COVER SHEET

Responsible Agency: Lead Federal Agency: U.S. Department of Energy (DOE)

Cooperating Agency: The State of Idaho

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

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

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

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

READERS GUIDE

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

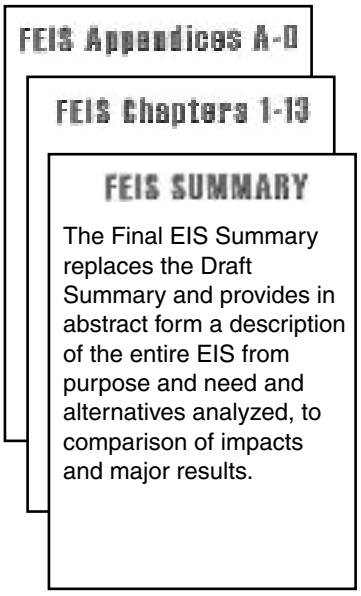


FIGURE 1

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 liquid wastes and shipping the high-level waste calcine directly to a geologic repository without further treatment.

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

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

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

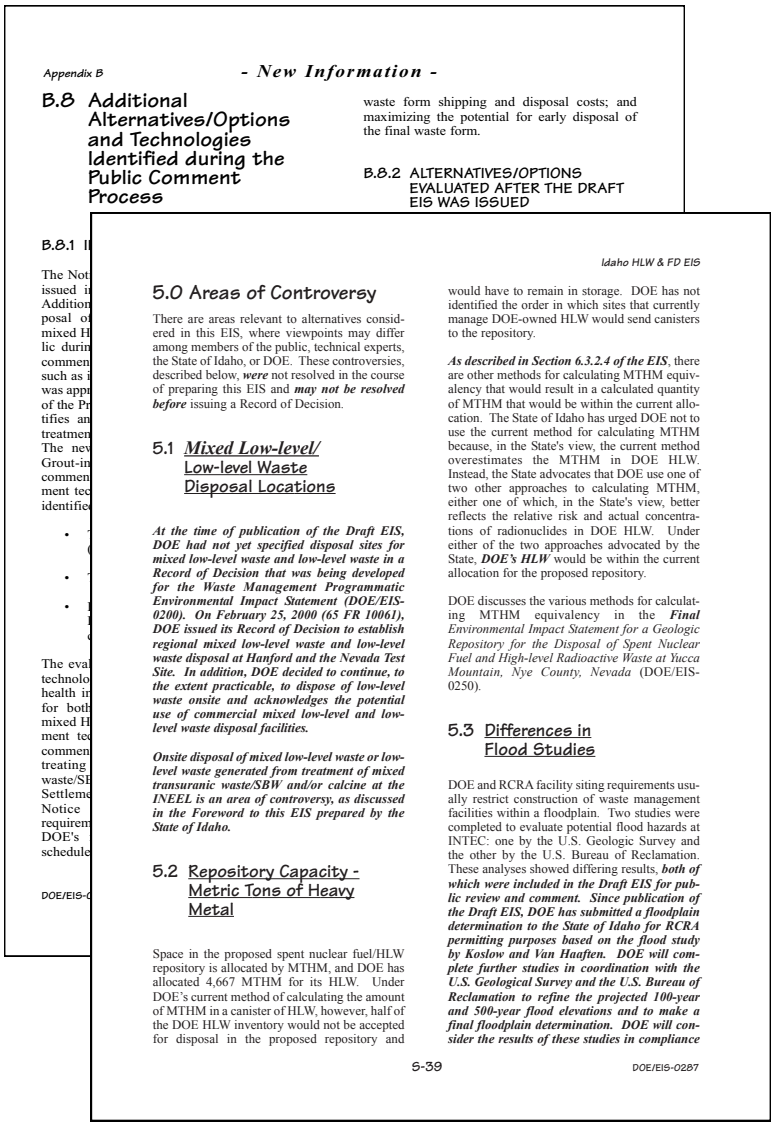
- Tables 3-1 and 3-3 and Tables 3-2 and 3-5 were combined. Table 3-5 was added to summarize the impacts associated with the facility disposition alternatives evaluated in the Draft EIS as well as the State of Idaho and DOE Preferred Alternative for facility disposition.

- Chapter 4 "Affected Environment" has been updated.

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

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

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



Appendix B - New Information -

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

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

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

Idaho HLW & FD EIS

5.0 Areas of Controversy

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

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

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

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

5.2 Repository Capacity - Metric Tons of Heavy Metal

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

As described in Section 6.3.2.4 of the EIS, there are other methods for calculating MTHM equivalency that would result in a calculated quantity of MTHM that would be within the current allocation. The State of Idaho has urged DOE not to use the current method for calculating MTHM because, in the State's view, the current method overestimates the MTHM in DOE HLW. Instead, the State advocates that DOE use one of two other approaches to calculating MTHM, either one of which, in the State's view, better reflects the relative risk and actual concentrations of radionuclides in DOE HLW. Under either of the two approaches advocated by the State, ***DOE's HLW*** would be within the current allocation for the proposed repository.

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

5.3 Differences in Flood Studies

DOE and RCRA facility siting requirements usually restrict construction of waste management facilities within a floodplain. Two studies were completed to evaluate potential flood hazards at INTEC: one by the U.S. Geologic Survey and the other by the U.S. Bureau of Reclamation. These analyses showed differing results, ***both of which were included in the Draft EIS for public review and comment. Since publication of the Draft EIS, DOE has submitted a floodplain determination to the State of Idaho for RCRA permitting purposes based on the flood study by Koslow and Van Haaften. DOE will complete further studies in coordination with the U.S. Geological Survey and the U.S. Bureau of Reclamation to refine the projected 100-year and 500-year flood elevations and to make a final floodplain determination. DOE will consider the results of these studies in compliance***

5-39 DOE/EIS-0287

FIGURE 2

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

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

TABLE OF CONTENTS

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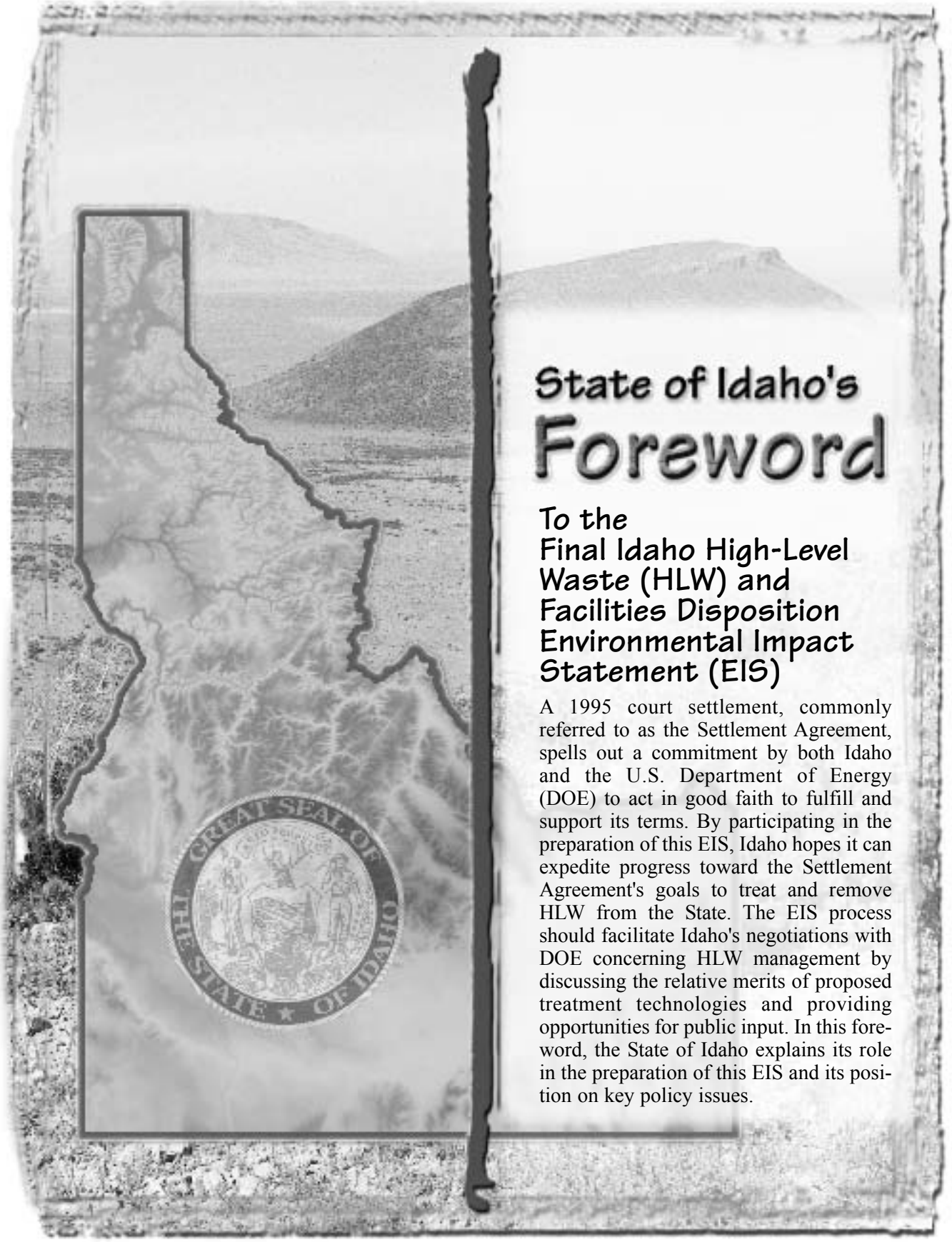
Foreword



State of Idaho's Foreword

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

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

Idaho's Role in the EIS

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

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

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

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

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

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

Key Policy Issues

1 Idaho finds *some alternatives and options to be inconsistent with the intent of the Settlement Agreement.*

Idaho recognizes that under NEPA, DOE may evaluate alternatives that are not consistent with existing legal obligations. However, Idaho wants to inform decisionmakers and the public of ***alternatives and*** options ***evaluated in this EIS*** that are inconsistent with the Settlement Agreement.

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

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

For example, the No Action Alternative, which leaves liquids in the Tank Farm, and the Continued Current Operations Alternative, which leaves calcined waste at

INTEC indefinitely, are inconsistent with the Settlement Agreement. Similarly, alternatives that propose to dispose of low-level waste fractions separated from ***calcine or sodium-bearing waste*** at INTEC will not meet the Settlement Agreement's intent to have all ***this waste*** treated and ***ready to be*** removed from Idaho.

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

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

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

Reprocessing at INTEC used a three-cycle solvent extraction process to recover highly enriched uranium from spent fuel. Each cycle created liquid waste, as did ***calciner operations and*** decontamination activities. ***For the most part, DOE stored first cycle liquids separately from the second and third cycle liquids. In addition, second and third cycle liquids were typically mixed with liquids from calciner operations, decontamination activities, and some INEEL sources not associated with reprocessing. This mixture of liquids is referred to collectively as sodium-bearing waste since relatively high concentrations of sodium are present as a result of decontamination agents. In preparing the EIS, DOE and the State agreed first cycle liquids are HLW, but disagreed on how to classify the sodium-bearing waste.***

DOE's Radioactive Waste Management Order (DOE O 435.1) identifies HLW as liquid produced "directly in reprocessing." Idaho interprets this HLW definition to include waste from the first reprocessing cycle ("non-sodium bearing waste") and the second and third ***reprocessing*** cycles ("sodium-bearing waste"). This interpretation is consistent with language in the Settlement Agreement that identifies both sodium-bearing waste and non-sodium bearing waste as HLW.

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

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

As ***discussed*** above ***under key policy issue #1***, even if DOE determines some of the HLW ***(sodium bearing liquid or calcine)*** should be classified as other waste types, all of it must be treated and prepared for shipment out of Idaho as the Settlement Agreement intended.

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

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

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

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

Space in the proposed geologic repository is allocated by Metric Tons of Heavy Metal (MTHM). MTHM refers to the amount of energy-producing material in nuclear fuel, primarily uranium and plutonium. DOE has allocated 4,667 MTHM in the proposed repository for its HLW. Determining the MTHM in spent nuclear fuel is straightforward, since the quantity was established when the fuel was fabricated. Because reprocessing removed plutonium and uranium from different types of nuclear fuel over three cycles, calculating MTHM for DOE's HLW is more complex.

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

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

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

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

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

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

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

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

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

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

Public Involvement Appreciated

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

Acronyms & Abbreviations

Acronyms & Abbreviations

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

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

AA.1 Document-wide Acronyms and Abbreviations

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

AA.2 Citations for Laws and Regulations

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

United States Code (USC)

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

Code of Federal Regulations (CFR)

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

Federal Register (FR)

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

AA.3 Significant Figures

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

AA.4 Scientific Notation

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

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

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

AA.5 Units of Measure

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

Metric Conversion Chart

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

Metric Prefixes

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