institutional control, DOE has mechanisms in place to detect and mitigate such an event. Furthermore, the design life of the storage tanks is estimated to be well in excess of 500 years.

Under the No Action Alternative, all five tanks could eventually degrade and release the entire inventory of mixed transuranic waste/SBW to the ground. For analysis purposes, this event is assumed to begin to occur in 500 years. At that time, the strontium-90 in the tanks would have decayed sufficiently so that it would not pose a significant radioactive risk. Iodine-129 ***would also be released to the groundwater but the iodine-129*** in the groundwater from ***past INTEC***

operations would have peaked, become diluted, and moved down-gradient in the aquifer. Therefore, the ***peak*** iodine-129 ***groundwater concentration would be 47 percent of the maximum contaminant level. Technetium-99 would also be released in this event, and the peak groundwater concentration would be about 42 percent of the current maximum contaminant level.*** For plutonium, the total contribution from the five tanks that could eventually reach the groundwater would ***be very small and*** would lag behind the contribution ***from past INTEC operations*** by ***greater than*** 500 years. ***Total plutonium would peak about 4,000 years after the five-tank failure and would be about one half the current regulatory maximum contaminant level.***

Continued Current Operations Alternative - This alternative would calcine all remaining mixed transuranic waste/SBW and store the calcine in the bin sets indefinitely. As a result, the bin set source terms would be somewhat increased from those evaluated for the No Action Alternative. The volume of calcine stored in the bin sets would be increased by about 20 percent from that evaluated for the No Action Alternative. The amount of radioactivity (total curies) remaining in the bin sets would be increased by about 5 percent.

If a bin set full of mixed HLW calcine degrades and fails during a seismic event after 500 years, 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 described above. 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.

The nonradiological impacts of this accident would also be bounded by the 5-tank failure accident. 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.

Low-Level Class A and Class C-Type Grout Alternatives - Facility disposition alternatives that include filling the ***Tank Farm and bin sets*** with low-level waste, Class A or Class C-type grout would eventually release contaminants to groundwater. Under these alternatives, DOE assumed that the contaminants would not be available for transport to groundwater for 500 years ***when the tanks, bin sets, and disposal units are assumed to degrade. Further, even after degradation, the release of contaminants would be relatively slow*** because grout chemistry can be formulated to specifically control release of contaminants and the rate at which these contaminants migrate to groundwater. The contaminant of concern at this time would be iodine-129, because strontium-90 would have decayed sufficiently and plutonium would be removed as part of the separations process. After 500 years, the iodine-129 from historical practices should have ***dispersed***, so that any contribution from the grout would not result in a ***significant*** cumulative impact.

6.4.3 TRAFFIC AND TRANSPORTATION

Cumulative transportation impacts would result from implementation of the alternatives for this EIS in the context of continuing historical radioactive shipments and reasonably foreseeable shipments. DOE conservatively estimated the total cumulative number of cancer fatalities resulting from domestic U.S. shipments of all kinds of radioactive materials from 1953 through 2037 (DOE and non-DOE activities). These estimates indicate that these shipments collectively may cause 140 latent cancer fatalities to the public. Of this total, 1.4 latent cancer fatalities could result from the radioactive waste shipments for the INEEL waste processing alternative with the highest impact (Direct Cement Waste Option), and ***25*** latent cancer fatalities from other future INEEL programs.

6.4.4 HEALTH AND SAFETY

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

By comparison, the maximum annual collective dose from the waste processing alternatives and treatment options would add ***0.11*** person-rem to the population living within 50 miles of INTEC. This dose would result from implementation of the Continued Current Operations Alternative, the Planning Basis Option, the Hot Isostatic Pressed Waste Option, or the Direct Cement Waste Option. Other projected releases from new facilities planned at the INEEL would add an additional 0.05 person-rem per year. The most likely outcome is that no latent cancer fatalities would occur as a result of the cumulative radiation dose received by the population from the waste processing alternatives and treatment options evaluated.

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

The occupational radiation dose received by the entire INEEL workforce would result in about 1 latent cancer fatality during 10 years of operations. This compares to the natural lifetime incidence of fatal cancers in the same population from all causes of about ***2,000*** over a 10-year period. The greatest increases in collective worker dose, under the Direct Cement Waste Option, would be about ***0.43*** latent cancer fatality over the life of the project. Public exposure could also result from airborne contaminants due to soil erosion or inadvertent intrusion into disposal areas.

6.4.5 WASTE AND MATERIALS

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

DOE ***estimates that the waste processing and facility disposition*** alternatives would ***generate about*** $\boldsymbol{1.0 \times 10^4}$ ***cubic meters*** of low-level waste and about $\boldsymbol{1.1 \times 10^5}$ cubic meters of industrial waste. The actual volumes generated may be smaller than estimated because waste minimization and recycling could reduce the quantity of waste.

6.5 Summary Comparison of Alternatives

The five waste processing alternatives from the Draft EIS are briefly summarized in Figure S-14 along with the new Steam Reforming Option (under the Non-Separations Alternative) and the new Direct Vitrification Alternative (selected by the State of Idaho as its Preferred Alternative for waste processing). A summary of the facility disposition alternatives is provided in Figure S-15. Figures S-14 and S-15 identify those options that DOE prefers along with those not included under DOE's preferred waste processing alternative and the preferred facility disposition alternative. A comparison of impacts for the five key areas of interest (air resources, transportation, waste and materials, health and safety, and accidents) is provided in Table S-2. The table presents analysis results for waste processing alternatives, facility disposition alternatives, and the increment of INEEL cumulative impacts.

DOE's Preferred Alternative

NO ACTION ALTERNATIVE	CONTINUED CURRENT OPERATIONS ALTERNATIVE	SEPARATIONS ALTERNATIVE
Required under NEPA as a basis for comparison. · Leave mixed transuranic waste/SBW in tanks indefinitely. · Leave mixed HLW calcine in bin sets indefinitely.	· Upgrade and permit calciner. · Calcine the liquid mixed transuranic waste/SBW, add to existing mixed HLW calcine in bin sets. · Remove transuranics from tank heels and newly generated liquid waste and send to the Waste Isolation Pilot Plant (WIPP). · Grout remaining low-level waste (Class A-type) for disposal at INEEL. *The following are not included in DOE's Preferred Alternative:* · Store calcine in bin sets indefinitely. · *Grout remaining mixed low-level waste (Class A-type) for disposal at INEEL.*	Different ways to chemically separate waste into fractions that can be disposed of differently depending on the type and level of radioactivity. FULL SEPARATIONS OPTION The most highly radioactive and long-lived radionuclides removed for disposal in a HLW repository. · Separate cesium, strontium, and transuranics from mixed HLW calcine and mixed transuranic waste/SBW & treat (vitrify) for disposal in a HLW repository. · Treat ***mixed*** low-level waste (Class A-type) fraction for disposal ***in an*** offsite landfill. · *Treat mixed low-level waste (Class A-type) fraction for disposal in empty tanks, bin sets, or onsite landfill (not a component of DOE's Preferred Alternative).* PLANNING BASIS OPTION This option mirrors the previously announced DOE decisions and agreements regarding mixed HLW ***calcine*** and the mixed transuranic waste/SBW. · Upgrade and permit the calciner · Calcine the liquid mixed transuranic waste/SBW andadd to the bin sets. · Proceed as for Full Separations Option above except that the ***mixed*** low-level waste fraction would be disposed of at ***an*** offsite landfill. · Remove transuranics from tank heels and newly generated liquid waste and send to WIPP. TRANSURANIC SEPARATIONS OPTION Does not result in a HLW fraction. · Remove transuranics from calcine and mixed transuranic waste/SBW,solidify and send to WIPP. · Grout ***mixed*** low-level waste (Class C-type) fraction containing cesium, strontium, ***and other nuclides for*** disposal ***in an*** offsite landfill. · *Grout mixed low-level waste (Class C-type) fraction containing cesium, strontium, and other nuclides for disposal in empty tanks, bin sets, or onsite landfill (not a component of DOE's Preferred Alternative).*

Waste Processing Alternatives at a Glance

- These alternatives offer DOE different ways to treat mixed HLW currently stored in calcine bin sets and mixed transuranic waste/SBW currently stored in underground tanks so that these wastes can be safely stored and properly disposed of.
- These alternatives differ in the kinds of technology used to treat the waste, specifically, whether the calciner will be upgraded and permitted for treating the liquid mixed transuranic waste/SBW and whether waste will be separated into fractions for different disposal destinations.
- These alternatives also differ in the kind of disposal options available for mixed low-level waste fractions produced as a result of treatment alternatives.
- The timeframe of the waste processing alternatives spans approximately through the year 2035. The year 2035 is the target date in the Settlement Agreement/Consent Order for DOE to have all the calcined mixed HLW ready for shipment to a storage facility or repository outside of Idaho.
- Long-term impacts (beyond 2035) associated with waste processing alternatives that include onsite disposal of low-level waste (Class A-type and Class C-type) are carried over to the facility disposition alternatives, which evaluate impacts associated with the long term closure of HLW facilities at INTEC.
- Projects and facilities are identified individually and can be combined in a building block fashion to develop other waste processing alternatives.

State of Idaho's
Preferred Alternative

DOE's Preferred Alternative

NON-SEPARATIONS ALTERNATIVE

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

HOT ISOSTATIC PRESSED WASTE OPTION

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

DIRECT CEMENT WASTE OPTION

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

EARLY VITRIFICATION OPTION

Creates a non-leaching, glass waste out of mixed transuranic waste/SBW and *mixed* HLW calcine.
- Blend mixed transuranic waste/SBW and tank heels with glass frit, vitrify, and send to WIPP.
- Blend mixed HLW calcine with glass frit, and vitrify for disposal in a HLW repository.

STEAM REFORMING OPTION

Creates a calcine-like waste from mixed transuranic waste/SBW.
- ***Steam reform mixed transuranic waste/SBW and dispose of the product at WIPP.***
- ***Grout newly generated liquid waste.***
- ***Package calcine from the bin sets for shipment to a HLW repository.***

MINIMUM INEEL PROCESSING ALTERNATIVE

Mixed HLW calcine would be sent to the Hanford Site in Washington State for treatment and mixed transuranic waste/SBW would be treated at INEEL.

- At INEEL, process mixed transuranic waste/SBW and tank heels to remove cesium and grout remainder for shipment to WIPP.

The following are not included in DOE's Preferred Alternative:
- Place mixed HLW calcine and cesium ion exchange resin (from mixed transuranic waste/SBW treatment) in shipping containers and transport to the Hanford Site.
- Separate calcine into *mixed* high-level and *mixed* low-level waste fractions and treat at Hanford.
- Return treated *mixed* HLW and *mixed* low-level waste fractions to INEEL.
- Dispose of *mixed* low-level waste fraction at INEEL or offsite; store HLW fraction for disposal in a HLW repository.

DIRECT VITRIFICATION ALTERNATIVE

VITRIFICATION WITHOUT CALCINE SEPARATIONS

Creates a non-leaching glass waste out of mixed transuranic waste/SBW, tank heels, and mixed HLW calcine.
- ***Blend mixed transuranic waste/SBW and tank heels with glass frit, vitrify, and send to WIPP or a HLW repository based on the outcome of the waste incidental to reprocessing determination.***
- ***Blend mixed HLW calcine with glass frit, and vitrify for disposal in a HLW repository.***

VITRIFICATION WITH CALCINE SEPARATIONS

Same information as above with the following additions:
- ***Separate strontium, cesium, and/or transuranics from mixed HLW calcine and vitrify for disposal in a HLW repository. Type of separations to be determined by further technology development.***
- ***Grout mixed low-level waste fraction for disposal in an offsite disposal facility. Mixed low-level waste fraction to be disposed of in accordance with Waste Management Programatic EIS ROD.***

FIGURE *S-14.*
Waste processing alternatives at a glance.

Facility Disposition Alternatives at a Glance

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

Preferred Alternative

CLOSURE TO LANDFILL STANDARDS ALTERNATIVE

Facilities closed in accordance with state and Federal requirements for landfills.
- Stabilize waste residuals in tanks, vaults, and piping with grout.
- Build an engineered cap over facilities.
- Install groundwater monitoring system.
- Provide post-closure monitoring.

PERFORMANCE-BASED CLOSURE WITH CLASS A GROUT DISPOSAL

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

NO ACTION ALTERNATIVE

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

CLEAN CLOSURE ALTERNATIVE

Restore the land to a condition after closure that presents no risk to workers or the public from hazardous or radiological components.
- Remove or treat all wastes and contaminated items so that radiation is at background level.
- If necessary, remove buildings, vaults, and contaminated soil.
- Post-closure monitoring may be required.

PERFORMANCE-BASED CLOSURE ALTERNATIVE

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

PERFORMANCE-BASED CLOSURE WITH CLASS C GROUT DISPOSAL

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

FIGURE *S-15.*
Facility disposition alternatives at a glance.

No Action Alternative	Continued Current Operations Alternative	Separations Alternative	Non-Separations Alternative	Minimum INEEL Processing Alternative	*Direct Vitrification Alternative*
Impacts to Air - Waste Processing					
Radiation dose from emissions would be 6.0×10^{-4} millirem per year to offsite MEI *and 7.0×10^{-6} millirem per year to noninvolved worker.* Collective population dose to the general public is *0.038* person-rem per year. No criteria pollutant would exceed significance threshold. Maximum *offsite* impact *from* carcinogenic toxic pollutant emissions would be approximately *1.2* percent of the applicable standard.	Radiation dose from emissions would be 1.7×10^{-3} millirem per year to offsite MEI *and 1.8×10^{-5} millirem per year to noninvolved worker.* Collective population dose to the general public is *0.11* person-rem per year. One criteria pollutant (sulfur dioxide) would exceed significance threshold. Maximum *offsite* impact *from* carcinogenic toxic pollutant emissions would be approximately *1.9* percent of the applicable standard.	FULL SEPARATIONS OPTION Radiation dose from emissions would be 1.2×10^{-4} millirem per year to offsite MEI *and 4.4×10^{-5} millirem per year to noninvolved worker.* Collective population dose to the general public is *6.6×10^{-3}* person-rem per year. Two criteria pollutants (sulfur dioxide and nitrogen oxides) would exceed significance thresholds. PLANNING BASIS OPTION Radiation dose from emissions would be 1.8×10^{-3} millirem per year to offsite MEI *and 9.0×10^{-5} millirem per year to noninvolved worker.* Collective population dose to the general public is *0.11* person-rem per year. Two criteria pollutants (sulfur dioxide and nitrogen oxides) would exceed significance thresholds. TRANSURANIC SEPARATIONS OPTION Radiation dose from emissions would be 6.0×10^{-5} millirem per year to offsite MEI *and 3.4×10^{-5} millirem per year to noninvolved worker.* Collective population dose to the general public is *3.6×10^{-3}* person-rem per year. *Two criteria* pollutants (sulfur dioxide *and nitrogen oxides*) would exceed significance *thresholds.* Maximum *offsite* impact *from* carcinogenic toxic pollutant emissions would be *4.5 to 10* percent of the applicable standard under the Separations Alternative.	HOT ISOSTATIC PRESSED WASTE OPTION Radiation dose from emissions would be 1.8×10^{-3} millirem per year to offsite MEI *and 3.6×10^{-5} millirem per year to noninvolved worker.* Collective population dose to the general public is *0.11* person-rem per year. Two criteria pollutants (sulfur dioxide and nitrogen oxides) would exceed significance thresholds. DIRECT CEMENT WASTE OPTION Radiation dose from emissions would be 1.7×10^{-3} millirem per year to offsite MEI *and 3.0×10^{-5} millirem per year to noninvolved worker.* Collective population dose to the general public is *0.11* person-rem per year. One criteria pollutant (sulfur dioxide) would exceed significance threshold. EARLY VITRIFICATION OPTION Radiation dose from emissions would be 8.9×10^{-4} millirem per year to offsite MEI *and 4.8×10^{-5} millirem per year to noninvolved worker.* Collective population dose to the general public is *0.056* person-rem per year. *No* criteria pollutant would exceed significance threshold. *STEAM REFORMING OPTION* *Radiation dose from emissions would be 6.2×10^{-4} millirem per year to offsite MEI and 2.2×10^{-5} millirem per year to noninvolved worker. Collective population dose to the general public is 0.040 person-rem per year. No criteria pollutant would exceed significance threshold.* Maximum *offsite* impact *from* 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 9.5×10^{-4} millirem per year to offsite MEI *and 1.0×10^{-4} millirem per year to noninvolved worker.* Collective population dose to the general public is *0.056* person-rem per year. No criteria pollutant would exceed significance threshold. Maximum *offsite* impact *from* carcinogenic toxic pollutant emissions would be *1.0* percent of the applicable standard. At Hanford - Radiation dose from emissions would be 1.7×10^{-5} millirem per year to offsite MEI *and 1.3×10^{-5} millirem per year to noninvolved worker.* Collective population dose to the general public is 1.3×10^{-3} person-rem per year. One criteria pollutant (carbon monoxide) would exceed significance threshold.	*VITRIFICATION WITHOUT CALCINE SEPARATIONS OPTION* *Radiation dose from emissions would be 6.5×10^{-4} millirem per year to offsite MEI and 2.3×10^{-5} millirem per year to noninvolved worker. Collective population dose to the general public is 0.045 person-rem per year. No criteria pollutant would exceed significance threshold.* *Maximum offsite impact from carcinogenic toxic pollutant emissions would be 1.7 percent of the applicable standard.* *VITRIFICATION WITH CALCINE SEPARATIONS OPTION* *Radiation dose from emissions would be 6.8×10^{-4} millirem per year to offsite MEI and 2.3×10^{-5} millirem per year to noninvolved worker. Collective population dose to the general public is 0.047 person-rem per year. Two criteria pollutants (sulfur dioxide and nitrogen oxides) would exceed significance thresholds.* *Maximum offsite impact from carcinogenic toxic pollutant emissions would be 9.5 percent of the applicable standard.*

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

No Action Alternative	Continued Current Operations Alternative	Separations Alternative	Non-Separations Alternative	Minimum INEEL Processing Alternative	Direct Vitrification Alternative
Impacts to Transportation - Waste Processing					
No offsite transportation would occur.	Incident-free LCF from truck transport: public: 0.013 workers: 1.8×10^{-3} Accident LCF risk for the public from transport: truck: 5.7×10^{-4} rail: 4.6×10^{-5}	FULL SEPARATIONS OPTION Incident-free LCF from truck transport: public: 0.077 workers: 0.022 Accident LCF risk for the public from transport: truck: 8.9×10^{-5} rail: 1.8×10^{-5} PLANNING BASIS OPTION Incident-free LCF from truck transport: public: 0.091 workers: 0.026 Accident LCF risk for the public from transport: truck: 6.7×10^{-4} rail: 6.6×10^{-5} TRANSURANIC SEPARATIONS OPTION Incident-free LCF from truck transport public: 0.23 workers: 0.035 Accident LCF risk for the public from transport: truck: 0.10 rail: 0.038	HOT ISOSTATIC PRESSED WASTE OPTION Incident-free LCF from truck transport: public: 0.47 workers: 0.068 Accident LCF risk for the public from transport: truck: 5.7×10^{-4} rail: 4.6×10^{-5} DIRECT CEMENT WASTE OPTION Incident-free LCF from truck transport: public: 1.4 workers: 0.21 Accident LCF risk for the public from transport: truck: 0.023 rail: 1.3×10^{-3} EARLY VITRIFICATION OPTION Incident-free LCF from truck transport: public: 0.98 workers: 0.14 Accident LCF risk for the public from transport: truck: 1.5×10^{-6} rail: 7.8×10^{-8} STEAM REFORMING OPTION Incident-free LCF from truck transport: public: 0.78 workers: 0.11 Accident LCF risk for the public from transport: truck: 0.039 rail: 2.0×10^{-3}	Incident-free LCF from truck transport: public: 1.1 workers: 0.16 Accident LCF risk for the public from transport: truck: 0.018 rail: 2.9×10^{-3}	VITRIFICATION WITHOUT CALCINE SEPARATIONS OPTION Incident-free LCF from truck transport: public: 0.99 workers: 0.15 Accident LCF risk for the public from transport: truck: 1.5×10^{-6} rail: 9.9×10^{-8} VITRIFICATION WITH CALCINE SEPARATIONS OPTION Incident-free LCF from truck transport: public: 0.12 workers: 0.027 Accident LCF risk for the public from transport: truck: 7.9×10^{-5} rail: 1.2×10^{-5}

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

No Action Alternative	Continued Current Operations Alternative	Separations Alternative	Non-Separations Alternative	Minimum INEEL Processing Alternative	*Direct Vitrification Alternative*
Impacts to Waste and Materials - Waste Processing					
Approximately 15,000 cubic meters of industrial waste, *0 cubic meters of hazardous waste,* 1,500 cubic meters of mixed low-level waste, and 190 cubic meters of low-level waste generated through year 2035 *(includes construction and operations phases).*	Approximately 26,000 cubic meters of industrial waste, *30 cubic meters of hazardous waste,* 3,400 cubic meters of mixed low-level waste, and 9,500 cubic meters of low-level waste generated through year 2035 (includes construction and operation phases).	FULL SEPARATIONS OPTION Approximately 110,000 cubic meters of industrial waste, *2,400 cubic meters of hazardous waste,* 7,000 cubic meters of mixed low-level waste, and 1,500 cubic meters of low-level waste generated through year 2035 (includes construction and operation phases). PLANNING BASIS OPTION Approximately 110,000 cubic meters of industrial waste, *2,100 cubic meters of hazardous waste,* 9,000 cubic meters of mixed low-level waste, and 10,000 cubic meters of low-level waste generated through year 2035 (includes construction and operation phases). TRANSURANIC SEPARATIONS OPTION Approximately 82,000 cubic meters of industrial waste, *1,200 cubic meters of hazardous waste,* 6,400 cubic meters of mixed low-level waste, and 1,200 cubic meters of low-level waste generated through year 2035 (includes construction and operation phases).	HOT ISOSTATIC PRESSED WASTE OPTION Approximately 69,000 cubic meters of industrial waste, *790 cubic meters of hazardous waste,* 7,500 cubic meters of mixed low-level waste, and 10,000 cubic meters of low-level waste generated through year 2035 (includes construction and operation phases). DIRECT CEMENT WASTE OPTION Approximately 80,000 cubic meters of industrial waste, *560 cubic meters of hazardous waste,* 9,700 cubic meters of mixed low-level waste, and 10,000 cubic meters of low-level waste generated through year 2035 (includes construction and operation phases). EARLY VITRIFICATION OPTION Approximately 65,000 cubic meters of industrial waste, *640 cubic meters of hazardous waste,* 7,100 cubic meters of mixed low-level waste, and 1,100 cubic meters of low-level waste generated through year 2035 (includes construction and operation phases). *STEAM REFORMING OPTION* *Approximately 49,000 cubic meters of industrial waste, 260 cubic meters of hazardous waste, 5,200 cubic meters of mixed low-level waste, and 560 cubic meters of low-level waste generated through year 2035 (includes construction and operation phases).*	At INEEL - Approximately 61,000 cubic meters of industrial waste, *380 cubic meters of hazardous waste,* 6,800 cubic meters of mixed low-level waste, and 810 cubic meters of low-level waste generated through the year 2035 (includes construction and operation phases). At Hanford - Approximately 26,000 cubic meters of industrial waste, *43 cubic meters of hazardous waste,* 0 cubic meters of mixed low-level waste, and 1,500 cubic meters of low-level waste generated through year 2030 (includes construction and operation phases).	*VITRIFICATION WITHOUT CALCINE SEPARATIONS OPTION* *Approximately 53,000 cubic meters of industrial waste, 570 cubic meters of hazardous waste, 7,100 cubic meters of mixed low-level waste, and 2,300 cubic meters of low-level waste generated through the year 2035 (includes construction and operation phases).* *VITRIFICATION WITH CALCINE SEPARATIONS OPTION* *Approximately 85,000 cubic meters of industrial waste, 2,200 cubic meters of hazardous waste, 8,600 cubic meters of mixed low-level waste, and 3,000 cubic meters of low-level waste generated through the year 2035 (includes construction and operation phases).*

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

No Action Alternative	Continued Current Operations Alternative	Separations Alternative	Non-Separations Alternative	Minimum INEEL Processing Alternative	Direct Vitrification Alternative
Impacts to Waste and Materials - Waste Processing (continued)					
No product wastes would be produced under this alternative.	Approximately 110 cubic meters of transuranic waste.	FULL SEPARATIONS OPTION Approximately 27,000 cubic meters of low-level waste and 470 cubic meters of HLW. PLANNING BASIS OPTION Approximately 30,000 cubic meters of low-level waste, 110 cubic meters of transuranic waste, and 470 cubic meters of HLW. TRANSURANIC SEPARATIONS OPTION Approximately 23,000 cubic meters of low-level waste and 220 cubic meters of transuranic waste.	HOT ISOSTATIC PRESSED WASTE OPTION Approximately 110 cubic meters of transuranic waste and 3,400 cubic meters of HLW. DIRECT CEMENT WASTE OPTION Approximately 110 cubic meters of transuranic waste and 13,000 cubic meters of HLW. EARLY VITRIFICATION OPTION Approximately 360 cubic meters of transuranic waste and 8,500 cubic meters of HLW. STEAM REFORMING OPTION Approximately 2,600 cubic meters of transuranic waste and 4,400 cubic meters of HLW.	At INEEL - Approximately 7,500 cubic meters of transuranic waste. At Hanford - Approximately 14,000 cubic meters of low-level waste and 3,500 cubic meters of HLW.	VITRIFICATION WITHOUT CALCINE SEPARATIONS OPTION Approximately 8,900 cubic meters of HLW (including 440 cubic meters of vitrified SBW). VITRIFICATION WITH CALCINE SEPARATIONS OPTION Approximately 24,000 cubic meters of low-level waste and 910 cubic meters of HLW (including 440 cubic meters of vitrified SBW).

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

- New Information -

No Action Alternative	Continued Current Operations Alternative	Separations Alternative	Non-Separations Alternative	Minimum INEEL Processing Alternative	Direct Vitrification Alternative
Impacts to Health and Safety - Waste Processing - Construction Impacts					
Total lost workdays: 30. Total recordable cases: 3.9.	Total lost workdays: 110. Total recordable cases: 14.	FULL SEPARATIONS OPTION Total lost workdays: 1,500. Total recordable cases: 190. PLANNING BASIS OPTION Total lost workdays: 1,500. Total recordable cases: 200. TRANSURANIC SEPARATIONS OPTION Total lost workdays: 1,100. Total recordable cases: 150.	HOT ISOSTATIC PRESSED WASTE OPTION Total lost workdays: 520. Total recordable cases: 67. DIRECT CEMENT WASTE OPTION Total lost workdays: 620. Total recordable cases: 81. EARLY VITRIFICATION OPTION Total lost workdays: 530. Total recordable cases: 69. STEAM REFORMING OPTION Total lost workdays: 770. Total recordable cases: 100.	At INEEL - Total lost workdays: 620. Total recordable cases: 81. At Hanford - Total lost workdays not reported. Total recordable cases: 230.	VITRIFICATION WITHOUT CALCINE SEPARATIONS OPTION Total lost workdays: 710. Total recordable cases: 93. VITRIFICATION WITH CALCINE SEPARATIONS OPTION Total lost workdays: 1,300. Total recordable cases: 170.
Impacts to Health and Safety - Waste Processing - Operations Impacts					
Total lost workdays: 850. Total recordable cases: 110.	Total lost workdays: 1,100. Total recordable cases: 150.	FULL SEPARATIONS OPTION Total lost workdays: 3,000. Total recordable cases: 400. PLANNING BASIS OPTION Total lost workdays: 3,700. Total recordable cases: 480. TRANSURANIC SEPARATIONS OPTION Total lost workdays: 2,300. Total recordable cases: 300.	HOT ISOSTATIC PRESSED WASTE OPTION Total lost workdays: 2,500. Total recordable cases: 320. DIRECT CEMENT WASTE OPTION Total lost workdays: 2,900. Total recordable cases: 380. EARLY VITRIFICATION OPTION Total lost workdays: 2,500. Total recordable cases: 330. STEAM REFORMING OPTION Total lost workdays: 1,400. Total recordable cases: 180.	At INEEL - Total lost workdays: 2,000. Total recordable cases: 270. At Hanford - Total lost workdays not reported. Total recordable cases: 27.	VITRIFICATION WITHOUT CALCINE SEPARATIONS OPTION Total lost workdays: 1,900. Total recordable cases: 250. VITRIFICATION WITH CALCINE SEPARATIONS OPTION Total lost workdays: 2,500. Total recordable cases: 330.
The estimated LCF in involved workers would be 0.14.	The estimated LCF in involved workers would be 0.16.	FULL SEPARATIONS OPTION The estimated LCF in involved workers related to waste processing under this option would be 0.31. PLANNING BASIS OPTION The estimated LCF in involved workers related to waste processing under this option would be 0.39. TRANSURANIC SEPARATIONS OPTION The estimated LCF in involved workers related to waste processing under this option would be 0.27.	HOT ISOSTATIC PRESSED WASTE OPTION The estimated LCF in involved workers related to waste processing under this option would be 0.31. DIRECT CEMENT WASTE OPTION The estimated LCF in involved workers related to waste processing under this option would be 0.43. EARLY VITRIFICATION OPTION The estimated LCF in involved workers related to waste processing under this option would be 0.29. STEAM REFORMING OPTION The estimated LCF in involved workers related to waste processing under this option would be 0.25.	At INEEL - The estimated LCF in involved workers would be 0.27. At Hanford - The estimated LCF in involved workers would be 0.14.	VITRIFICATION WITHOUT CALCINE SEPARATIONS OPTION The estimated LCF in involved workers related to waste processing under this option would be 0.20. VITRIFICATION WITH CALCINE SEPARATIONS OPTION The estimated LCF in involved workers related to waste processing under this option would be 0.26.

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

- New Information -

No Action Alternative	Continued Current Operations Alternative	Separations Alternative	Non-Separations Alternative	Minimum INEEL Processing Alternative	Direct Vitrification Alternative
Impacts to Health and Safety - Waste Processing - Operations Impacts(continued)					
The estimated probability of an LCF for the offsite MEI would be 1.0×10^{-8}. The estimated probability of an LCF for the noninvolved worker would be 1.0×10^{-10}. The estimated LCF in the population within 50 miles of INTEC would be 7.0×10^{-4}.	The estimated probability of an LCF for the offsite MEI would be 1.0×10^{-8}. The estimated probability of an LCF for the noninvolved worker would be 8.0×10^{-11}. The estimated LCF in the population within 50 miles of INTEC would be 6.0×10^{-4}.	FULL SEPARATIONS OPTION The estimated probability of an LCF for the offsite MEI would be 1.2×10^{-9}. The estimated probability of an LCF for the noninvolved worker would be 3.7×10^{-10}. The estimated LCF in the population within 50 miles of INTEC would be 7.0×10^{-5}. PLANNING BASIS OPTION The estimated probability of an LCF for the offsite MEI would be 3.2×10^{-9}. The estimated probability of an LCF for the noninvolved worker would be 3.4×10^{-10}. The estimated LCF in the population within 50 miles of INTEC would be 2.0×10^{-4}. TRANSURANIC SEPARATIONS OPTION The estimated probability of an LCF for the offsite MEI would be 6.5×10^{-10}. The estimated probability of an LCF for the noninvolved worker would be 2.8×10^{-10}. The estimated LCF in the population within 50 miles of INTEC would be 3.8×10^{-5}.	HOT ISOSTATIC PRESSED WASTE OPTION The estimated probability of an LCF for the offsite MEI would be 1.0×10^{-8}. The estimated probability of an LCF for the noninvolved worker would be 2.3×10^{-10}. The estimated LCF in the population within 50 miles of INTEC would be 6.5×10^{-4}. DIRECT CEMENT WASTE OPTION The estimated probability of an LCF for the offsite MEI would be 1.0×10^{-8}. The estimated probability of an LCF for the noninvolved worker would be 1.4×10^{-10}. The estimated LCF in the population within 50 miles of INTEC would be 6.5×10^{-4}. EARLY VITRIFICATION OPTION The estimated probability of an LCF for the offsite MEI would be 1.5×10^{-8}. The estimated probability of an LCF for the noninvolved worker would be 5.2×10^{-10}. The estimated LCF in the population within 50 miles of INTEC would be 1.0×10^{-3}. STEAM REFORMING OPTION The estimated probability of an LCF for the offsite MEI would be 1.1×10^{-8}. The estimated probability of an LCF for the noninvolved worker would be 1.9×10^{-10}. The estimated LCF in the population within 50 miles of INTEC would be 7.0×10^{-4}.	At INEEL - The estimated probability of an LCF for the offsite MEI would be 1.0×10^{-8}. The estimated probability of an LCF for the noninvolved worker would be 5.6×10^{-10}. The estimated LCF in the population within 50 miles of INTEC would be 7.0×10^{-4}. At Hanford - The estimated probability of an LCF for the offsite MEI would be 2.5×10^{-11}. The estimated probability of an LCF for the noninvolved worker would be 9.2×10^{-12}. The estimated LCF in the population within 50 miles of 200-East Area would be 1.1×10^{-6}.	VITRIFICATION WITHOUT CALCINE SEPARATIONS OPTION The estimated probability of an LCF for the offsite MEI would be 1.1×10^{-8}. The estimated probability of an LCF for the noninvolved worker would be 1.9×10^{-10}. The estimated LCF in the population within 50 miles of INTEC would be 7.5×10^{-4}. VITRIFICATION WITH CALCINE SEPARATIONS OPTION The estimated probability of an LCF for the offsite MEI would be 1.2×10^{-8}. The estimated probability of an LCF for the noninvolved worker would be 1.9×10^{-10}. The estimated LCF in the population within 50 miles of INTEC would be 7.5×10^{-4}.

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

- New Information -

No Action Alternative	Continued Current Operations Alternative	Separations Alternative	Non-Separations Alternative	Minimum INEEL Processing Alternative	Direct Vitrification Alternative
Potential Impacts from Abnormal Events* - Waste Processing					
BOUNDING ABNORMAL EVENT Degraded bin set fails in seismic event after 500 years. MEI dose: 83,000 millirem; 42 in a thousand likelihood of LCF. Noninvolved worker dose: 5.7 million millirem; nearly certain death from acute radiation. Offsite population dose: 530,000 person-rem; 270 LCFs.	BOUNDING ABNORMAL EVENT Same as No Action Alternative.	BOUNDING ABNORMAL EVENT Equipment failure results in release during transfer operation. MEI dose: 40 millirem; 20 in a million likelihood of LCF. Noninvolved worker dose: 2,700 millirem; 1.4 in a thousand likelihood of LCF. Offsite population dose: 470 person-rem; less than one LCF.	BOUNDING ABNORMAL EVENT Same as Separations Alternative.	BOUNDING ABNORMAL EVENT Same as Separations Alternative.	BOUNDING ABNORMAL EVENT Same as Separations Alternative.
Potential Impacts from Bounding Design Basis Events - Waste Processing**					
Flood Induced failure of bin set. MEI dose: 880 millirem; 440 in a million likelihood of LCF. Noninvolved worker dose: 59,000 millirem; 59 per thousand likelihood of LCF.*** Offsite population dose: 57,000 person-rem; 29 LCFs.	Same as No Action Alternative.	Same as No Action Alternative.	Same as No Action Alternative.	Same as No Action Alternative.	Same as No Action Alternative.

*Greater than once in a thousand years.

**Greater than once in a million years.

***For doses potentially exceeding exposure rates of 10 rad per hour, the increased likelihood of an LCF is doubled to account for the human body's diminished capability to repair radiation damage.

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

No Action Alternative	Continued Current Operations Alternative	Separations Alternative	Non-Separations Alternative	Minimum INEEL Processing Alternative	Direct Vitrification Alternative
Potential Impacts from Beyond Design Basis Events* - Waste Processing					
BOUNDING BEYOND DESIGN BASIS EVENT External event causes failure of bin set structure. MEI dose: 14,000 millirem; 7 in a thousand likelihood of LCF. Noninvolved worker dose: 930,000 millirem; 94 percent likelihood of LCF. Offsite population dose: 120,000 person-rem; 61 LCFs.	BOUNDING BEYOND DESIGN BASIS EVENT Same as No Action Alternative.	BOUNDING BEYOND DESIGN BASIS EVENT FULL SEPARATIONS AND PLANNING BASIS OPTIONS External event results in a release from vitrification facility. MEI dose: 17,000 millirem; 8.5 in a thousand likelihood of LCF. Noninvolved worker dose: 1.2 million millirem; nearly certain death from acute radiation. Offsite population dose: 150,000 person-rem; 76 LCFs. TRANSURANIC SEPARATIONS OPTION Same as No Action Alternative.	BOUNDING BEYOND DESIGN BASIS EVENT Same as No Action Alternative.	BOUNDING BEYOND DESIGN BASIS EVENT Same as No Action Alternative.	BOUNDING BEYOND DESIGN BASIS EVENT VITRIFICATION WITHOUT CALCINE SEPARATIONS OPTION Same as No Action Alternative. VITRIFICATION WITH CALCINE SEPARATIONS OPTION External event results in a release from vitrification facility. MEI dose: 17,000 millirem; 8.5 in a thousand likelihood of LCF. Noninvolved worker dose: 1.2 million millirem; nearly certain death from acute radiation. Offsite population dose: 150,000 person-rem; 76 LCFs.

*Less than once in a million years

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

No Action Alternative	Continued Current Operations Alternative	Separations Alternative	Non-Separations Alternative	Minimum INEEL Processing Alternative	*Direct Vitrification Alternative*
Impacts to Air (New Facilities) - Facility Disposition					
No impacts from No Action Alternative are anticipated.	RADIATION EFFECTS Radiation doses from emissions would be 1.1x10^{-10} millirem per year to offsite MEI and *4.0x10^{-9}* person-rem per year to the offsite population.	RADIATION EFFECTS FULL SEPARATIONS OPTION 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. PLANNING BASIS OPTION 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. TRANSURANIC SEPARATIONS OPTION 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 HOT ISOSTATIC PRESSED WASTE OPTION 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. DIRECT CEMENT WASTE OPTION 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. EARLY VITIRIFICATION OPTION 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. ***STEAM REFORMING OPTION*** ***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*** ***VITRIFICATION WITHOUT CALCINE SEPARATIONS OPTION*** ***Radiation dose to the offsite MEI would be 2.1×10^{-10} millirem per year. Collective population dose to the general public would be 7.0×10^{-9} person-rem per year.*** ***VITRIFICATION WITH CALCINE SEPARATIONS OPTION*** ***Radiation dose to the offsite MEI would be 3.0×10^{-10} millirem per year. Collective population dose to the general public would be 9.9×10^{-9} person-rem per year.***
	HAZARDOUS/CARCINOGENIC Maximum *offsite* impacts of carcinogenic toxic pollutant emissions are estimated to be *0.65* percent of the applicable standard.	HAZARDOUS/CARCINOGENIC Maximum *offsite* impacts of carcinogenic toxic pollutant emissions are estimated to be 1.8 to *2.6* percent of the applicable standard.	HAZARDOUS/CARCINOGENIC Maximum *offsite* impacts of carcinogenic toxic pollutant emissions are estimated to be *0.72* to 2.1 percent of the applicable standard.	HAZARDOUS/CARCINOGENIC Maximum *offsite* impacts of carcinogenic toxic pollutant emissions are estimated to be 2.*0* percent of the applicable standard.	***HAZARDOUS/ CARCINOGENIC*** ***Maximum offsite impacts of carcinogenic toxic pollutant emissions are estimated to be 1.6 to 2.2 percent of the applicable standard.***

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

No Action Alternative	Continued Current Operations Alternative	Separations Alternative	Non-Separations Alternative	Minimum INEEL Processing Alternative	*Direct Vitrification Alternative*
Impacts to Health and Safety (New Facilities) - Facility Disposition					
No impacts from No Action Alternative are anticipated.	DOSE EFFECTS Estimated radiation dose to involved workers will result in *0.017* LCF and *43* person-rem.	DOSE EFFECTS Estimated radiation dose to involved workers will result in: FULL SEPARATIONS OPTION *0.11* LCF and *270* person-rem. PLANNING BASIS OPTION *0.11* LCF and *270* person-rem. TRANSURANIC SEPARATIONS OPTION *0.077* LCF and *190* person-rem.	DOSE EFFECTS Estimated radiation dose to involved workers will result in: HOT ISOSTATIC PRESSED WASTE OPTION *0.12* LCF and *290* person-rem. DIRECT CEMENT WASTE OPTION *0.084* LCF and *210* person-rem. EARLY VITRIFICATION OPTION *0.068* LCF and *170* person-rem. *STEAM REFORMING OPTION* *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:* *VITRIFICATION WITHOUT CALCINE SEPARATIONS OPTION* *0.071 LCF and 180 person-rem.* *VITRIFICATION WITH CALCINE SEPARATIONS OPTION* *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: FULL SEPARATIONS OPTION *570* and *74*, respectively. PLANNING BASIS OPTION *570* and *74*, respectively. TRANSURANIC SEPARATIONS OPTION *420* and *54*, respectively.	INDUSTRIAL EFFECTS Total lost workdays and recordable cases: HOT ISOSTATIC PRESSED WASTE OPTION *610* and *79*, respectively. DIRECT CEMENT WASTE OPTION *410* and *54*, respectively. EARLY VITRIFICATION OPTION *510* and *67*, respectively. *STEAM REFORMING OPTION* *140 and 19, respectively.*	INDUSTRIAL EFFECTS At INEEL - Total lost workdays: *350*. Total recordable cases: *45*.	*INDUSTRIAL EFFECTS* *VITRIFICATION WITHOUT CALCINE SEPARATIONS OPTION* *Total lost workdays: 520.* *Total recordable cases: 68.* *VITRIFICATION WITH CALCINE SEPARATIONS OPTION* *Total lost workdays: 610.* *Total recordable cases: 79.*

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

No Action Alternative	Continued Current Operations Alternative	Separations Alternative	Non-Separations Alternative	Minimum INEEL Processing Alternative	*Direct Vitrification Alternative*
Impacts to Waste and Materials (New Facilities) - Facility Disposition					
No impacts from No Action Alternative would be 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 would be generated.	FULL SEPARATIONS OPTION Approximately 70,000 cubic meters of industrial waste, 900 cubic meters of mixed low-level waste, and 68,000 cubic meters of low-level waste would be generated. PLANNING BASIS OPTION Approximately 72,000 cubic meters of industrial waste, 480 cubic meters of mixed low-level waste, and 73,000 cubic meters of low-level waste would be generated. TRANSURANIC SEPARATIONS OPTION Approximately 44,000 cubic meters of industrial waste, 710 cubic meters of mixed low-level waste, and 44,000 cubic meters of low-level waste would be generated.	HOT ISOSTATIC PRESSED WASTE OPTION Approximately 68,000 cubic meters of industrial waste, 340 cubic meters of mixed low-level waste, and 50,000 cubic meters of low-level waste would be generated. DIRECT CEMENT WASTE OPTION Approximately 95,000 cubic meters of industrial waste, 350 cubic meters of mixed low-level waste, and 49,000 cubic meters of low-level waste would be generated. EARLY VITRIFICATION OPTION Approximately 80,000 cubic meters of industrial waste, 480 cubic meters of mixed low-level waste, and 41,000 cubic meters of low-level waste would be generated. *STEAM REFORMING OPTION* *Approximately 18,000 cubic meters of industrial waste, 69 cubic meters of mixed low-level waste, and 15,000 cubic meters of low-level waste would be 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 would be generated.	*VITRIFICATION WITHOUT CALCINE SEPARATIONS OPTION* *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 would be generated.* *VITRIFICATION WITH CALCINE SEPARATIONS OPTION* *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 would be generated.*

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

No Action Alternative	Clean Closure	Performance-Based Closure	Closure to Landfill Standards
Accidents - Facility Disposition			
There are no anticipated accidents.	Approximately *1,100* 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.

Air	Water	Health & Safety	Waste & Materials
Increment of INEEL **Cumulative Impacts - Waste Processing and Facility Disposition**			
The maximum cumulative dose to the offsite MEI is 0.16 millirem per year and includes waste processing activities and is less than 2 percent of the 10 millirem per year dose limit.	USE Activities associated with this EIS will require an increased water withdrawal from the aquifer of 12 percent. CONTAMINATION A full-time occupant at INTEC would receive a lifetime dose of *420* millirem from using the contaminated groundwater after failure of 5 storage tanks. Because of the 500-year delay in reaching the aquifer, the iodine-129 and total plutonium contamination would not add cumulatively to the existing groundwater contamination.	The maximum annual collective dose from waste processing would add 0.10 person-rem to the population living within 50 miles of INTEC. The occupational radiation dose received by the entire INEEL workforce would result in *less than* one LCF.	*The waste processing and facility disposition alternatives would generate about 100,000 cubic meters of low-level waste and about 440,000 cubic meters of industrial waste.*

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

7.0 Other Environmental Review Requirements

7.1 Endangered Species Act

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

7.2 Clean Air Act

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

As a minimum, DOE would need a Permit to Construct and a review pursuant to the National Emissions Standards for Hazardous Air Pollutants before beginning construction of any facility. If any facility must be permitted under the Prevention of Significant Deterioration program, Federal Land Managers of pristine (Class I) areas, including the ***Wilderness Area of*** Craters of the Moon National Monument, are provided an early opportunity to review a project for visibility concerns.

7.3 Floodplain/Wetlands Management

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

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

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

8.0 Reading Rooms and Information Locations

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

Colorado

Rocky Flats Field Office
U.S. Department of Energy
Public Reading Room
Front Range Community College Library
3645 West 112th Avenue
Westminster, Colorado 80030

Idaho

Boise INEEL Outreach Office
800 Park Blvd. Suite 790
Boise, Idaho 83712

Boise Public Library
715 S. Capital Blvd.
Boise, Idaho 83702

Boise State University
Albertson Library
1910 University Drive
Boise, Idaho 83725

Shoshone-Bannock Library
Bannock and Pima Drive
Fort Hall, Idaho 83203

Idaho Falls Public Library
457 Broadway
Idaho Falls, Idaho 83402

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1910 University Drive
Boise, Idaho 83725

Shoshone-Bannock Library
Bannock and Pima Drive
Fort Hall, Idaho 83203

Idaho Falls Public Library
457 Broadway
Idaho Falls, Idaho 83402

Idaho Operations Office
U.S. Department of Energy
Public Reading Room
1776 Science Center Drive
Idaho Falls, Idaho 83415-2300

Lewis-Clark State College Library
500 8th Avenue
Lewiston, Idaho 83501-2698

University of Idaho Library
Rayburn Street
Moscow, Idaho 83844

Idaho State University
Eli M. Oboler Library
850 S 9th Ave
Pocatello, Idaho 83209-8089

Twin Falls Public Library
434 2nd St. E
Twin Falls, Idaho 83301

Montana

University of Montana
Mansfield Library
32 Campus Drive
Missoula, Montana 59812-9936

Nevada

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

New Mexico

Albuquerque Operations Office
U.S. Department of Energy
Zimmerman Library
University of New Mexico
Albuquerque, New Mexico 87131-1466

Oregon

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

Utah

Marriott Library
University of Utah
295 S. 1500 East
Salt Lake City, Utah 84112-0860

Washington

Office of River Protection/
Richland Operations Office
U.S. Department of Energy
Public Reading Room
Washington State University/Tri-Cities Campus
2770 University Drive
Richland, Washington 99352

Wyoming

Teton County Public Library
125 Virginian Lane
Jackson, Wyoming 83001

Wyoming State Library
Government Documents Collection
2301 Capitol Avenue
Cheyenne, Wyoming 82002-0060

District of Columbia

Headquarters
U.S. Department of Energy
FOIA Reading Room
Room 1E-190, Forrestal Building
1000 Independence Avenue, SW
Washington, D.C. 20585