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Reader's Guide

Final Tank Closure and Waste Management Environmental Impact Statement for the Hanford Site, Richland, Washington

U.S. Department of Energy

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Cover Sheet

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

Cooperating Agencies: Washington State Department of Ecology (Ecology)
U.S. Environmental Protection Agency (EPA)

Title: *Final Tank Closure and Waste Management Environmental Impact Statement for the Hanford Site, Richland, Washington* (*TC & WM EIS*) (DOE/EIS-0391)

Location: Benton County, Washington

Contacts: For copies of this *Final TC & WM EIS,* call toll-free 1-888-829-6347, or contact Mary Beth Burandt at the address below.

For additional information on this *Final TC & WM EIS,* contact:

Mary Beth Burandt, Document Manager
Office of River Protection
U.S. Department of Energy
Post Office Box 1178
Richland, WA 99352
Attention: *TC & WM EIS*
Email: TC&WMEIS@saic.com
Fax: 1-888-785-2865
Telephone and voicemail: 1-888-829-6347

For general information on the DOE National Environmental Policy Act (NEPA) process, contact:

Carol M. Borgstrom, Director
Office of NEPA Policy and Compliance (GC-54)
U.S. Department of Energy
1000 Independence Avenue, SW
Washington, DC 20585
Telephone: 202-586-4600, or leave a message at 1-800-472-2756
Email: askNEPA@hq.doe.gov
Website: http://energy.gov/nepa

Abstract: The Hanford Site (Hanford), located in southeastern Washington State along the Columbia River, is approximately 1,518 square kilometers (586 square miles) in size. Hanford's mission from the early 1940s to approximately 1989 included defense-related nuclear research, development, and weapons production activities. These activities created a wide variety of chemical and radioactive wastes. Hanford's mission now is focused on the cleanup of those wastes and ultimate closure of Hanford. To this end, several types of radioactive waste are being managed at Hanford: (1) high-level radioactive waste (HLW) as defined in DOE Manual 435.1-1; (2) transuranic (TRU) waste, which is waste containing alpha-particle-emitting radionuclides with atomic numbers greater than uranium (92) and half-lives greater than 20 years in concentrations greater than 100 nanocuries per gram of waste; (3) low-level radioactive waste (LLW), which is radioactive waste that is neither HLW nor TRU waste; and (4) mixed low-level radioactive waste (MLLW), which is LLW containing hazardous constituents as defined under the Resource Conservation and Recovery Act (RCRA) of 1976 (42 U.S.C 6901 et seq.). Thus, this environmental impact statement (EIS) analyzes the following three key areas:

1. **Retrieval, treatment, and disposal of waste from 149 single-shell tanks (SSTs) and 28 double-shell tanks (DSTs) and closure of the SST system.** In this *TC & WM EIS,* DOE proposes to retrieve and treat waste from 177 underground tanks and ancillary equipment and dispose of this waste in compliance with applicable regulatory requirements. At present, DOE is constructing a Waste Treatment and Immobilization Plant (WTP) in the 200-East Area of Hanford. The WTP would separate waste stored in Hanford's underground tanks into HLW and low-activity waste (LAW) fractions. HLW would be treated in the WTP and stored at Hanford until disposition decisions are made and implemented. LAW would be treated in the WTP and disposed of as LLW at Hanford as decided in DOE's Record of Decision (ROD) issued in 1997 (62 FR 8693), pursuant to the *Tank Waste Remediation System, Hanford Site, Richland, Washington, Final Environmental Impact Statement* (DOE/EIS-0189, August 1996). DOE

proposes to provide additional treatment capacity for the tank LAW that can supplement the planned WTP capacity in fulfillment of DOE's obligations under the Hanford Federal Facility Agreement and Consent Order (Tri-Party Agreement). DOE would dispose of immobilized LAW and Hanford's (and other DOE sites') LLW and MLLW in lined trenches on site. These trenches would be closed in accordance with applicable regulatory requirements.

2. **Final decontamination and decommissioning of the Fast Flux Test Facility (FFTF), a nuclear test reactor.** DOE proposes to determine the final end state for the aboveground, belowground, and ancillary support structures.

3. **Disposal of Hanford's waste and other DOE sites' LLW and MLLW.** DOE needs to decide where to locate onsite disposal facilities for Hanford's waste and other DOE sites' LLW and MLLW. DOE committed in the ROD (69 FR 39449) for the *Final Hanford Site Solid (Radioactive and Hazardous) Waste Program Environmental Impact Statement, Richland, Washington* (DOE/EIS-0286F, January 2004) that LLW would be disposed of in lined trenches. Specifically, DOE proposes to dispose of the waste in either the existing Integrated Disposal Facility (IDF) in the 200-East Area (IDF-East) or the proposed 200-West Area IDF (IDF-West).

DOE released the *Draft TC & WM EIS* in October 2009 (74 FR 56194) for review and comment by other Federal agencies, states, American Indian tribal governments, local governments, and the public. The comment period was 185 days, from October 30, 2009, to May 3, 2010.

In accordance with Council on Environmental Quality (CEQ) regulations (40 CFR 1502.9(c)) and DOE regulations (10 CFR 1021.314(c)), DOE prepared a supplement analysis (SA) of the *Draft TC & WM EIS* (*Supplement Analysis of the "Draft Tank Closure and Waste Management Environmental Impact Statement for the Hanford Site, Richland, Washington"* [DOE/EIS-0391-SA-01, February 2012]). DOE prepared an SA to evaluate updated, modified, or expanded information developed subsequent to publication of the *Draft TC & WM EIS* to determine whether a supplement to the draft EIS or a new draft EIS was warranted. Fourteen topic areas were reviewed. Revisions include changes to contaminant inventories, corrections to estimates, updates to characterization data, and new information that was not available at the time of publication of the *Draft TC & WM EIS*. The modified inventories do not change the key environmental findings presented in the draft EIS. They do not present significant new circumstances or information relevant to environmental concerns and bearing on the proposed action(s) and their impacts. Changes to some of the parameters used in the alternatives analysis do not significantly affect the potential environmental impacts of the alternatives on an absolute or relative basis, whether the changes are considered individually or collectively. These are not substantial changes in the proposed action(s) that are relevant to environmental concerns. DOE concluded, based on analyses in the SA, that the updated, modified, or expanded information developed subsequent to the *Draft TC & WM EIS* does not constitute significant new circumstances or information relevant to environmental concerns and bearing on the proposed actions(s) in the *Draft TC & WM EIS* or their impacts. Therefore, DOE determined that a supplement to the *Draft TC & WM EIS* or a new *Draft TC & WM EIS* was not required.

DOE posted the *Supplement Analysis of the "Draft Tank Closure and Waste Management Environmental Impact Statement for the Hanford Site, Richland, Washington"* on the DOE NEPA website, http://energy.gov/nepa/office-nepa-policy-and-compliance, on February 8, 2012, and on the *TC & WM EIS* website, http://www.hanford.gov/index.cfm?page=1117&, on February 9, 2012, and the SA was provided on February 14, 2012, to the DOE public reading room at 2770 University Drive, Room 101L, Richland, Washington 99352. The SA is also provided here as Appendix X of this final EIS for convenience only.

In preparing this *Final TC & WM EIS*, DOE considered all comments received on the draft EIS and revised this final EIS, as appropriate. DOE has clarified and/or revised its Preferred Alternatives for the three program areas as presented in this *TC & WM EIS*, as follows:

Tank Closure

Eleven alternatives for potential tank closure actions are evaluated in this final EIS. These alternatives cover tank waste retrieval and treatment, as well as closure of the SSTs. DOE has identified the following Preferred Alternatives: For retrieval, DOE prefers Tank Closure alternatives that would retrieve at least 99 percent of the tank waste. All Tank Closure alternatives would do this except Alternatives 1 (No Action) and 5. For closure of the SSTs, DOE prefers landfill closure; this could include implementation of corrective/mitigation actions as described in the Summary of this EIS, Section S.5.5.1, and Chapter 2, Section 2.10.1, which may require soil removal or treatment of the vadose zone. Decisions on the extent of soil removal or treatment, if needed, will be made on a tank farm– or waste management area–basis through the RCRA closure permitting process. These landfill closure considerations would apply to Tank Closure Alternatives 2B, 3A, 3B, 3C, 5, and 6C. DOE does not prefer alternatives that include removal of the tanks as evaluated in Tank Closure Alternatives 4, 6A, and 6B. As described in the Summary of this EIS, Section S.5.5.1, and Chapter 2, Section 2.10.1, DOE believes that removal of the tank structures is technically infeasible and, due to both the depth of the contamination and the technical issues associated with removal of the tank structures, that it presents significant uncertainty in terms of worker exposure risk and waste generation volume.

DOE does not have a preferred alternative regarding supplemental treatment for LAW; DOE believes it beneficial to study further the potential cost, safety, and environmental performance of supplemental treatment technologies. Nevertheless, DOE is committed to meeting its obligations under the TPA regarding supplemental LAW treatment. When DOE is ready to identify its preferred alternative regarding supplemental treatment for LAW, this action will be subject to NEPA review as appropriate. DOE will provide a notice of its preferred alternative in the *Federal Register* at least 30 days before issuing a ROD. For the actions related to tank waste retrieval, treatment and closure, DOE prefers Tank Closure Alternative 2B, without removing technetium in the Pretreatment Facility.

Although DOE previously expressed its preference that no Hanford tank waste would be shipped to the Waste Isolation Pilot Plant (WIPP) (74 FR 67189), DOE now prefers to consider the option to retrieve, treat, and package waste that may be properly and legally designated as mixed transuranic (TRU) waste from specific tanks for disposal at WIPP, as analyzed in Tank Closure Alternatives 3A, 3B, 3C, 4, and 5. Initiating retrieval of tank waste identified as mixed TRU waste would be contingent on DOE's obtaining the applicable disposal and other necessary permits and ensuring that the WIPP Waste Acceptance Criteria and all other applicable regulatory requirements have been met. Retrieval of tank waste identified as mixed TRU waste would commence only after DOE had issued a *Federal Register* notice of its preferred alternative and a ROD.

FFTF Decommissioning

There are three FFTF Decommissioning alternatives from which the Preferred Alternative was identified: (1) No Action, (2) Entombment, and (3) Removal. DOE's Preferred Alternative for FFTF Decommissioning is Alternative 2: Entombment, which would remove all above-grade structures, including the reactor building. Below-grade structures, the reactor vessel, piping, and other components would remain in place and be filled with grout to immobilize the remaining radioactive and hazardous constituents. Waste generated from these activities would be disposed of in an IDF, and an engineered modified RCRA Subtitle C barrier would be constructed over the filled area. The remote-handled special components would be processed at Idaho National Laboratory and returned to Hanford. Bulk sodium inventories would be processed at Hanford for use in the WTP.

Waste Management

Three Waste Management alternatives were identified for the proposed actions: (1) Alternative 1: No Action, under which all onsite LLW and MLLW would be treated and disposed of in the existing lined Low-Level Radioactive Waste Burial Ground 218-W-5 trenches and no offsite waste would be accepted; (2) Alternative 2, which would continue treatment of onsite LLW and MLLW in expanded, existing facilities and dispose of onsite and previously treated, offsite LLW and MLLW in a single IDF (IDF-East); and (3) Alternative 3, which also would continue treatment of onsite LLW and MLLW in expanded, existing facilities, but would dispose of onsite and previously treated offsite LLW and MLLW in two IDFs (IDF-East and IDF-West). DOE's Preferred Alternative for waste management is Alternative 2, disposal of onsite LLW and MLLW streams in a single IDF (IDF-East). Disposal of SST closure waste that is not highly contaminated, such as rubble, soils, and ancillary equipment, in the proposed River Protection Project Disposal Facility (RPPDF) is also included under this alternative. After completion of disposal activities, IDF-East and the proposed RPPDF would be landfill-closed under an engineered modified RCRA Subtitle C barrier. The final EIS analyses show that, even when mitigation is applied to certain offsite waste streams (e.g., removal of most of the iodine-129), some environmental impacts of small quantities of iodine-129 would still occur and, therefore, limitations for that constituent should apply regardless of the alternative selected.

DOE will continue to defer the importation of offsite waste to Hanford, at least until the WTP is operational, subject to appropriate NEPA review and consistent with its previous Preferred Alternative for waste management (74 FR 67189). The limitations and exemptions defined in DOE's January 6, 2006, Settlement Agreement with the State of Washington (as amended on June 5, 2008) regarding *State of Washington v. Bodman* (Civil No. 2:03-cv-05018-AAM), signed by DOE, Ecology, the Washington State Attorney General's Office, and the U.S. Department of Justice, will remain in place.

This *Final TC & WM EIS* contains revisions and new information based in part on comments received on the *Draft TC & WM EIS*. Sidebars in the margins indicate the locations of these revisions and new information. Minor editorial changes are not marked. Volume 3 contains the comments received on the draft EIS and DOE's responses to the comments. DOE will use the analysis presented in this final EIS, as well as other information, in preparing one or more RODs. DOE will issue a ROD no sooner than 30 days after EPA publishes a Notice of Availability of this *Final TC & WM EIS* in the *Federal Register*.

Final Tank Closure and Waste Management Environmental Impact Statement for the Hanford Site, Richland, Washington (Final TC & WM EIS)

Washington State Department of Ecology (Ecology) Foreword

Summary

Ecology believes that the U.S. Department of Energy (DOE) and its contractor have prepared a *Final TC & WM EIS* that presents many important issues for discussion. Ecology's involvement in the production of this *TC & WM EIS* shows that this document has benefited from quality reviews and quality assurance procedures. In addition, this document benefited from public comments, and important additions were made in regard to mitigation measures and sensitivity studies.

The single best thing this document does is to clearly indicate the severity of the environmental impacts (both current and future) associated with the waste at the Hanford Site (Hanford), and, as such, DOE and its environmental impact statement (EIS) contractor should be commended for their factual representation.

The information in this document will help shed light on many key decisions that remain to be made about Hanford cleanup. To Ecology, the results of this EIS clearly indicate that some basic tenets concerning future Hanford cleanup are needed to reduce the impacts. They include the following:

- Waste from the tanks needs to be removed to the maximum extent possible. It is not the shell of the tanks or the act of landfill closing that increases the environmental impacts, it is the extent of retrieval from the tanks and the amount of vadose zone remediation.

- Glass is the only acceptable waste form for immobilized low-activity waste (ILAW) that is going to be disposed of at Hanford. This is true for the low-activity waste (LAW) treated through the existing LAW Vitrification Facility and for the LAW treated in the additional supplemental LAW treatment facility. This *TC & WM EIS* shows that all other waste forms are not protective of the groundwater and Columbia River.

- Groundwater pump-and-treat systems will have to continue to treat the groundwater beneath the Central Plateau for a long time after the tank waste has been retrieved and treated.

- A new emphasis should be placed on remediating problematic soil contamination in and beneath the tank farms and in other Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) waste sites in the Central Plateau to limit further groundwater impacts; this would include development of vadose zone remediation methods.

- Hanford's existing waste burden exceeds the capacity of the natural and engineered environment to attenuate it. Therefore, poorly performing waste forms and offsite waste should be eliminated as waste management options.

- As DOE and Ecology have indicated consistently throughout the *TC & WM EIS* development process, certain secondary waste from the Waste Treatment Plant (WTP) must be treated and immobilized to a greater extent to protect groundwater. The performance criteria for secondary waste must be improved beyond a grouted waste form.

- Hanford should embrace the use of a Central Plateau cumulative risk tool to ensure that all individual remediation decisions are protective in aggregate.

Ecology expects DOE to consider our input through this foreword, as well as through our comments made during the public comment process. Ecology worked with DOE with the intent of helping to produce a final EIS that fully informs future decision making. Ecology will continue to work with DOE as it develops the National Environmental Policy Act (NEPA) Record of Decision (ROD) and the important mitigation action plan. As defined in our cooperating agency Memorandum of Understanding (MOU), Ecology expects to be fully involved in the preparation of the ROD.

I. Introduction

Ecology has been a cooperating agency with DOE since 2002 in the production of both the *Draft* and this *Final TC & WM EIS*, as well as a coauthor in the preceding *Tank Waste Remediation System, Hanford Site, Richland, Washington, Final Environmental Impact Statement* (*TWRS EIS*). DOE prepared this EIS to meet the requirements of NEPA. In addition, Ecology has reviewed this EIS to ensure important sections can be adopted to satisfy the requirements of the State Environmental Policy Act (SEPA) to support our permitting processes. The information in this EIS will help inform Ecology and others about critical future cleanup decisions impacting Hanford's closure. When Ecology makes decisions through its permitting process, Ecology will look to this *Final TC & WM EIS* and, if appropriate, adopt portions. Ecology will use the information to develop mitigating permit conditions.

Ecology provided comments regarding the *Draft TC & WM EIS* to document areas of agreement or concern with this EIS and to assist the public in their review. Public and regulator input on the *Draft TC & WM EIS* were critical for the completion of an acceptable *Final TC & WM EIS*.

In this *Final TC & WM EIS*, Ecology issued a revised foreword to comment on the EIS key findings, DOE's Preferred Alternatives, and disposition of Ecology's comments on the *Draft TC & WM EIS*. Ecology has also issued this revised foreword to discuss Ecology's position on certain issues and future needed mitigation actions.

II. Ecology's Role as a Cooperating Agency

Ecology has been a cooperating agency in the preparation of this EIS. A state agency may be a cooperating agency on a Federal EIS when the agency has jurisdiction by law over, or specialized expertise concerning, a major Federal action under evaluation in the EIS.

As a cooperating agency, Ecology did not coauthor or direct the production of this EIS. Ecology did have access to certain data and information as this document was being prepared by DOE and its contractor. Our roles and responsibilities in this process were defined in an MOU between Ecology and DOE.

DOE retained responsibility for making final decisions in the preparation of this *Final TC & WM EIS*, as well as for determining the Preferred Alternatives presented in this EIS. However, Ecology's participation as a cooperating agency enabled us to help formulate the alternatives presented in this *TC & WM EIS*.

Ecology's involvement as a cooperating agency—and the current scope of this *Final TC & WM EIS*—is grounded in a series of events.

On November 8, 2002, DOE asked Ecology to be a cooperating agency on the "Environmental Impact Statement for Retrieval, Treatment, and Disposal of Tank Waste and Closure of Single-Shell Tanks at the Hanford Site, Richland, Washington," known as the "Tank Closure EIS." On November 27, 2002, Ecology formally agreed. The March 25, 2003, MOU outlines the respective agency roles and responsibilities.

While the “Tank Closure EIS” was being developed, another DOE EIS, the *Draft Hanford Site Solid (Radioactive and Hazardous) Waste Program Environmental Impact Statement, Richland, Washington (HSW EIS)*, was in the review stage. Among other matters, the *HSW EIS* examined the impacts of disposal at Hanford of certain volumes of radioactive waste and mixed radioactive and hazardous waste, including waste generated from beyond Hanford.

In March 2003, Ecology filed a lawsuit in the U.S. District Court seeking to prevent the importation and storage of certain offsite transuranic (TRU) and mixed TRU wastes that DOE had decided to send to Hanford prior to issuance of the *Final HSW EIS*. Ecology and intervening plaintiffs obtained a preliminary injunction against these shipments.

In January 2004, DOE issued the *Final HSW EIS*. Based on the *Final HSW EIS*, DOE amended a ROD that directed offsite radioactive and hazardous wastes to Hanford (within certain volume limits) for disposal and/or storage. In response, Ecology amended its lawsuit to challenge the adequacy of the *HSW EIS* analysis.

In May 2005, the U.S. District Court expanded the existing preliminary injunction to enjoin a broader class of waste and to grant Ecology a discovery period to further explore issues with the *HSW EIS*.

In January 2006, DOE and Ecology signed a Settlement Agreement, ending litigation on the *HSW EIS* and addressing concerns found in the *HSW EIS* quality assurance review during the discovery period. The Settlement Agreement called for expanding the scope of the “Tank Closure EIS” to provide a single, integrated set of analyses of (1) tank closure impacts considered in the “Tank Closure EIS” and (2) the disposal of all waste types considered in the *Final HSW EIS*. The Settlement Agreement also called for an integrated cumulative impacts analysis.

Under the Settlement Agreement, the “Tank Closure EIS” was renamed this *TC & WM EIS*. Ecology’s existing MOU with DOE was revised along with the Settlement Agreement so that Ecology remained a cooperating agency on the expanded *TC & WM EIS*.

The Settlement Agreement defined specific tasks to address concerns Ecology had with the *HSW EIS*. DOE has now revised information and implemented quality assurance measures used in this *TC & WM EIS* related to the solid-waste portion of the analysis. Ecology and its contractors have performed discrete quality assurance reviews of that information to help confirm that the quality assurance processes of DOE’s EIS contractor have been followed.

Based on Ecology’s involvement throughout the years of EIS development, we believe that positive changes have been made to address data quality shortcomings in the *HSW EIS*. These specifically relate to the following:

- The data used in analyzing impacts on groundwater
- The integration of analyses of all waste types that DOE may dispose of at Hanford
- The adequacy of the cumulative impacts analysis

Ecology reviewed the *Draft TC & WM EIS* and this *Final TC & WM EIS*. In our reviews, we confirmed that the terms of the Settlement Agreement have been addressed to our satisfaction.

III. Regulatory Relationships and SEPA

Now that this *TC & WM EIS* has been finalized, Ecology will proceed with approving regulatory actions required to complete the Hanford cleanup. These include actions under the (1) Hanford Federal Facility Agreement and Consent Order, also known as the Tri-Party Agreement (TPA), and (2) *State of Washington v. Chu* (Civil No. 2:08-cv-05085-FVS) Consent Decree, as well as actions that require state permits or modifications to existing permits, such as the Hanford Dangerous Waste Sitewide Permit. This permit regulates hazardous waste treatment, storage, and disposal activity at Hanford, including actions such as tank closure and supplemental treatment for tank waste.

Ecology must comply with SEPA when undertaking permitting actions. It is Ecology's sense that this *Final TC & WM EIS* will be suitable for adoption in whole or in part to satisfy SEPA. It is Ecology's plan to adopt in part portions of this *Final TC & WM EIS* when needed for individual permitting actions.

In addition, Ecology will have a substantial role in establishing standards and methods for the cleanup of contaminated soil and groundwater at Hanford, including areas that are regulated under hazardous waste corrective action authority and/or under CERCLA through a CERCLA ROD. Information developed in this EIS will thus be useful in other applications for the cleanup of Hanford.

IV. DOE's Responses to Ecology's Comments on the *Draft TC & WM EIS*

Ecology submitted comments on the *Draft TC & WM EIS* with a cover letter from Jane Hedges, Program Manager of Ecology's Nuclear Waste Program. These comments were discussed in detail with DOE and the EIS contractor. Many of our comments resulted in changes and additions in this *Final TC & WM EIS*. All of our comments were resolved to our satisfaction. Our comments and DOE's responses to those comments can be seen in the Comment-Response Document, Section 3.1, at Commentor No. 498.

V. Preferred Alternatives

This *Final TC & WM EIS* considers three sets of actions: tank waste treatment and tank farm closure, Fast Flux Test Facility (FFTF) decommissioning, and waste management. The Preferred Alternatives are summarized in this section. DOE's Preferred Alternative decisions with which Ecology disagrees are discussed in this section under Area of Disagreement; those Ecology generally agrees with are discussed in the subsequent section VI of this foreword.

The Preferred Alternatives for the three sets of actions can be summarized as follows:

<u>Tank Waste Treatment and Tank Farm Closure:</u>

- Retrieval of at least 99 percent of the waste from each tank.
- Landfill closure of the tank farms.
- Possible soil removal or treatment of the vadose zone.
- DOE chose to not identify a preferred alternative for supplemental treatment needed to treat that portion of LAW that the WTP, as currently designed, does not have the capacity to treat in a reasonable timeframe.

<u>FFTF Decommissioning:</u>

- All above-grade structures, including the reactor building, would be removed.
- Below-grade structures, the reactor vessel, piping, and other components would remain in place and be filled with grout to immobilize the remaining radioactive and hazardous constituents (FFTF Decommissioning Alternative 2: Entombment).
- Waste generated from these activities would be disposed of in an Integrated Disposal Facility (IDF), and an engineered modified Resource Conservation and Recovery Act (RCRA) Subtitle C barrier would be placed on top.
- Bulk sodium inventories would be processed at Hanford.

Waste Management:

- Onsite low-level radioactive waste (LLW) and mixed low-level radioactive waste (MLLW) streams would be disposed of in a single 200-East Area IDF (IDF-East) under a modified RCRA Subtitle C barrier.

- Single-shell tank (SST) closure waste that is not highly contaminated would be disposed of in the River Protection Project Disposal Facility (RPPDF) under a modified RCRA Subtitle C barrier.

- This final EIS shows that, even when mitigation is applied to offsite waste, environmental impacts would still occur. DOE is deferring the decision on the importation of offsite waste at Hanford, at least until the WTP is operational, subject to appropriate NEPA review. The limitations and exemptions defined in DOE's January 6, 2006, Settlement Agreement with the State of Washington (as amended on June 5, 2008), signed by DOE, Ecology, the Washington State Attorney General's Office, and the U.S. Department of Justice, regarding *State of Washington v. Bodman* (Civil No. 2:03-cv-05018-AAM) will remain in place.

Area of Disagreement:

Ecology agrees with a majority of the Preferred Alternative choices made in this *Final TC & WM EIS*, except for DOE's decision to omit a preferred supplemental treatment alternative from this *Final TC & WM EIS*. This omission leaves this EIS incomplete. This omission is not supported by (and is contrary to) the analysis in this *TC & WM EIS*, which clearly supports a second LAW vitrification alternative as the only environmentally protective option for supplemental treatment. Further, the cost comparisons in this EIS show that all the various options are cost neutral, so any assumptions about potential cost savings in choosing other treatment options are invalid.

As a cooperating agency on this *TC & WM EIS*, Ecology encourages DOE to select a preferred alternative in the ROD that includes a supplemental treatment decision. Ecology prefers an alternative that is similar to Tank Closure Alternative 2B or, at the very least, Alternative 2A. It is essential that ILAW to be disposed of above groundwater and upstream from the Columbia River be vitrified to ensure the water and future users will be protected from the tank waste constituents.

Alternative 2B is consistent with the TPA and the *State of Washington v. Chu* Consent Decree. Also, Alternative 2B does not extend the mission as far as Alternative 2A. Alternatives 2A and 2B both support the retrieval of waste from all the tanks, treatment of all that waste, and a defined end of mission.

Ecology is concerned that, by choosing vague language in this *Final TC & WM EIS* concerning supplemental treatment, DOE is bringing into question its previous commitments about when and if all of the waste will be removed from the SSTs and when and if all the tank waste will be treated. This puts into question the end of mission for tank waste treatment. Because such an undefined scenario was not analyzed in any of the alternatives in this *TC & WM EIS*, related impacts are not visible to decision makers or the public. There are several milestone dates that were critical components of the Consent Decree settlement that resolved the *State of Washington v. Chu* lawsuit. We believe DOE's failure to identify a preferred alternative in this *Final TC & WM EIS* will jeopardize compliance with these dates.

DOE has invested 10 years and $85 million, and Ecology has provided significant effort in cooperating agency review and consultation in producing this *TC & WM EIS*. Ecology expects that investment should result in a *Final TC & WM EIS* that supports making a supplemental treatment decision. We are especially concerned because the *Draft TC & WM EIS* identified no data gaps and gave no indication of DOE's intent to delay a decision on supplemental treatment. Further, no analysis in the *Preliminary Final TC & WM EIS* reviewed by Ecology identified gaps in the supplemental treatment data, nor did the analysis support a delay in making a supplemental treatment decision. No public comment received on the *Draft TC & WM EIS* encouraged DOE to delay selecting a preferred alternative.

If DOE does not select a preferred alternative for supplemental tank waste treatment, we request that it identify the following:

- The data it is using to make this decision and where is it documented in this *TC & WM EIS*.
- Any data gaps in this *TC & WM EIS* and how those gaps will be addressed in the future.
- Additional data it is analyzing to aid it in making the decision.
- The NEPA documentation DOE will use to analyze and support supplemental waste treatment selection. Will it be an additional EIS? How will DOE reconcile the timing of future NEPA documentation and TPA supplemental treatment milestones?

VI. Ecology Insights on Alternatives Considered, EIS Key Findings, and Needed Mitigation Measures

This *Final TC & WM EIS* considers 17 alternatives. Ecology's insights, technical perspectives, and legal and policy perspectives are provided below. Areas of agreement with DOE and points of concern are noted.

SST Waste Retrieval and Tank Farm Closure

Ecology believes that DOE has presented an appropriate range of alternatives for evaluating tank waste retrieval and tank closure impacts. However, based on the hazardous waste tank closure standards of the "Dangerous Waste Regulations" (WAC 173-303-610(2)) and the TPA requirements, Ecology supports only alternatives that involve tank waste retrieval to the maximum extent possible or 99 percent, whichever is greater, from each of the 149 SSTs. An acceptable performance assessment is essential in establishing a clear understanding of the risks and benefits of this retrieval goal. This assessment will be an important part of any specific tank farm closure plan permitting actions.

The analysis in this final EIS, including the new mitigation section, shows that the two most important factors in tank farm closure are (1) maximizing tank waste retrieval and (2) vadose zone remediation of specifically identified hot spots of contamination. Specific vadose zone mitigation will be addressed in specific tank farm closure plan permitting actions.

While DOE has identified the Preferred Alternative for tank closure as including landfill closure, it is important to point out that the specific details of how a tank farm will be closed will be identified in each tank farm closure plan permit. These closure plans will be subject to public comment and agency response before landfill decisions can be implemented.

High-Level Radioactive Waste Disposal

High-level radioactive waste (HLW) associated with the tank waste includes, but may not be limited to, immobilized high-level radioactive waste (IHLW) and HLW melters (both retired and failed). It has been DOE's longstanding plan to store these wastes at Hanford and then ship them off site and dispose of them in a deep geologic repository. The idea was that the nature of the geology would isolate the waste and protect humans from exposure to these very long-lived, lethal radionuclides. The Nuclear Waste Policy Act (NWPA) indicates that these waste streams require permanent isolation. By contrast, the ILAW glass, and perhaps other waste streams, may not require deep geologic disposal due to the level of pretreatment resulting in radionuclide removal and the degree of immobilization provided for in the ILAW glass.

However, the final decision on HLW disposal has recently become an issue with significant uncertainty. This *Final TC & WM EIS* contains the following statement:

> The Secretary of Energy has determined that a Yucca Mountain repository is not a workable option for permanent disposal of spent nuclear fuel (SNF) and HLW. However, DOE remains committed to meeting its obligations to manage and ultimately dispose of these materials. The Administration has convened the Blue Ribbon Commission on America's Nuclear Future (BRC) to conduct a comprehensive review of policies for managing the back end of the nuclear fuel cycle, including all alternatives for the storage, processing, and disposal of SNF and HLW. The BRC's final recommendations will form the basis of a new solution to managing and disposing of SNF and HLW.

The State of Washington asserts that there is only one legal process in place for developing a geologic repository, which is provided by the NWPA. Under the NWPA, only Congress can take Yucca Mountain off the table. The convening of the BRC to examine alternatives to Yucca Mountain and recommend possible amendments to the NWPA cannot substitute for a process already provided by law. Legally, Yucca Mountain is still the location for the deep geologic repository.

The NWPA requires permanent isolation of these most difficult waste streams. Leaving these wastes stored at Hanford indefinitely is not a legal option or an acceptable option to the State of Washington.

Ecology is concerned about the glass standards and canister requirements for the IHLW. These standards were developed based on what was acceptable for Yucca Mountain. Now that Yucca Mountain is no longer DOE's assumed disposal location, Ecology is concerned about what standards for glass and canisters will be utilized by the WTP. Ecology insists that DOE implement the most conservative approach in these two areas to guarantee that the glass and canister configurations adopted at the WTP will be acceptable at the future deep geologic repository.

In addition, Ecology maintains that DOE should build and operate adequate interim storage capacity for the IHLW and the HLW melters in a manner that does not slow down the treatment of tank waste.

This *Final TC & WM EIS* assumes that the used (both retired and failed) HLW melters are HLW and, therefore, should be disposed of in a deep geologic repository. This EIS also assumes that the used HLW melters will stay on site before shipment to such a repository. DOE has not requested, and Ecology has not accepted, long-term interim storage of used HLW melters at Hanford.

The final disposal of these melters should be in a deep geologic repository. This EIS evaluates only storage of the HLW melters and not the disposal pathway. The disposal pathway for the used melters (both retired and failed) will require further evaluation than is presented in this *Final TC & WM EIS*. Ecology and DOE will need to reach a mutual understanding and agreement on the regulatory framework for disposal.

Pretreatment of Tank Waste

This *Final TC & WM EIS* includes numerous alternatives that pretreat tank waste to separate the high-activity components and direct them to an HLW stream. The HLW stream will be vitrified, resulting in a glass waste product that will be sent to a deep geologic repository. However, this final EIS has one alternative (not the Preferred Alternative) that provides no pretreatment for some portion of the waste in the 200-West Area.

As a legal and policy issue, Ecology does not agree with alternatives that do not require pretreatment of the tank waste. Such alternatives do not meet the intent of the NWPA to remove as many of the fission products and radionuclides as possible to concentrate them in the HLW stream. For this reason, Ecology requests that DOE rule out any alternative that does not pretreat tank waste.

TRU Tank Waste

This *Final TC & WM EIS* considers the option of treating waste from specific tanks as mixed TRU waste and sending it to the Waste Isolation Pilot Plant (WIPP). This final EIS also considers WTP processing of the waste from these specific tanks.

Ecology is concerned by DOE's current approach to the potential mixed TRU tank waste. Prior to public comment on the *Draft TC & WM EIS*, DOE issued a statement in the Federal Register (74 FR 67189) that indicated that it was no longer considering sending Hanford tank waste to WIPP:

> DOE is now expressing its preference that no Hanford tank wastes would be shipped to WIPP. These wastes would be retrieved and treated in the Waste Treatment Plant (WTP) being constructed at Hanford. The State of Washington Department of Ecology (Ecology), a cooperating agency on the EIS, has revised its Foreword to the Draft EIS in response to this modification to the preferred alternative for tank waste.

For this reason, Ecology did not comment on this approach during public comment, and no public meeting was held in New Mexico.

However, this *Final TC & WM EIS* reversed this course and is now supporting the idea of some tank waste being classified as TRU waste and being packaged for disposal at WIPP. Ecology has concerns that there may be significant public concern regarding this path forward that has not been given the opportunity to be voiced, particularly since the public meetings in New Mexico were canceled.

Ecology has legal and technical concerns with any tank waste being classified as mixed TRU waste at this time. DOE must provide peer-reviewed data and a strong, defensible, technically and legally detailed justification for the designation of any tank waste as mixed TRU waste, rather than as HLW. DOE must also complete the WIPP certification process and assure Ecology that there is a viable disposal pathway (i.e., permit approval from the State of New Mexico and the U.S. Environmental Protection Agency) before Ecology will modify the Hanford Sitewide Permit to allow tank waste to be treated as mixed TRU waste. Further, Ecology is concerned with the cost benefit viability of an approach that sends a relatively minor amount of tank waste to WIPP, given the cost it would take to secure the disposal path, and to construct and operate the drying facility for the TRU tank waste.

Supplemental Treatment

In this *Final TC & WM EIS*, DOE considers additions to the treatment processes that the WTP would use; specifically, technologies to supplement the WTP's treatment of LAW. Because the WTP as currently designed does not have the capacity to treat the entire volume of LAW in a reasonable timeframe, additional LAW treatment capacity is needed. In section V of this foreword, we describe DOE's approach to delay the decision on supplemental treatment and describe Ecology's significant concern over that approach. In this section, we provide further information on our concerns.

Ecology is stating that this EIS and ROD should make a decision on supplemental treatment; that the only viable choice is the second LAW Vitrification Facility; and that to delay the decision in this EIS will endanger future tank waste milestones and commitments.

<u>Vitrification Options:</u>

Ecology agrees that evaluation of additional LAW vitrification treatment capacity as part of the scope of this EIS was needed. An additional supplemental LAW treatment system is necessary to treat all the tank waste in a reasonable amount of time. Ecology fully supports the *Final TC & WM EIS* alternative that assumes a second LAW Vitrification Facility would provide additional waste processing. Building a second LAW Vitrification Facility has consistently been Ecology's and DOE's baseline approach.

Ecology is supportive of a second LAW Vitrification Facility as the Preferred Alternative in the ROD for the following reasons:

- LAW vitrification is a mature technology that is ready to be implemented with no further testing.

- LAW vitrification produces a well-understood waste form that is extremely protective of the environment (the bulk vitrification waste form is not as protective and the waste form performance data show that cast stone and steam reforming are the least protective forms).

Ecology's measuring stick for a successful supplemental treatment technology has always been whether it is "as good as glass" (from the WTP).

Bulk vitrification is a type of vitrification; however, data from the last bulk vitrification experimental testing indicate waste form performance and technology implementation issues. There has been a lack of significant progress on advancing a bulk vitrification test facility for actual waste. The environmental results from the waste form performance presented in this *Final TC & WM EIS* indicate that LAW vitrification is superior to bulk vitrification. A recently published DOE report indicates that a second LAW Vitrification Facility would be preferable.

<u>Cast Stone and Steam Reforming Options:</u>

Ecology is not supportive of alternatives that consider supplemental treatment methods that are not vitrification. This issue was addressed during the *State of Washington v. Chu* settlement negotiations and resolved with a series of target milestones, to become enforceable after the 2015 TPA negotiations on supplemental treatment, which dictate the schedule for a "Supplemental Treatment Vitrification Facility" (see TPA Milestones M-62-31-T01 through M-62-34-T01 and Milestone M-62-45). Specifically related to the cast stone (grout) and steam reforming alternatives, Ecology has waste form performance and technical concerns. From a technical standpoint, the waste treatment processes of steam reforming and cast stone would not provide adequate primary-waste forms for disposal of tank waste in onsite landfills. This has been the subject of a previous DOE down-select process, in which Ecology and other participants rated these treatment technologies as low in performance. This final EIS shows that the waste form performance of both cast stone and steam reforming would be inadequate. These alternatives do not merit any further review.

Specifically related to the steam reforming alternative, Ecology has technical concerns about the *Draft* and *Final TC & WM EIS* assumptions regarding contaminant partitioning and its effects on waste form performance. Additionally, recent testing (2009 to 2011) on steam reforming development has shown that the technology readiness is very low, the mass balance cannot be closed, cost savings assumptions have evaporated, and waste performance is still undetermined. In addition, there have been operational off-normal events in 2012 in an Idaho steam reforming plant that raise many operations and safety questions. DOE should not include steam reforming as part of the Preferred Alternative and no further studies are warranted.

Washington State is particularly concerned with the recent re-emergence of cast stone or grout as the favored choice for treating LAW. Because this re-emergence coincides with the vague-language change about a preferred alternative for supplemental treatment in this *TC & WM EIS*, Ecology would like to recap the important history of grouting tank waste at Hanford.

For the past two decades, the citizens of the Northwest have vigorously opposed grouting LAW. Their concerns included waste form performance and the increased waste volume (twice as much as ILAW glass) that would create increased disposal needs and associated costs.

Important information on grout and cast stone waste form performance history includes the following:

- The Hanford Waste Task Force, a stakeholder advisory group, concluded that "grout doesn't adequately protect public, workers, and environment" and that "reduction of waste volume was an issue for grout" because grout increases final-waste-form volume significantly. (*Final Report of the Hanford Waste Task Force, Appendix F*, 1993.)

- DOE's 1995 waste form performance assessment resulted in identification of three constituents that would ultimately violate drinking water standards if grout is used. The three constituents (nitrate, iodine-129, and technetium-99) violated drinking water standards before and after the 10,000-year analysis timeframe. (*Performance Assessment of Grouted Double Shell Tank Waste Disposal at Hanford*, 1995, WHC-SD-WM-EE-004 Rev. 1.)

- The 2003–2006 supplemental treatment down-select showed that cast stone would not be appropriate for LAW treatment because it would significantly impact the groundwater, i.e., above drinking water standards, and would not be "as good as glass." Roy Schepens, Office of River Protection Manager, defined the term "as good as glass" in his letter to Mike Wilson, Ecology (June 12, 2003), as follows:

  > The waste form resulting from treatment must meet the same qualifications of those imposed for the expected glass form produced by the Waste Treatment Plant (WTP). We expect all waste forms produced from any supplemental technology to: (1) perform over the specified time period as well as, or better than WTP vitrified waste; (2) be equally protective of the environment as WTP glass; (3) meet LDR [land disposal restrictions] requirements for hazardous waste constituents; (4) meet or exceed all appropriate performance requirements for glass, including those identified in the WTP contract, Immobilized Low Activity Waste (ILAW) Interface Control Documents, and ILAW Performance Assessment.

- The 2009 *Draft* and 2011 *Preliminary Final TC & WM EIS* indicated that the environmental performance of the grouted waste form would not meet required standards and that grout actually performed the worst of all the supplemental treatment options considered.

- In 2012, the U.S. Nuclear Regulatory Commission (NRC) issued a report, *Technical Evaluation Report for the Revised Performance Assessment for the Saltstone Disposal Facility at the Savannah River Site, South Carolina*, exposing issues related to long-term performance of the resulting waste form.

Based on this history and the results of this *Final TC & WM EIS*, no further consideration of grout or cast stone is warranted.

Cost Comparisons:

We believe that credible cost comparisons have been made in a number of documents and that all current data, including that in this EIS, do not demonstrate marked cost reductions, nor have our experiences with other technologies (bulk vitrification) at Hanford demonstrated significant cost reductions. The cost information is included in the following:

- In the mid-1990s, recognizing the broad-based public concern about grout and the potential for LAW vitrification at costs that appeared similar to those for grout on a grand scale, Washington State opted for vitrification when negotiating a new set of milestones for tank waste treatment. In return, Washington agreed to DOE's desire to delay construction of the Hanford Waste Vitrification Plant [the treatment plant prior to the WTP] for budgetary reasons and other DOE sites competing for the same resources.

- DOE's 2003 report, *Assessment of Low-Activity Waste (LAW) Treatment and Disposal Scenarios for the River Protection Project (RPP)*, did not show a favorable grout waste treatment cost estimate.

- DOE's 2007 report, *Hanford River Protection Project Low Activity Waste Treatment: A Business Case Evaluation*, examined the cost and viability of implementing cast stone, bulk vitrification, and steam reforming waste treatment. The report stated that "cost differences between Business Cases 2 through 7 are unlikely to be the major factor in selecting a supplemental LAW technology."

  In the report, all the technologies were cost neutral when compared to each other and to ILAW glass. The report went on to comment on the added time and cost that would be required to bring the supplemental technologies up to the technology readiness level of ILAW glass.

- The 2009 *Draft* and 2011 *Preliminary Final TC & WM EIS*, which have gone through extensive DOE and external review, indicate that the costs are relatively equivalent for ILAW glass and grouted LAW approaches.

<u>Summary of Important History of Tank Waste Treatment:</u>

This summary provides select relevant history on issues related to Hanford tank waste treatment that should be considered before the *TC & WM EIS* decision on supplemental treatment is finalized in the ROD.

- The 1996 *TWRS EIS*, which Ecology coauthored with DOE, resulted in a ROD that committed to some important actions, including the following:

  – Treating all of the tank waste

  – Pretreating and separating the tank waste so that some of the tank HLW can be disposed of in a near-surface landfill, while the remainder is disposed of in a deep geologic repository

  – Vitrifying the pretreated LAW portion prior to near-surface disposal and vitrifying the HLW portion for deep geologic disposal

  – Removing all of the retrievable waste out of the tanks

  Because the *TWRS EIS* ROD will be superseded by the *TC & WM EIS* ROD, it is important to the State of Washington that DOE stand by its commitments to these actions.

- In 1997, NRC issued a determination that a portion of Hanford tank waste could be considered waste incidental to reprocessing and, therefore, could be disposed of in a near-surface landfill. The tank waste treatment system for 177 tanks included the following:

  – Solids leaching, complexant destruction, liquid–solids separation, and cesium ion exchange to separate tank waste into HLW and incidental waste fractions

  – Vitrification (glass) for treatment and disposal of the incidental waste fraction

  NRC stated that the determination of the proposed LAW fraction as incidental waste is a provisional agreement. If the Hanford tank waste is not managed using a program comparable to the technical basis analyzed in the reference letter, NRC must revisit the waste determination (Paperiello [1997], NRC, to J. Kinzer, DOE). Changing the methods of pretreatment, the near-surface disposal location, or the form of treatment for LAW from vitrification to something new would invalidate the incidental waste determination, and a new analysis would be necessary.

- Between 2003 and 2006, Washington State agreed to allow DOE to consider alternative supplemental treatment approaches as long as they performed "as good as glass." DOE stated that its goal was to identify alternative approaches that were faster and cheaper, but still performed just as well as glass. This effort examined many different technologies; however, in the end, no viable approaches have been identified.

- In the Consent Decree settlement that resolved *State of Washington v. Chu*, Civil No. 2:08-cv-05085-FVS, we agreed to the following:

  - A delay in the end of tank waste treatment from 2028 to no later than 2047
  - A delay in final waste removal from SSTs from 2018 to no later than 2040
  - A schedule for supplemental treatment to be online by 2022

  As outlined above, the State of Washington asserts that the milestones resulting from these negotiations dictate that supplemental treatment be some form of vitrification.

Secondary Waste from Tank Waste Treatment

This *Final TC & WM EIS* evaluates the impacts of disposing of secondary waste that would result from tank waste treatment. Ecology agrees with DOE that secondary waste from the WTP and from supplemental treatment operations will need additional mitigation before disposal. This assumption is not reflected in (and, in fact, is contradicted by) the current DOE baseline, which does not identify additional mitigation.

The new mitigation section in this final EIS outlines the requirement for treatment standards for the secondary waste. This was an important addition to this EIS. Chapter 7, Section 7.5.2.8, and Appendix M, Section M.5.7.5, discuss a number of options for improving grout performance for secondary waste. At an infiltration rate of 3.5 millimeters per year, lowering the diffusivity for grout by two orders of magnitude (i.e., from 1×10^{-10} to 1×10^{-12} square centimeters per second) would decrease the contribution of Effluent Treatment Facility–generated secondary waste by a factor of 100, thus deleting this waste from the list of dominant contributors to risk.

DOE has not determined what the secondary-waste treatment would be, but DOE and its contractor are evaluating various treatment options. These treatment options should meet at least the performance standard (1×10^{-12} square centimeters per second) identified in this final EIS. This will have to be refined and verified through the risk budget tool mitigation measures required in the IDF permit.

Tank Waste Treatment Flowsheet

In preparing this *Final TC & WM EIS*, some assumptions were made about highly technical issues, such as the tank waste treatment flowsheet, which is a representation of how much of which constituent would end up in which waste form and in what amount.

Certain constituents, such as technetium-99 and iodine-129, are significant risk drivers because they are mobile in the environment and have long half-lives. This final EIS assumes that 20 percent of the iodine-129 from the tank waste would end up in vitrified glass and 80 percent in the grouted secondary waste. The same assumption was made for bulk vitrification glass and the WTP LAW Vitrification Facility waste glass.

Based on review of the *Final TC & WM EIS* contaminant flowsheets for the WTP and bulk vitrification, Ecology has technical concerns with this approach. The design configuration for the WTP indicates that iodine-129 recycles past the melter multiple times, which leads to a higher retention in the glass and less in the secondary waste. Therefore, Ecology believes the retention rate of iodine-129 in the ILAW glass may be higher than that in the bulk vitrification glass. However, Ecology is aware that there is uncertainty in the actual glass retention results.

Through our cooperating agency interactions, DOE agreed to run a sensitivity analysis to show the information under a different approach. The sensitivity analysis in this *Final TC & WM EIS* shows that if recycling of iodine-129 is as effective as the WTP flowsheets indicate, then the WTP with a Bulk Vitrification Facility alternative would place 80 percent of iodine-129 in secondary waste (a less robust waste form). This can be compared to an alternative that includes a second LAW Vitrification Facility in addition to the WTP, which would place 30 percent of the iodine-129 in secondary waste. This 50 percent difference in capture reinforces Ecology's opinion that choosing Tank Closure Alternative 2B, which would use the WTP and a second LAW Vitrification Facility, would be most protective from a tank waste treatment perspective. This is one more reason that Ecology is supportive of Alternative 2B as the Preferred Alternative.

One key treatment mitigation identified in this final EIS is that both WTP and supplemental treatment must include recycle of key contaminants through the melter systems to maximize the retention of these constituents into the most robust waste forms.

Waste Release

This *Final TC & WM EIS* models contaminant releases from several different types of final waste forms, including the following:

- ILAW glass
- LAW melters (retired and failed)
- Waste in bulk vitrification boxes
- Steam reformed waste
- Grouted LAW from tank waste
- Grouted secondary waste
- Waste left in waste sites
- Grouted waste in the bottom of tanks
- Waste buried directly in landfills
- Waste that has been macroencapsulate

Ecology understands the methods and formulas used for the waste form release calculations (for all waste types). After reviewing the analysis approaches and contaminant release results for the waste forms identified above, Ecology agrees with most of the approaches used. The one area where Ecology has concerns is the steam reforming waste form release rates. Based on the limited test data available, the results in this final EIS may overestimate the contaminant retention in the steam reforming waste form.

Offsite Waste

DOE is decades behind its legal schedule in retrieving tank waste from the SSTs and years behind its legal schedule in completing construction of the WTP. DOE has not even begun treating Hanford's 207 million liters (54.6 million gallons) of tank waste.

Ecology is concerned about DOE maintaining its legal schedule for contact-handled TRU waste shipments for disposal at WIPP. Additionally, it is essential that DOE proceed with planning and development of a remote-handled TRU waste facility.

Large areas of Hanford's soil and groundwater are contaminated, and many of these areas will likely remain contaminated for generations to come, even after final cleanup remedies have been instituted.

In light of the current issues associated with a deep geologic disposal facility and DOE's attempt to terminate the Yucca Mountain program, it is unclear when close to 60 percent of the nation's HLW and more than 90 percent of the nation's defense-related SNF will leave the state of Washington.

Washington State is aware that, under DOE's plans, more curies of radioactivity would leave Hanford (in the form of vitrified HLW and processed TRU waste) than would be added to Hanford through proposed offsite-waste disposal. However, based on the current lack of waste movement from Hanford, the current state of Hanford's cleanup, and the analysis in this *Final TC & WM EIS*, Washington objects to the disposal at Hanford of additional wastes that have been generated from beyond Hanford.

As the *Draft* and *Final TC & WM EIS*s show, disposal at Hanford of the proposed offsite waste would significantly increase groundwater impacts to beyond acceptable levels. Such disposal would add to the risk term at Hanford today, at a time when progress on reducing the bulk of Hanford's existing risk term has yet to be realized. DOE should take a conservative approach to ensure that the impact of proposed offsite-waste disposal, when added to other existing Hanford risks, does not result in exceeding the "reasonable expectation" standard of DOE's own performance objectives (DOE Manual 435.1-1, Section IV.P(1)) and of other environmental standards (e.g., drinking water standards). The additional analysis in this *Final TC & WM EIS*, including the mitigation section, clearly indicates that eliminating offsite-waste disposal at Hanford is the only environmentally appropriate action.

Washington State supports a "no offsite-waste disposal" alternative as the Preferred Alternative in this *Final TC & WM EIS*, to be adopted in a ROD. DOE should forgo offsite-waste disposal at Hanford (subject to the exceptions in the current *State of Washington v. Bodman* Settlement Agreement).

Waste Disposal Location Alternatives

Ecology agrees with DOE that a preferred alternative utilizing IDF-East appears better for long-term disposal of waste than locating the IDF in the 200-West Area (IDF-West) because of the faster rate of groundwater flow in the 200-East Area.

Climate Change

Additional qualitative discussion of the potential effects of climate change on human health, erosion, water resources, air quality, ecological resources, and environmental justice has been added to Chapter 6 of this final EIS. Additional discussion of the types of regional climate change that could be expected has also been added to Chapter 6, Section 6.5.2, Global Climate Change. Appendix V has also been expanded. In the *Draft TC & WM EIS*, Appendix V focused on the potential impacts of a rising water table from a proposed Black Rock Reservoir. Following the retraction of this proposal, the focus of Appendix V was changed to analysis of potential impacts of infiltration increases resulting from climate change under three different scenarios.

Vadose Zone Modeling

This *Final TC & WM EIS* uses the STOMP [Subsurface Transport Over Multiple Phases] modeling code for vadose zone modeling. Based on its current review, Ecology believes that the Hanford parameters used with this code are adequate for the purposes served by this EIS. Ecology notes that the *TC & WM EIS* STOMP modeling code parameters are based on a regional scale and may need to be adjusted for site-specific closure decisions or other Hanford assessments. Use of STOMP in other assessments requires careful technical review and consideration of site-specific parameters. Ecology supports the process that DOE used for the Waste Management Area C performance assessment workshops in determining appropriate site-specific parameters. These workshops included a broad level of participation with other agencies, tribal nations, and stakeholders.

Risk Assessment and Cumulative Impacts

This *Final TC & WM EIS* evaluates risk under the alternatives and in the cumulative impact analyses. The risk assessment modeling presented in this final EIS should not be interpreted as a Hanford sitewide comprehensive human health and ecological risk assessment, applied to the river corridor or other specific

Hanford areas. Specific Hanford areas will require unique site parameters that are applicable to that area's specific use.

This *Final TC & WM EIS* presents an evaluation of the cumulative environmental impacts of treatment and disposal of wastes at Hanford. The cumulative impact analyses allow DOE to consider the impacts of all cleanup actions it has taken or plans to take at Hanford.

Cumulative Risk Evaluation Tool

This *Final TC & WM EIS* indicates that Hanford's Central Plateau remediation is going to be a difficult balancing of the risks from many contamination sources. This final EIS also points out the need to make cleanup and mitigation decisions with the cumulative impacts in mind and not in isolation. It is clear from reading this EIS that contamination source remediation across the Central Plateau will have to be gauged against a tool that evaluates cumulative risks as they are determined. Another DOE document, *Status of Hanford Site Risk Assessment Integration, FY2005* (DOE/RL-2005-37), stated that the groundwater and the Columbia River are natural accumulation points for impacts from multiple sources. A comprehensive risk assessment capability is necessary to address the cumulative impacts on these resources. The proposed acceptable risk left in an individual site will have to be evaluated against such a cumulative evaluation tool prior to making final decisions. For this and other reasons, a significantly detailed mitigation action plan is required by this NEPA process. From the standpoint of SEPA, the plan will have to point to requirements in the TPA to drive the required mitigation actions and their integration. Ecology will work with DOE to incorporate new TPA requirements to accomplish the following:

- Comprehensively and transparently transfer the working files, vadose zone and groundwater modeling framework, and quality assurance and quality control requirements to the appropriate site contractor and responsible DOE agent to serve as the basis for all future modeling.
- Develop a work plan for continuing this modeling for the purpose of making overall Central Plateau risk decisions and site-specific remedial decisions.
- Identify a gap analysis to highlight areas that are currently not being addressed by a risk evaluation.
- Develop a Central Plateau cumulative risk evaluation tool.
- Develop site-specific risk assessments that are integrated with the Central Plateau cumulative risk evaluation tool.

Without these requirements and implementation of such future risk evaluation tools, future Hanford remediation has the potential to be random at best and not protective, as well as, in some places, to re-contaminate groundwater and vadose zone areas that have been remediated.

VII. Noteworthy Areas of Agreement

Ecology and DOE have discussed and reached agreement on the following significant issues and parameters for the purposes of this *Final TC & WM EIS*:

- Tank waste must be retrieved from tanks and immobilized.
- Secondary waste will need to be mitigated in waste forms that are more protective than grout to provide adequate protection.
- The best location for the IDF is in the 200-East Area.

- Waste from the tanks needs to be removed to the maximum extent possible.
- In many cases, vadose zone contamination under the tank farms will have to be mitigated to be protective of the groundwater and the Columbia River.
- Remediation of problematic soil contamination in the Central Plateau will be needed to limit further groundwater impacts; this would include development of vadose zone remediation methods.
- Eliminating or limiting offsite waste disposal at Hanford is the only legitimate approach.
- The manner in which DOE presents groundwater data and information (i.e., with graphics).
- The quality assurance requirements that DOE and Ecology identified in the *State of Washington v. Bodman* Settlement Agreement.
- The *Technical Guidance Document for Tank Closure Environmental Impact Statement Vadose Zone and Groundwater Revised Analyses* agreement, which focused on parameters shown to be important in groundwater analysis.
- The location of calculation points for contaminant concentrations in groundwater.
- The use of tank farm closure descriptions and alternatives analysis.
- The use of tank waste treatment descriptions and alternatives analysis.
- Inclusion of the US Ecology Commercial LLW Radioactive Waste Disposal Site and the cocooned reactors transported to the Central Plateau in the comprehensive cumulative impacts assessment.
- Overall modeling approaches for vadose zone and groundwater.
- The use of modeling assumptions for the double-shell tanks.
- Alternatives assumptions about how processes would treat existing wastes and generate other wastes during treatment processes, and how DOE would dispose of all of the wastes.
- The methods for evaluating and using waste inventory data.
- Release mechanisms for contaminants from various waste forms.
- An alternative in this *Final TC & WM EIS* that evaluates the impacts of treating and disposing of all tank waste and residue to meet the RCRA/Hazardous Waste Management Act HLW treatment standard of vitrification.
- The inventory assumptions used for the pre-1970 burial grounds.

Ecology's agreement on these issues and parameters is specifically for the purposes of this *Final TC & WM EIS* and is based on Ecology's current knowledge and best professional judgment.

Final Tank Closure and Waste Management Environmental Impact Statement for the Hanford Site, Richland, Washington (Final TC & WM EIS)

U.S. Environmental Protection Agency (EPA), Region 10 Foreword

After receiving the EPA comments on the *Draft TC & WM EIS*, the U.S. Department of Energy (DOE) wrote to the EPA, inviting the EPA to be a cooperating agency in the development of this *Final TC & WM EIS*. The two agencies signed a memorandum of understanding (MOU) in April 2011 to formalize the EPA's involvement as a cooperating agency and to define each agency's roles and responsibilities in the preparation of this final EIS. Prior to entering into the MOU, the EPA participated in two meetings organized by DOE, in April and October of 2010, to discuss the EPA's comments on the draft EIS and DOE's preliminary plans to address them.

The EPA was not involved in the development of the preliminary final EIS beyond the April and October 2010 meetings. When preliminary final EIS documents were released for review in August 2011, the limited timeframes for review necessitated our focused review on DOE's draft responses to the EPA's draft EIS comments and issues that the EPA considered important to address in this final EIS. This Foreword, therefore, reflects only a limited review of the preliminary and draft final EIS documents. Based on our limited review, the EPA has the following concerns regarding this *Final TC & WM EIS*:

Tank Closure and Waste Management

The EPA notes that the results of analyses of all Tank Closure alternatives in the preliminary and draft final EISs, including DOE's Preferred Alternative for tank closure, Tank Closure Alternative 2B, predict sustained release of contaminants to the environment, particularly to the vadose zone and to groundwater within the EIS analysis area. While we recognize the technical challenges associated with analyzing and addressing this problem, and that there are multiple sources of contaminants over time, we remain concerned about the potential impacts of sustained contaminant release to the vadose zone in the study area and migration to groundwater. We understand that the models used in this EIS to analyze impacts were developed in a process that included peer review. However, present and future users of the models should be aware of any limitations of the models, and assumptions employed in these analyses. We agree with statements in the preliminary and draft final EISs stating that, "these models are complex and rely on assumptions that are subject to a large degree of uncertainty…." At present, we collectively do not have enough information to accurately predict how various contaminants migrate through soils and groundwater, nor when peak groundwater impacts will occur. However, the best site-specific data should be incorporated into the assumptions, especially when the models are being used to inform site-specific decisions.

The EPA will continue to coordinate with DOE and the Washington State Department of Ecology (Ecology) to address contamination issues through our relevant authorities under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA); Resource Conservation and Recovery Act (RCRA); and Hanford Federal Facility Agreement and Consent Order, also known as the Tri-Party Agreement (TPA). The TPA currently identifies groundwater in the study area as an operable unit, which will be addressed under CERCLA.

The EPA's comments on the preliminary final EIS addressed the relationship of this EIS to permitting requirements of Ecology's authorized dangerous waste program. We appreciate the changes made to this final EIS in response. The EPA believes that this EIS can serve as a set of bounding analyses reasonably expected to reflect the environmental performance requirements that Ecology may establish through the permitting process. In this context, the EPA would support an approach to tank closure that includes landfill and clean closure components analyzed in this EIS. The EPA will continue to work closely with Ecology in support of that agency's authorized dangerous waste permitting program.

Secondary- and Offsite-Waste Disposal

This final EIS indicates that disposal of secondary and offsite waste on site at Hanford would continue to show significant impacts of the release of technetium-99 into the vadose zone and groundwater. To prevent additional contamination of the vadose zone and groundwater from such disposal, DOE will need to establish waste acceptance criteria and appropriate treatment technologies to reduce or immobilize contaminants in the wastes, primarily technetium-99 and iodine-129. For example, the steam reforming waste performance is still associated with a high degree of uncertainty, suggesting that steam reforming technology remains immature and requires more improvements. Similarly, iodine-129 is very volatile and cannot be easily converted to immobilized low-activity waste glass.

Next Steps

The EPA's role and responsibilities as a cooperating agency in the development of this final EIS are distinct from its obligations under the National Environmental Policy Act (NEPA) and Section 309 of the Clean Air Act, which require the EPA to review and comment in writing on the environmental impacts of major Federal actions, including actions that are the subject of draft and final EISs under NEPA. The EPA intends to carry out this independent authority in a review of the publicly released version of this final EIS. In addition, the EPA's role as a cooperating agency is separate from, and not intended to duplicate or replace the EPA's regulatory roles, including those under RCRA, CERCLA, and the TPA. We will continue to carry out these responsibilities in coordination with other agencies as appropriate.

Final Tank Closure and Waste Management Environmental Impact Statement for the Hanford Site, Richland, Washington (Final TC & WM EIS)

U.S. Department of Energy (DOE) Foreword

DOE appreciates the efforts of the Washington State Department of Ecology (Ecology) and the U.S. Environmental Protection Agency (EPA), Region 10, which participated as cooperating agencies in the preparation of this *TC & WM EIS*. Although each had different roles as cooperating agencies, their involvement improved the quality of the National Environmental Policy Act (NEPA) process for this environmental impact statement (EIS).

Ecology began participating in the EIS development as a cooperating agency in 2002 and reconfirmed their participation in 2006 after signing the January 6, 2006, Settlement Agreement (*State of Washington v. Bodman*, Civil No. 2:03-cv-05018-AAM) (subsequently amended on June 5, 2008) ending litigation on the January 2004 *Final Hanford Site Solid (Radioactive and Hazardous) Waste Program Environmental Impact Statement, Richland, Washington*. Ecology's participation as a cooperating agency was important, among other things, to ensure that this *TC & WM EIS* meets Washington State Environmental Policy Act (SEPA) requirements. As a result of the 2006 Settlement Agreement, Ecology accepted additional responsibilities under a concurrent revised Memorandum of Understanding (MOU) to conduct quality assurance reviews of the groundwater and other technical analyses. Ecology also independently ran the models used in this EIS and verified DOE's results. Ecology's role as a cooperating agency supporting SEPA requirements is different from its role under the Hanford Federal Facility Agreement and Consent Order (also known as the Tri-Party Agreement [TPA]) or its role in implementing Washington State's Hazardous Waste Program at the Hanford Site. More-detailed information on Ecology's role can be found in the cooperating agency agreements in Appendix C, Section C.1.1, of this *Final TC & WM EIS*.

DOE appreciates Ecology's support in the development of this EIS and its participation in all the scoping meetings, public hearings on the *Draft TC & WM EIS*, and stakeholder interactions, as well as its support of the EIS schedule. This EIS is needed to support NEPA and SEPA decisions related to the TPA and 2010 Consent Decree (*State of Washington v. Chu*, Civil No. 2:08-cv-05085-FVS) milestone commitments. DOE also appreciates the efforts made by Ecology to understand the inventory, input assumptions, modeling results, and uncertainty analyses and to conduct the quality assurance reviews, contribute to analysis development, assist in presentation of analyses, and participate jointly in public involvement activities. Ecology has expressed both substantial areas of agreement and some areas of disagreement with DOE's Preferred Alternative selections in its foreword to this *Final TC & WM EIS*, consistent with the opportunity afforded to them under the provisions of the *TC & WM EIS* MOU between Ecology and DOE. For its part, DOE understands the state's perspective and will continue to work with them on the path forward at the Hanford Site.

Ecology's comments on the draft EIS can be found in the Comment-Response Document (CRD) (Volume 3 of this final EIS), Section 3, commentor number 498. Ecology and DOE have identified the need for additional secondary-waste-form development (see Chapter 7, Section 7.5.2.8, and Appendix M, Section M.5.7.5). Ecology has also focused on closure of the single-shell tanks; specifically, in Waste Management Area C. More-detailed information on Ecology's permitting process in relation to the NEPA actions can be found in Section 7.1.

DOE invited EPA to be a cooperating agency in 2002 and to participate in model development in 2006 after the January 6, 2006, Settlement Agreement was signed. EPA was not able to participate as a cooperating agency until 2010. Information on EPA's role as a cooperating agency can be found in Appendix C, Section C.1.2.

EPA's comments on the draft EIS as part of their responsibility under Section 309 of the Clean Air Act and DOE's responses can be found in the CRD, Section 3, commentor number 509, of this final EIS. DOE has made changes to this final EIS as a result of EPA's specific comments. EPA's foreword to this EIS indicates a limited timeframe for review of this final EIS. DOE appreciates EPA's focus on DOE's responses to their comments on the draft EIS.

EPA expressed concern regarding the impacts of sustained releases under Tank Closure Alternative 2B. To address this concern, DOE has added information regarding Alternative 2B to Chapter 5, Section 5.1.1.3.4, showing the potential impacts when discharges from the CERCLA [Comprehensive Environmental Response, Compensation, and Liability Act] cribs and trenches (ditches) are excluded. This was done to more clearly show the impacts of the proposed actions separate from the impacts attributed to the adjacent CERCLA cribs and trenches (ditches). For example, Figure 5–87 shows the hydrogen-3 (tritium) results under Tank Closure Alternative 2B, Case 3 (Case 3 excludes cribs and trenches [ditches]), indicating that the tritium concentrations peak two to four orders of magnitude below the benchmark in this case, which highlights that the primary concentration of tritium originates from discharges to cribs and trenches (ditches). In addition, the CRD, Section 2.7, discusses impacts of alternatives based on whether a proposed action being evaluated has occurred, and how mitigation strategies and environmental compliance vary based on those factors.

EPA had comments regarding the EIS modeling that was developed as an outcome of the 2006 Settlement Agreement. DOE believes that its detailed responses to EPA's comments on this specific issue address this EPA concern. EPA also expressed concern about DOE's disclosure of uncertainty relative to future use of the model. DOE believes that discussion of uncertainty, comparison of model results to field data, and disclosure of data and model limitations are important aspects of the analysis presented in this final EIS, as required under NEPA. More-specific discussion on this point can be found in the CRD, Section 2.4. In addition, the groundwater model development process was reviewed by a Technical Review Group (TRG). The TRG was formed to evaluate conversion of the groundwater model from previous models used on site (see the Summary, Section S.1.4.1, and Chapter 1, Section 1.6.1.2). For more information, the report titled *MODFLOW Flow-Field Development: Technical Review Group Process and Results Report*, dated November 2007, can be found on the *TC & WM EIS* website at http://www.hanford.gov/index.cfm?page =1117&.

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List of Acronyms and Abbreviations

CEQ	Council on Environmental Quality
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CWC	Central Waste Complex
DOE	U.S. Department of Energy
DST	double-shell tank
Ecology	Washington State Department of Ecology
EIS	environmental impact statement
FFTF	Fast Flux Test Facility
Hanford	Hanford Site
HLW	high-level radioactive waste
IDF	Integrated Disposal Facility
IDF-East	200-East Area Integrated Disposal Facility
IDF-West	200-West Area Integrated Disposal Facility
IHLW	immobilized high-level radioactive waste
ILAW	immobilized low-activity waste
INL	Idaho National Laboratory
INTEC	Idaho Nuclear Technology and Engineering Center
LAW	low-activity waste
LLBG	low-level radioactive waste burial ground
LLW	low-level radioactive waste
MFC	Materials and Fuels Complex
MLLW	mixed low-level radioactive waste
NEPA	National Environmental Policy Act
PPA	Property Protected Area
PPF	Preprocessing Facility
RCB	Reactor Containment Building
RCRA	Resource Conservation and Recovery Act
RH-SC	remote-handled special component
RPPDF	River Protection Project Disposal Facility
SST	single-shell tank
TC & WM EIS	*Tank Closure and Waste Management Environmental Impact Statement for the Hanford Site, Richland, Washington*
TMC	theoretical maximum capacity
TPA	Hanford Federal Facility Agreement and Consent Order (Tri-Party Agreement)
TRU	transuranic
TWRS EIS	*Tank Waste Remediation System, Hanford Site, Richland, Washington, Final Environmental Impact Statement*
WESF	Waste Encapsulation and Storage Facility
WIPP	Waste Isolation Pilot Plant
WRAP	Waste Receiving and Processing Facility
WRF	waste receiver facility
WTP	Waste Treatment Plant

Final Tank Closure and Waste Management Environmental Impact Statement for the Hanford Site, Richland, Washington

READER'S GUIDE

INTRODUCTION

This Reader's Guide serves as an introduction and guide to the contents of the U.S. Department of Energy's (DOE's) *Tank Closure and Waste Management Environmental Impact Statement for the Hanford Site, Richland, Washington (TC & WM EIS)* to highlight the key features of the reasonable alternatives and to help readers review the technical analyses presented in this environmental impact statement (EIS). Included here are descriptions of the proposed actions; the scope of this EIS; the alternatives evaluated; and the organization of this EIS itself. Readers are encouraged to use this guide to assist them in navigating through the complex information presented in this *TC & WM EIS*.

DOE prepared this *TC & WM EIS* to evaluate the potential environmental impacts of storing, retrieving, treating, and disposing of the waste generated during defense-related nuclear research, development, and weapons production activities at the Hanford Site (Hanford) in Washington State. This waste inventory of about 207 million liters (54.6 million gallons) of mixed radioactive and chemically hazardous waste, stored in 177 large and 61 smaller underground storage tanks, presents a major source of potential public health and environmental risk. DOE proposes to reduce this risk by updating its waste storage methodology and retrieving, treating, and disposing of key elements of this waste inventory. This *TC & WM EIS* revises and updates the analyses of the *Tank Waste Remediation System, Hanford Site, Richland, Washington, Final Environmental Impact Statement (TWRS EIS)* (DOE and Ecology 1996) and subsequent supplement analyses (DOE 1997, 1998, 2001), which addressed retrieval, treatment, and disposal of the tank waste, by also evaluating the impacts of different scenarios for final closure of the single-shell tank (SST) system.

In addition, this *TC & WM EIS* evaluates the potential environmental impacts of proposed activities to decommission the Fast Flux Test Facility (FFTF), a nuclear test reactor, and associated auxiliary facilities at Hanford, including management of waste generated by the decommissioning process (such as certain waste designated as remote-handled special components [RH-SCs]) and disposition of Hanford's inventory of radioactively contaminated bulk sodium from FFTF and other onsite facilities.

Finally, this *TC & WM EIS* evaluates the potential environmental impacts of ongoing solid waste management operations at Hanford, as well as the proposed disposal of Hanford low-level radioactive waste (LLW) and mixed low-level radioactive waste (MLLW) and a limited volume of LLW and MLLW from other DOE sites in an Integrated Disposal Facility(ies) (IDF) located at Hanford.

This *TC & WM EIS* describes the potential environmental impacts and relative cost consequences of the proposed actions and reasonable alternatives for the major activities discussed above. This *TC & WM EIS* was prepared in accordance with the National Environmental Policy Act (NEPA) of 1969, as amended (42 U.S.C. 4321 et seq.); DOE implementing procedures for NEPA (10 CFR 1021 and DOE Order 451.1B); and Council on Environmental Quality (CEQ) "Regulations for Implementing the Procedural Provisions of NEPA" (40 CFR 1500–1508). Further, this *TC & WM EIS* implements DOE's January 6, 2006, Settlement Agreement with the State of Washington (as amended on June 5, 2008), signed by DOE, the Washington State Department of Ecology (Ecology), the Washington State Attorney General's Office, and the U.S. Department of Justice. The agreement settles NEPA claims made in the case *State of Washington v. Bodman* (Civil No. 2:03-cv-05018-AAM), which addressed the January 2004 *Final Hanford Site Solid (Radioactive and Hazardous) Waste Program Environmental Impact Statement, Richland, Washington* (DOE 2004). Ecology is participating in this NEPA activity as a cooperating agency; as such, it is responsible for reviewing the content of this *TC & WM EIS* under authority of Washington's State Environmental Policy Act (RCW 43.21C) to ensure it satisfies the State of Washington's requirements and supports its proposed action to issue permits under its hazardous waste program. The information provided in this EIS will be considered, along with other pertinent information, in the decision process for DOE's proposed actions. Since publication of the *Draft TC & WM EIS*, the U.S. Environmental Protection Agency began participation in this NEPA activity as a cooperating agency in May 2010 (DOE and EPA 2011).

Figure 1 is a simplified process flow diagram displaying the general flow of waste from the SSTs and double-shell tanks (DSTs) at Hanford through the proposed alternative treatment, interim storage, and disposal options. For the reader's ease, the flow diagram does not reflect a single alternative or set of alternatives; instead, the diagram displays all of the options that were analyzed under the 17 proposed alternatives (11 for tank closure, 3 for FFTF decommissioning, and 3 for waste management). A distinction between current and proposed facilities is also made in Figure 1 to assist the reader in understanding which capabilities currently exist and which proposed additional capabilities were analyzed.

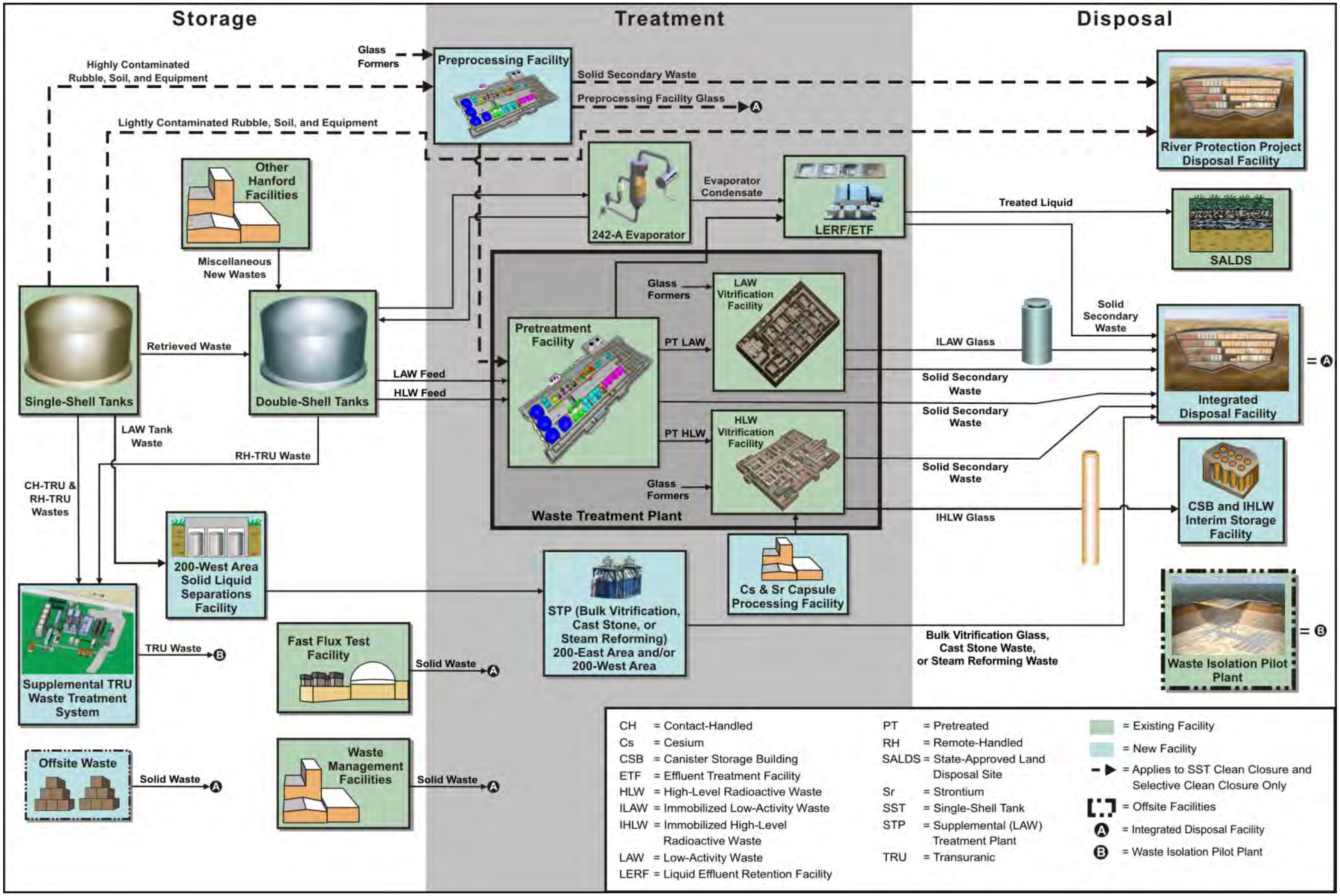

Figure 1. Simplified Process Flow Diagram

ALTERNATIVES

The following sections present the alternatives analyzed in this *TC & WM EIS*. More-detailed discussions of the alternatives are provided in Chapters 1 and 2 of this EIS.

> **Revisions to the Draft Environmental Impact Statement (EIS)**
>
> Sidebars, which are vertical lines in the margin, in this final EIS identify revisions made to the draft EIS in response to comments, revised information, or updates. Sidebars are not used to identify editorial changes.

TANK CLOSURE

In developing the alternatives analyzed in this *TC & WM EIS*, DOE emphasized the inclusion of all reasonable waste storage, retrieval, treatment, disposal, and tank closure components that could be selected. The goal was to give the public and decisionmakers sufficient information about each candidate component and allow maximum flexibility in selecting the technologies, methods, time periods, and locations of the treatment and closure activities. The alternatives described in this section and evaluated in the balance of this EIS are combinations of the treatment and closure decision options under consideration.

> **Dates for Alternatives**
>
> The dates referenced in this environmental impact statement (EIS) for the alternatives were selected to support relationships between, and durations for, activities, thus allowing comparisons of the alternatives. Due to ongoing technical developments and their inherent uncertainties, they do not necessarily represent the current dates. For example, this EIS used a Waste Treatment Plant (WTP) startup date of 2018; the 2010 Consent Decree milestone for WTP startup is 2022. Note that the durations, rather than the startup dates, of the activities evaluated in this EIS are of the most significance. As this EIS evaluates modeling from 1944 through 11,944, the dates provide a reference for past, current, and future activities.

Tank Closure Alternative 1: No Action

In the CEQ's "Forty Most Asked Questions Concerning CEQ's National Environmental Policy Act Regulations" (46 FR 18026), two types of No Action Alternative are described. In one case, work is stopped and impacts are evaluated. In the second case, ongoing activities are evaluated as a "no change" and continuation of the present course of action.

In this EIS, DOE has chosen to show both types of no action. Under this alternative, the work would be stopped and impacts would be evaluated. Under Tank Closure Alternative 2A, DOE would evaluate retrieval from the tanks and treatment through the Waste Treatment Plant (WTP), in accordance with the *TWRS EIS* Record of Decision.

Storage: DOE would continue to store and monitor waste in the SSTs and DSTs for 100 years. Tanks showing signs of deterioration affecting their structural integrity would be filled with grout or gravel as a corrective action or emergency response. The cesium and strontium capsules would remain in storage in the Waste Encapsulation and Storage Facility (WESF).

Retrieval: Waste from the tanks would not be retrieved.

Treatment: No vitrification or treatment capacity would be built after 2008. Ongoing WTP construction would be terminated, and the WTP site would be isolated pending some future use, if any. No immobilized low-activity waste (ILAW) or immobilized high-level radioactive waste (IHLW) would be produced.

Disposal: The waste in the SST and DST systems would remain in the tank farms indefinitely.

Closure: Tank closure would not be addressed under this alternative. DOE would maintain security and management of the site for a 100-year administrative control period (ending in 2107). During this period, DOE would continue to store and conduct routine monitoring of the waste in the SSTs, DSTs, and miscellaneous underground storage tanks.

Tank Closure Alternative 2: Implement the *Tank Waste Remediation System EIS* Record of Decision with Modifications

Tank Closure Alternative 2 would continue to implement the decisions made in the Record of Decision for the *TWRS EIS* and considered in three supplement analyses completed through 2001. Under this alternative, all waste retrieved from the tanks would be vitrified, resulting in either an ILAW or IHLW glass product.

Tank Closure Alternative 2 consists of two subalternatives: (1) Tank Closure Alternative 2A: Existing WTP Vitrification; No Closure and (2) Tank Closure Alternative 2B: Expanded WTP Vitrification; Landfill Closure, as described below.

Tank Closure Alternative 2A: Existing WTP Vitrification; No Closure

Storage: DOE would continue current waste management operations using existing tank storage facilities. Because all of the DSTs will exceed their 40-year design life during the approximate 80-year period of waste retrieval, they would be replaced in a phased manner through 2054.

Retrieval: Using currently available liquid-based waste retrieval and leak detection systems, waste would be retrieved to the goal of the Hanford Federal Facility Agreement and Consent Order, also known as the Tri-Party Agreement (TPA), i.e., residual waste would not exceed 10.2 cubic meters (360 cubic feet) for the 100-series tanks or 0.85 cubic meters (30 cubic feet) for the smaller 200-series tanks, corresponding to 99 percent retrieval (Ecology, EPA, and DOE 1989). This approach would be the same under Tank Closure Alternative 2B.

Treatment: The existing WTP configuration (two high-level radioactive waste [HLW] melters and two low-activity waste [LAW] melters) would operate at a theoretical maximum capacity (TMC) of 6 metric tons of glass IHLW per day and 30 metric tons of glass ILAW per day. Treatment would start in 2018, and both HLW and LAW treatment would end in 2093. All of the waste streams routed to the WTP would be pretreated, although technetium-99 removal would not occur. For analysis purposes, it was assumed that the WTP would need to be replaced after 60 years. No supplemental or transuranic (TRU) waste treatment is proposed. The cesium and strontium capsules would be retrieved from the WESF, de-encapsulated, and treated in the WTP.

Disposal: LAW immobilized via the WTP would be disposed of on site in an IDF. IHLW would be stored on site until disposition decisions are made and implemented. This approach would be the same under Tank Closure Alternative 2B.

Closure: Tank closure would not be addressed under this alternative. For analysis purposes, administrative control of the tank farms would cease following a 100-year period ending in 2193.

Tank Closure Alternative 2B: Expanded WTP Vitrification; Landfill Closure

Storage: DOE would continue current waste management operations using existing tank storage facilities. No new DSTs would be required, but four new waste receiver facilities (WRFs), which are below-grade lag storage and minimal waste treatment facilities, would be constructed.

Retrieval: Using currently available liquid-based waste retrieval and leak detection systems, waste would be retrieved to the TPA goal, i.e., residual waste would not exceed 10.2 cubic meters (360 cubic feet) for the 100-series tanks or 0.85 cubic meters (30 cubic feet) for the smaller 200-series tanks, corresponding to 99 percent retrieval. This approach would be the same under Tank Closure Alternative 2A.

Treatment: The existing WTP configuration (two HLW melters and two LAW melters) would be supplemented with expanded LAW vitrification capacity (an addition of four LAW melters) to provide a vitrification TMC of 6 metric tons of glass IHLW per day and 90 metric tons of glass ILAW per day. Treatment would start in 2018 and end in approximately 2040 (for HLW) and 2043 (for LAW). All of the waste streams routed to the WTP would be pretreated, including technetium-99 removal from the LAW stream. No facilities would need to be replaced. No supplemental or TRU waste treatment is proposed. The cesium and strontium capsules would be retrieved from the WESF, de-encapsulated, and treated in the WTP.

Disposal: LAW immobilized via the WTP would be disposed of on site in an IDF. IHLW would be stored on site until disposition decisions are made and implemented. This approach would be the same under Tank Closure Alternative 2A.

Closure: As operations are completed, the SST system at Hanford would be closed as a Resource Conservation and Recovery Act (RCRA) hazardous waste landfill unit under Section 173-303 of the *Washington Administrative Code* (WAC 173-303), "Dangerous Waste Regulations," and DOE Order 435.1, *Radioactive Waste Management*, as applicable, or it would be decommissioned under DOE Order 430.1B, *Real Property Asset Management*. The tanks and ancillary equipment would be filled with grout to immobilize the residual waste, prevent future tank subsidence, and discourage intruder access. Soil would be removed down to 4.6 meters (15 feet) at the BX and SX tank farms and replaced with clean soil from onsite sources. The removed contaminated soils and ancillary equipment would be disposed of on site in the River Protection Project Disposal Facility (RPPDF), a new facility similar to an IDF. The closed tank systems and six sets of adjacent cribs and trenches (ditches) would be covered with an engineered modified RCRA Subtitle C barrier. Postclosure care would continue for 100 years.

Tank Closure Alternative 3: Existing WTP Vitrification with Supplemental Treatment Technology; Landfill Closure

This alternative consists of three subalternatives: (1) Tank Closure Alternative 3A: Existing WTP Vitrification with Thermal Supplemental Treatment (Bulk Vitrification); Landfill Closure, (2) Tank Closure Alternative 3B: Existing WTP Vitrification with Nonthermal Supplemental Treatment (Cast Stone); Landfill Closure, and (3) Tank Closure Alternative 3C: Existing WTP Vitrification with Thermal Supplemental Treatment (Steam Reforming); Landfill Closure. These subalternatives would involve the use of either thermal or nonthermal treatment technologies to supplement the WTP treatment processes. TRU tank waste would be packaged and interim-stored pending shipment to the Waste Isolation Pilot Plant (WIPP) for disposal.

Tank Closure Alternative 3A: Existing WTP Vitrification with Thermal Supplemental Treatment (Bulk Vitrification); Landfill Closure

Storage: DOE would continue current waste management operations using existing tank storage facilities. No new DSTs would be required, but four new WRFs would be constructed. This approach would be the same under Tank Closure Alternatives 3B and 3C.

Retrieval: Using currently available liquid-based waste retrieval and leak detection systems, waste would be retrieved to the TPA goal, i.e., residual waste would not exceed 10.2 cubic meters (360 cubic feet) for the 100-series tanks or 0.85 cubic meters (30 cubic feet) for the smaller 200-series tanks, corresponding to 99 percent retrieval. This approach would be the same under Tank Closure Alternatives 3B and 3C.

Treatment: The existing WTP configuration (two HLW melters and two LAW melters) would operate at a TMC of 6 metric tons of glass IHLW per day and 30 metric tons of glass ILAW per day. Treatment would start in 2018, and both HLW and LAW treatment would end in approximately 2040. All waste streams routed to the WTP would be pretreated, although technetium-99 removal would not occur as part of WTP pretreatment. WTP capacity would be supplemented with bulk vitrification treatment capacity to immobilize a portion of the LAW. Bulk vitrification supplemental treatment of the LAW would occur in both the 200-East and 200-West Areas. In the 200-East Area, the waste feed would be pretreated in the WTP, excluding technetium-99 removal. In the 200-West Area, the waste feed would be pretreated in a new Solid-Liquid Separations Facility. A separate portion of the tank waste (approximately 11.8 million liters [3.1 million gallons]) would be designated as mixed TRU waste and treated and packaged for disposal at WIPP.[1] The cesium and strontium capsules would be retrieved from the WESF, de-encapsulated, and treated in the WTP.

Disposal: LAW immobilized both via the WTP and external to the WTP would be disposed of on site in an IDF. IHLW would be stored on site until disposition decisions are made and implemented. Mixed TRU waste would be stored on site in a new storage facility, pending disposal at WIPP. This approach would be the same under Tank Closure Alternatives 3B and 3C.

Closure: As operations are completed, the SST system at Hanford would be closed as an RCRA hazardous waste landfill unit under WAC 173-303, "Dangerous Waste Regulations," and DOE Order 435.1, *Radioactive Waste Management*, as applicable, or it would be decommissioned under DOE Order 430.1B, *Real Property Asset Management*. The tanks and ancillary equipment would be filled with grout to immobilize the residual waste, prevent future tank subsidence, and discourage intruder access. Soil would be removed down to 4.6 meters (15 feet) at the BX and SX tank farms and replaced with clean soils from onsite sources. The removed contaminated soils and ancillary equipment would be disposed of on site in the proposed RPPDF. The closed tank systems and six sets of adjacent cribs and trenches (ditches) would be covered with an engineered modified RCRA Subtitle C barrier. Postclosure care would continue for 100 years. This approach would be the same under Tank Closure Alternatives 3B and 3C.

Tank Closure Alternative 3B: Existing WTP Vitrification with Nonthermal Supplemental Treatment (Cast Stone); Landfill Closure

Storage: DOE would continue current waste management operations using existing tank storage facilities. No new DSTs would be required, but four new WRFs would be constructed. This approach would be the same under Tank Closure Alternatives 3A and 3C.

Retrieval: Using currently available liquid-based waste retrieval and leak detection systems, waste would be retrieved to the TPA goal, i.e., residual waste would not exceed 10.2 cubic meters (360 cubic feet) for the 100-series tanks or 0.85 cubic meters (30 cubic feet) for the smaller 200-series tanks, corresponding to 99 percent retrieval. This approach would be the same under Tank Closure Alternatives 3A and 3C.

Treatment: The existing WTP configuration (two HLW melters and two LAW melters) would operate at a TMC of 6 metric tons of glass IHLW per day and 30 metric tons of glass ILAW per day. Treatment would start in 2018, and both HLW and LAW treatment would end in approximately 2040. All waste streams routed to the WTP would be pretreated, including technetium-99 removal from the LAW stream. WTP capacity would be supplemented with cast stone treatment capacity to immobilize a portion of the

[1] DOE believes there may be certain HLW storage tanks that it could demonstrate should be classified as TRU waste based on the origin of the waste. This *TC & WM EIS* evaluates the environmental impacts of managing this waste as TRU waste because it assumes the historical processing data support this classification. For Tank Closure Alternatives 3 through 5, the EIS analyses evaluated treating the waste stream associated with the TRU waste portion as both TRU waste and HLW because this waste has not gone through the TRU waste confirmation and certification process.

LAW. Cast stone supplemental treatment of the LAW would occur in both the 200-East and 200-West Areas. In the 200-East Area, the waste feed would be pretreated in the WTP, including technetium-99 removal. In the 200-West Area, the waste feed would be pretreated in a new Solid-Liquid Separations Facility. A separate portion of the tank waste (approximately 11.8 million liters [3.1 million gallons]) would be designated as mixed TRU waste and packaged for disposal at WIPP. The cesium and strontium capsules would be retrieved from the WESF, de-encapsulated, and treated in the WTP.

Disposal: LAW immobilized both via the WTP and external to the WTP would be disposed of on site in an IDF. IHLW would be stored on site until disposition decisions are made and implemented. Mixed TRU waste would be stored on site in a new storage facility, pending disposal at WIPP. This approach would be the same under Tank Closure Alternatives 3A and 3C.

Closure: As operations are completed, the SST system at Hanford would be closed as an RCRA hazardous waste landfill unit under WAC 173-303, "Dangerous Waste Regulations," and DOE Order 435.1, *Radioactive Waste Management*, as applicable, or it would be decommissioned under DOE Order 430.1B, *Real Property Asset Management*. The tanks and ancillary equipment would be filled with grout to immobilize the residual waste, prevent future tank subsidence, and discourage intruder access. Soil would be removed down to 4.6 meters (15 feet) at the BX and SX tank farms and replaced with clean soils from onsite sources. The removed contaminated soils and ancillary equipment would be disposed of on site in the proposed RPPDF. The closed tank systems and six sets of adjacent cribs and trenches (ditches) would be covered with an engineered modified RCRA Subtitle C barrier. Postclosure care would continue for 100 years. This approach would be the same under Tank Closure Alternatives 3A and 3C.

Tank Closure Alternative 3C: Existing WTP Vitrification with Thermal Supplemental Treatment (Steam Reforming); Landfill Closure

Storage: DOE would continue current waste management operations using existing tank storage facilities. No new DSTs would be required, but four new WRFs would be constructed. This approach would be the same under Tank Closure Alternatives 3A and 3B.

Retrieval: Using currently available liquid-based waste retrieval and leak detection systems, waste would be retrieved to the TPA goal, i.e., residual waste would not exceed 10.2 cubic meters (360 cubic feet) for the 100-series tanks or 0.85 cubic meters (30 cubic feet) for the smaller 200-series tanks, corresponding to 99 percent retrieval. This approach would be the same under Tank Closure Alternatives 3A and 3B.

Treatment: The existing WTP configuration (two HLW melters and two LAW melters) would operate at a TMC of 6 metric tons of glass IHLW per day and 30 metric tons of glass ILAW per day. Treatment would start in 2018, and both HLW and LAW treatment would end in approximately 2040. All waste streams routed to the WTP would be pretreated, although technetium-99 removal would not occur as part of WTP pretreatment. WTP capacity would be supplemented with steam reforming treatment capacity to immobilize a portion of the LAW. The steam reforming supplemental treatment for the LAW would occur in both the 200-East and 200-West Areas. In the 200-East Area, the waste feed would be pretreated in the WTP, excluding technetium-99 removal. In the 200-West Area, the waste feed would be pretreated in a new Solid-Liquid Separations Facility. A separate portion of the tank waste (approximately 11.8 million liters [3.1 million gallons]) would be designated as mixed TRU waste and treated and packaged for disposal at WIPP. The cesium and strontium capsules would be retrieved from the WESF, de-encapsulated, and treated in the WTP.

Disposal: LAW immobilized both via the WTP and external to the WTP would be disposed of on site in an IDF. IHLW would be stored on site until disposition decisions are made and implemented. Mixed TRU waste would be stored on site in a new storage facility, pending disposal at WIPP. This approach would be the same under Tank Closure Alternatives 3A and 3B.

Closure: As operations are completed, the SST system at Hanford would be closed as an RCRA hazardous waste landfill unit under WAC 173-303, "Dangerous Waste Regulations," and DOE Order 435.1, *Radioactive Waste Management*, as applicable, or it would be decommissioned under DOE Order 430.1B, *Real Property Asset Management*. The tanks and ancillary equipment would be filled with grout to immobilize the residual waste, prevent future tank subsidence, and discourage intruder access. Soil would be removed down to 4.6 meters (15 feet) at the BX and SX tank farms and replaced with clean soils from onsite sources. The removed contaminated soils and ancillary equipment would be disposed of on site in the proposed RPPDF. The closed tank systems and six sets of adjacent cribs and trenches (ditches) would be covered with an engineered modified RCRA Subtitle C barrier. Postclosure care would continue for 100 years. This approach would be the same under Tank Closure Alternatives 3A and 3B.

Tank Closure Alternative 4: Existing WTP Vitrification with Supplemental Treatment Technologies; Selective Clean Closure/Landfill Closure

This alternative involves the use of both thermal and nonthermal treatment technologies (bulk vitrification and cast stone, respectively) to supplement WTP treatment. This alternative also evaluates treatment of 99.9 percent of the waste volume in the tank farms, clean closure of two representative (BX and SX) tank farms, and landfill closure of the remaining tank farms.

Storage: DOE would continue current waste management operations using existing tank storage facilities. No new DSTs would be required, but four new WRFs would be constructed.

Retrieval: Using currently available liquid-based retrieval and leak detection systems and a final chemical wash step, waste would be retrieved to a volume corresponding to 99.9 percent retrieval, equal to residual tank waste of no more than 1 cubic meter (36 cubic feet) for the 100-series tanks or 0.08 cubic meters (3 cubic feet) for the smaller 200-series tanks.

Treatment: The existing WTP configuration (two HLW melters and two LAW melters) would operate at a TMC of 6 metric tons of glass IHLW per day and 30 metric tons of glass ILAW per day. Treatment would start in 2018, and both HLW and LAW treatment would end in approximately 2043, including treatment of the highly contaminated waste stream resulting from clean closure of the BX and SX tank farms. All waste streams routed to the WTP would be pretreated, although technetium-99 removal would not occur as part of WTP pretreatment. WTP capacity would be supplemented with additional waste treatment capacity to immobilize a portion of the LAW. Supplemental treatment of the LAW would occur in both the 200-East and 200-West Areas and consist of a combination of cast stone treatment in the 200-East Area and bulk vitrification treatment in the 200-West Area. The waste stream feed for the 200-East Area cast stone supplemental treatment facility would be pretreated in the WTP, excluding technetium-99 removal. In the 200-West Area, the waste feed would be pretreated in a new Solid-Liquid Separations Facility. A separate portion of the tank waste (approximately 11.8 million liters [3.1 million gallons]) would be designated as mixed TRU waste and packaged for disposal at WIPP. The cesium and strontium capsules would be retrieved from the WESF, de-encapsulated, and treated in the WTP.

Disposal: LAW immobilized both via the WTP and external to the WTP would be disposed of on site in an IDF. IHLW would be stored on site until disposition decisions are made and implemented. Mixed TRU waste would be packaged and stored on site in an existing or new storage facility, pending disposal at WIPP.

Closure: As operations are completed, the SST system at Hanford, except the BX and SX tank farms, would be closed as an RCRA hazardous waste landfill unit under WAC 173-303, "Dangerous Waste Regulations," and DOE Order 435.1, *Radioactive Waste Management*, as applicable, or it would be decommissioned under DOE Order 430.1B, *Real Property Asset Management*. The tanks and ancillary equipment would be filled with grout to immobilize the residual waste, prevent long-term degradation of the tanks, and discourage intruder access. The closed tank systems, except the BX and SX tank farms and six sets of adjacent cribs and trenches (ditches), would be covered with an engineered modified RCRA Subtitle C barrier. Postclosure care would continue for 100 years. The BX and SX tank farms would be clean-closed by removing the tanks, ancillary equipment, and soils to a depth of 3 meters (10 feet) below the tank base. The removed tanks, ancillary equipment, and soils would be treated, as appropriate, in the Preprocessing Facility (PPF), resulting in MLLW and a highly contaminated liquid waste stream. The MLLW would be disposed of on site, and the highly contaminated liquid waste stream would be processed as HLW in the WTP, resulting in additional IHLW. Where necessary, deep soil excavation would also be conducted to remove contamination plumes within the soil column. Highly contaminated soils from deep soil excavation would be treated in the PPF. This process would generate a contaminated liquid waste stream that would be processed as LAW in the WTP, resulting in additional ILAW. The washed soils would be disposed of in the proposed RPPDF. The BX and SX tank farms would be backfilled with clean soil.

Tank Closure Alternative 5: Expanded WTP Vitrification with Supplemental Treatment Technologies; Landfill Closure

This alternative involves the use of both thermal and nonthermal treatment technologies (bulk vitrification and cast stone, respectively) to supplement the WTP treatment. This alternative also evaluates retrieval and treatment of 90 percent of the tank waste volume in the tank farms, but on an accelerated schedule, as well as landfill closure of the SST system.

Storage: DOE would continue current waste management operations using existing tank storage facilities. Four new DSTs and four WRFs would be constructed.

Retrieval: Using currently available liquid-based retrieval and leak detection systems, waste would be retrieved to a volume corresponding to 90 percent retrieval, less than the TPA Milestone M-45-00 goal of 99 percent (Ecology, EPA, and DOE 1989). Retrieval to 90 percent represents a programmatic risk analysis for the tank farms as defined by Appendix H of the TPA, "Single-Shell Tank Waste Retrieval Criteria Procedure." The 90 percent retrieval level would be equal to residual tank waste of no more than 102 cubic meters (3,600 cubic feet) for the 100-series tanks or 8.5 cubic meters (300 cubic feet) for the smaller 200-series tanks.

Treatment: The existing WTP configuration (two HLW melters and two LAW melters) would be supplemented with expanded LAW vitrification capacity (an addition of one LAW melter) to provide a vitrification TMC of 6 metric tons of glass IHLW per day and 45 metric tons of glass ILAW per day. All waste streams routed to the WTP would be pretreated, although technetium-99 removal would not occur as part of WTP pretreatment. Treatment would start in 2018 and end in approximately 2034. This alternative considers implementation of a sulfate removal technology following WTP pretreatment that would potentially reduce the amount of glass produced in the WTP by increasing the waste loading in the ILAW glass. WTP capacity would be supplemented with additional waste treatment capacity to immobilize a portion of the LAW. Supplemental treatment of the LAW would occur in both the 200-East and 200-West Areas and consist of a combination of cast stone treatment in the 200-East Area and bulk vitrification treatment in the 200-West Area. The waste stream feed for the 200-East Area Cast Stone Facility would be pretreated in the WTP, excluding technetium-99 removal. In the 200-West Area, the waste feed would be pretreated in a new Solid-Liquid Separations Facility. A separate portion of the tank waste (approximately 11.8 million liters [3.1 million gallons]) would be designated as mixed TRU waste and packaged for disposal at WIPP. The cesium and strontium capsules would be retrieved from the WESF, de-encapsulated, and treated in the WTP.

Disposal: LAW immobilized both via the WTP and external to the WTP would be disposed of on site in an IDF. IHLW would be stored on site until disposition decisions are made and implemented. Mixed TRU waste would be packaged and stored on site in a new storage facility, pending disposal at WIPP.

Closure: As operations are completed, the SST system would be closed as an RCRA hazardous waste landfill unit under WAC 173-303, "Dangerous Waste Regulations," and DOE Order 435.1, *Radioactive Waste Management*, as applicable, or it would be decommissioned under DOE Order 430.1B, *Real Property Asset Management*. The tanks and ancillary equipment would be filled with grout to immobilize the residual waste, prevent long-term degradation of the tanks, and discourage intruder access. The tank systems (tanks, ancillary equipment, and soils) and the six sets of adjacent cribs and trenches (ditches) would be closed in place and covered with the Hanford barrier (a barrier with performance characteristics that exceed RCRA requirements for disposal of hazardous waste). To support this schedule, SST system ancillary equipment outside the boundaries of the surface barriers would not be removed or decontaminated. Postclosure care would continue for 100 years.

Tank Closure Alternative 6: All Waste as Vitrified HLW[2]

This alternative consists of three subalternatives: (1) Alternative 6A: All Vitrification/No Separations; Clean Closure (Base and Option Cases), (2) Alternative 6B: All Vitrification with Separations; Clean Closure (Base and Option Cases), and (3) Alternative 6C: All Vitrification with Separations; Landfill Closure. These alternatives evaluate an all-vitrification case wherein all vitrified waste would be managed as HLW.

Tank Closure Alternative 6A: All Vitrification/No Separations; Clean Closure (Base and Option Cases)

Storage: DOE would continue current waste management operations using existing tank storage facilities that would be modified as needed to support SST waste retrieval and treatment. New DSTs would be required after the existing DSTs reach the end of their design life.

Retrieval: Using currently available liquid-based retrieval and leak detection systems and a final chemical wash step, waste would be retrieved to a volume corresponding to 99.9 percent retrieval, equal to residual tank waste of no more than 1 cubic meter (36 cubic feet) for the 100-series tanks or 0.08 cubic meters (3 cubic feet) for the smaller 200-series tanks. This approach would be the same under Tank Closure Alternative 6B.

Treatment: The existing WTP configuration would be modified to process all waste as HLW through expanded HLW vitrification capacity. This new WTP configuration (five HLW melters and no LAW melters) would provide a total vitrification TMC of 15 metric tons of glass IHLW per day. Treatment

[2] Tank Closure Alternatives 6A, 6B, and 6C of this EIS evaluate management of tank waste as HLW combined with different closure scenarios. The purpose of Tank Closure Alternative 6A is to evaluate the bounding case for no-separation scenarios. Per DOE Manual 435.1-1, *Radioactive Waste Management Manual,* waste incidental to the reprocessing evaluation determination process is not required for treatment of the waste under these alternatives because all tank waste would be managed as HLW.

would start in 2018 and end in approximately 2163, requiring two WTP replacement facilities due to design-life constraints. There would be no pretreatment, LAW treatment, or technetium-99 removal. No supplemental or TRU waste treatment is proposed. The cesium and strontium capsules would be retrieved from the WESF, de-encapsulated, and treated in the WTP.

Disposal: IHLW canisters would be stored on site until disposition decisions are made and implemented. Replacement of the canister storage facilities would be required after a 60-year design life. The HLW debris from clean closure would be managed as HLW and stored on site.

Closure: Clean closure of all twelve 200-East and 200-West Area SST farms following deactivation would involve removal of all tanks, associated ancillary equipment, and contaminated soil to a depth of 3 meters (10 feet) directly beneath the tank base. These materials would be packaged as HLW for onsite storage in shielded boxes. Where necessary, deep soil excavation would also be conducted to remove contamination plumes within the soil column. The new PPF would process the highly contaminated deep soil to render it acceptable for onsite disposal. The liquid waste stream from the PPF soil washing would be thermally treated in the PPF and disposed of on site in an IDF. The washed soils would be disposed of in the proposed RPPDF. Clean closure of the SST system would preclude the need for postclosure care. The six sets of adjacent cribs and trenches (ditches) would be covered with an engineered modified RCRA Subtitle C barrier (Base Case). Optional clean closure of these cribs and trenches (ditches) would occur under the Option Case. This approach would be the same under Tank Closure Alternative 6B.

Tank Closure Alternative 6B: All Vitrification with Separations; Clean Closure (Base and Option Cases)

Storage: DOE would continue current waste management operations using existing tank storage facilities. No new DSTs would be required, but four new WRFs would be constructed. This approach would be the same under Tank Closure Alternative 6C.

Retrieval: Using currently available liquid-based retrieval and leak detection systems and a final chemical wash step, waste would be retrieved to a volume corresponding to 99.9 percent retrieval, equal to residual tank waste of no more than 1 cubic meter (36 cubic feet) for the 100-series tanks or 0.08 cubic meters (3 cubic feet) for the smaller 200-series tanks. This approach would be the same under Tank Closure Alternative 6A.

Treatment: The existing WTP configuration (two HLW melters and two LAW melters) would be supplemented with expanded LAW vitrification capacity (an addition of four LAW melters) to provide a vitrification TMC of 6 metric tons of glass IHLW per day and 90 metric tons of glass ILAW per day. Treatment would start in 2018 and end in approximately 2040 (for HLW) and 2043 (for LAW). All waste streams routed to the WTP would be pretreated, although technetium-99 removal would not occur as part of WTP pretreatment. No supplemental or TRU waste treatment is proposed. The cesium and strontium capsules would be retrieved from the WESF, de-encapsulated, and treated in the WTP. This approach would be the same under Tank Closure Alternative 6C.

Disposal: IHLW canisters would be stored on site until disposition decisions are made and implemented. ILAW glass canisters would be managed as HLW and stored on site. HLW debris from clean closure also would be managed as HLW and stored on site. This approach would be the same under Tank Closure Alternative 6C.

Closure: Clean closure of all twelve 200-East and 200-West Area SST farms following deactivation would involve removal of all tanks, associated ancillary equipment, and contaminated soil to a depth of 3 meters (10 feet) directly beneath the tank base. These materials would be packaged as HLW for onsite storage in shielded boxes. Where necessary, deep soil excavation would also be conducted to remove contamination plumes within the soil column. The new PPF would process the highly contaminated deep soil to render it acceptable for onsite disposal. The liquid waste stream from the PPF soil washing would be thermally treated in the PPF and disposed of on site in an IDF. The washed soils would be disposed of in the proposed RPPDF. Clean closure of the SST system would preclude the need for postclosure care. The six sets of adjacent cribs and trenches (ditches) would be covered with an engineered modified RCRA Subtitle C barrier (Base Case). Optional clean closure of these cribs and trenches (ditches) would occur under the Option Case. This approach would be the same under Tank Closure Alternative 6A.

Tank Closure Alternative 6C: All Vitrification with Separations; Landfill Closure

Storage: DOE would continue current waste management operations using existing tank storage facilities. No new DSTs would be required, but four new WRFs would be constructed. This approach would be the same under Tank Closure Alternative 6B.

Retrieval: Using currently available liquid-based waste retrieval and leak detection systems, waste would be retrieved to the TPA goal, i.e., residual waste would not exceed 10.2 cubic meters (360 cubic feet) for the 100-series tanks or 0.85 cubic meters (30 cubic feet) for the smaller 200-series tanks, corresponding to 99 percent retrieval.

Treatment: The existing WTP configuration (two HLW melters and two LAW melters) would be supplemented with expanded LAW vitrification capacity (an addition of four LAW melters) to provide a vitrification TMC of 6 metric tons of glass IHLW per day and 90 metric tons of glass ILAW per day. Treatment would start in 2018 and end in approximately 2040 (for HLW) and 2043 (for LAW). All waste streams routed to the WTP would be pretreated, although technetium-99 removal would not occur as part of WTP pretreatment. No supplemental or TRU waste treatment is proposed. The cesium and strontium capsules would be retrieved from the WESF, de-encapsulated, and treated in the WTP. This approach would be the same under Tank Closure Alternative 6B.

Disposal: IHLW canisters would be stored on site until disposition decisions are made and implemented. ILAW glass canisters would be managed as HLW and stored on site. This approach would be the same under Tank Closure Alternative 6B.

Closure: As operations are completed, the SST system would be closed as an RCRA hazardous waste landfill unit under WAC 173-303, "Dangerous Waste Regulations," and DOE Order 435.1, *Radioactive Waste Management*, as applicable, or it would be decommissioned under DOE Order 430.1B, *Real Property Asset Management*. The tanks would be filled with grout to immobilize the residual waste, prevent long-term degradation of the tanks, and discourage intruder access. Soil would be removed down to 4.6 meters (15 feet) at the BX and SX tank farms and replaced with clean soils from onsite sources. The removed contaminated soils and ancillary equipment would be disposed of on site in the proposed RPPDF. The closed tank systems and the six sets of adjacent cribs and trenches (ditches) would be covered with an engineered modified RCRA Subtitle C barrier. Postclosure care would continue for 100 years.

Table 1 compares each of the Tank Closure alternatives by component.

Table 1. Comparison of the Tank Closure Alternatives

	Alternative 1: No Action	Alternative 2A: Existing WTP Vitrification; No Closure	Alternative 2B: Expanded WTP Vitrification; Landfill Closure	Alternative 3A: Existing WTP Vitrification with Thermal Supplemental Treatment (Bulk Vitrification); Landfill Closure	Alternative 3B: Existing WTP Vitrification with Nonthermal Supplemental Treatment (Cast Stone); Landfill Closure	Alternative 3C: Existing WTP Vitrification with Thermal Supplemental Treatment (Steam Reforming); Landfill Closure	Alternative 4: Existing WTP Vitrification with Supplemental Treatment Technologies; Selective Clean Closure/ Landfill Closure	Alternative 5: Expanded WTP Vitrification with Supplemental Treatment Technologies; Landfill Closure	Alternative 6A: All Vitrification/No Separations; Clean Closure	Alternative 6B: All Vitrification with Separations; Clean Closure	Alternative 6C: All Vitrification with Separations; Landfill Closure
Storage											
Existing	✓										
New WRFs			✓	✓	✓	✓	✓	✓		✓	✓
New DSTs		✓						✓	✓		
Retrieval											
90 percent								✓			
99 percent		✓	✓	✓	✓	✓					✓
99.9 percent							✓		✓	✓	
Treatment											
WTP											
Existing vitrification only		✓		✓	✓	✓	✓				
Expanded LAW vitrification			✓					✓		✓	✓
Expanded HLW vitrification									✓		
Replacement of WTP		✓							✓		
Technetium-99 removal			✓		✓						
Sulfate removal								✓			
Cesium and strontium capsules		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Non-WTP											
Tank mixed TRU waste supplemental treatment				✓	✓	✓	✓	✓			
Thermal supplemental treatment				✓		✓	✓	✓			
Nonthermal supplemental treatment					✓		✓	✓			
Disposal (including post-treatment storage)											
On Site											
ILAW		✓	✓	✓	✓	✓	✓	✓		(a)	(a)
IHLW[b]		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Sulfate grout								✓			
Contaminated soil			✓	✓	✓	✓	✓		✓	✓	✓
SSTs							(c)		(d)	(d)	
Off Site											
Tank mixed TRU waste to WIPP				✓	✓	✓	✓	✓			
Closure											
Clean closure									✓	✓	
Selective clean closure/landfill closure							✓				
Landfill closure			✓	✓	✓	✓		✓			✓
Modified RCRA Subtitle C barrier			✓	✓	✓	✓	✓		(e)	(e)	✓
Hanford barrier								✓			

a Under Alternatives 6B and 6C, ILAW glass would be interim-stored on site and managed as IHLW glass.
b Although disposition decisions have not been made and implemented, these alternatives do not assume the inventory in the IHLW canisters remains on site. However, the number of storage facilities needed to store all the IHLW is one more than the number of canister storage facilities analyzed under Tank Closure Alternative 2B.
c Under Alternative 4, SSTs at the BX and SX tank farms would be removed and treated in the Preprocessing Facility.
d Under Alternatives 6A and 6B, all SSTs would be removed and packaged in shielded boxes for onsite storage pending disposition.
e Base Case: Construct modified RCRA Subtitle C barrier over six sets of cribs and trenches (ditches) in the B and T Areas. Option Case: Remove six sets of cribs and trenches (ditches) in the B and T Areas and remediate their deep-soil plumes.

Key: DST=double-shell tank; HLW=high-level radioactive waste; IHLW=immobilized high-level radioactive waste; ILAW=immobilized low-activity waste; LAW=low-activity waste; RCRA=Resource Conservation and Recovery Act; SST=single-shell tank; TRU=transuranic; WIPP=Waste Isolation Pilot Plant; WRF=waste receiver facility; WTP=Waste Treatment Plant.

FFTF DECOMMISSIONING

In 2004, DOE published in the *Federal Register* a "Notice of Intent to Prepare an Environmental Impact Statement for the Decommissioning of the Fast Flux Test Facility at the Hanford Site, Richland, WA" (69 FR 50176) that identified three alternatives for decommissioning FFTF and auxiliary facilities at Hanford. That EIS was not completed; however, the same alternatives—No Action, Entombment, and Removal—were adopted for analysis in this *TC & WM EIS*.

FFTF Decommissioning Alternative 1: No Action

As previously stated, CEQ NEPA regulations (40 CFR 1500–1508) and DOE NEPA regulations (10 CFR 1021) require analysis of a "no action" alternative. The FFTF Decommissioning No Action Alternative includes completion of actions in accordance with previous DOE NEPA decisions. Final decommissioning of FFTF would not occur. Specifically, only deactivation activities for the FFTF complex and support buildings would be conducted, as described in the 2006 *Environmental Assessment, Sodium Residuals Reaction/Removal and Other Deactivation Work Activities, Fast Flux Test Facility (FFTF) Project, Hanford Site, Richland, Washington* (DOE 2006). Deactivation activities would include removal and packaging of the four RH-SCs for storage in the 400 Area, as described in the Finding of No Significant Impact, dated March 31, 2006 (DOE 2006:Appendix B). The FFTF Reactor Containment Building (RCB) and the rest of the buildings within the 400 Area Property Protected Area (PPA) would be maintained through 2107 (for 100 years) under administrative controls such as site security and management. After 2107, administrative controls would cease and remaining waste was assumed to become available for release to the environment.

FFTF Decommissioning Alternative 2: Entombment

Facility Disposition: The Entombment Alternative consists of removing all aboveground structures within the 400 Area PPA and minimal removal of below-grade structures, equipment, and materials as required for compliance with regulatory standards. The RCB would be demolished and removed to grade, and the auxiliary facilities would be removed to 0.91 meters (3 feet) below grade. Equipment, piping, and components containing hazardous and radioactive materials would be removed from below-grade structures only as needed for treatment to meet regulatory requirements. Any other necessary treatment of equipment or components would occur in place (without removal from the facilities). After treatment, some of the components could be returned to below-grade spaces and grouted in place with the remaining structures and equipment to stabilize them and minimize void space. Most other equipment and materials removed from the facilities would be disposed of in the 200 Areas. An RCRA-compliant barrier would be constructed over the remains of the RCB and any other remaining below-grade structures (including the reactor vessel) that contain residual radioactive and treated hazardous materials. Equipment to be removed under this alternative would include the RH-SCs, which contain sufficient quantities of metallic sodium and radionuclides that they could not be treated and entombed in the RCB with the remaining materials.

Disposition of Remote-Handled Special Components: The RH-SCs consist of four large filter assemblies designed to remove radionuclides and other contaminants from the FFTF sodium coolant systems and the inert-cover gas systems. These components contain sufficient quantities of radionuclides to require remote handling and would require treatment to drain and stabilize residual metallic sodium prior to disposal. Removal and storage of the RH-SCs in the 400 Area are covered in a Finding of No Significant Impact dated March 31, 2006 (DOE 2006:Appendix B). It would be necessary to treat these components in a specialized facility that is equipped to handle hazardous reactive materials and components with high radiation dose rates. Such a facility does not currently exist without modification within the DOE waste management complex; however, most other waste generated during facility decommissioning could be managed using existing or proposed capabilities. Therefore, DOE needs to decide on an approach for treating and disposing of the FFTF RH-SCs. The following two options are being considered for managing these components:

- **Hanford Option.** The RH-SCs would be shipped to an onsite treatment facility. The capability to treat these components does not currently exist at Hanford, nor has such a capability been previously proposed, although construction of a facility to treat remote-handled and oversized MLLW or TRU waste was evaluated in a previous NEPA review (DOE 2004). Following treatment, the components and residuals would be disposed of with other Hanford waste in the 200 Areas. DOE is considering this option for management of the FFTF RH-SCs in response to scoping comments that recommended minimizing offsite transportation of these components and treatment residuals.

- **Idaho Option.** The RH-SCs would be shipped to Idaho National Laboratory's (INL's) Idaho Nuclear Technology and Engineering Center (INTEC). The INTEC facilities would treat remote-handled components containing comparable levels of radioactive materials, as well as metallic sodium. An environmental assessment was prepared to evaluate this proposed treatment at INL and a Finding of No Significant Impact was issued on February 18, 2009 (DOE 2009). Following treatment at INTEC, the FFTF components and residuals would be disposed of with other INL waste at an offsite facility, or they could be returned to Hanford for disposal. DOE is considering this option for the FFTF RH-SCs to utilize the existing sodium management expertise at INL and to consolidate waste management activities within the DOE complex at existing or proposed facilities.

Disposition of Bulk Sodium: The Hanford radioactively contaminated bulk sodium inventory consists of approximately 1.1 million liters (300,000 gallons) of metallic sodium, including sodium from the Hallam Reactor and the Sodium Reactor Experiment, in addition to sodium drained from the FFTF cooling systems during deactivation. Hallam and Sodium Reactor Experiment sodium are currently stored in the Hanford 200-West Area Central Waste Complex (CWC). Sodium from FFTF is stored in the 400 Area within the RCB or adjacent storage facilities. The current DOE plan for this sodium is to convert it to a caustic for product reuse by the DOE Office of River Protection. The following two options are being considered for managing the Hanford radioactively contaminated bulk sodium inventory:

- **Hanford Reuse Option.** The bulk sodium would be stored in its current locations until it is shipped to an onsite facility for processing into a caustic (sodium hydroxide). The capability to process the bulk sodium does not currently exist at Hanford. The treated caustic would be transferred to the 200-East Area for product reuse by the Office of River Protection in the WTP. DOE is considering this option for processing the Hanford bulk sodium inventory in response to scoping comments that recommended minimizing the need for offsite transportation of the bulk sodium and caustic.

- **Idaho Reuse Option.** The bulk sodium would be stored in its current locations until it is shipped to INL's Materials and Fuels Complex (MFC) for processing. The capability to process bulk metallic sodium currently exists at the MFC Sodium Processing Facility with modifications, which was previously used to process metallic sodium from the Experimental Breeder Reactor II and other facilities. Following processing, the caustic would be returned to Hanford for use in the WTP. DOE is considering this option for processing the Hanford bulk sodium inventory to utilize existing sodium management expertise and facilities at the MFC.

FFTF Decommissioning Alternative 3: Removal

Facility Disposition: The Removal Alternative consists of removing all above-grade structures within the 400 Area PPA, as well as contaminated below-grade structures, equipment, and materials. The RCB would be demolished and removed to grade, and all auxiliary facilities would be removed to 0.91 meters (3 feet) below grade. Most equipment, piping, and components containing chemically hazardous and radioactive materials, including the reactor vessel, lead shielding, depleted uranium shielding, and asbestos, would be removed from below-grade structures. Most equipment and materials removed from the facilities would be disposed of in the 200 Areas. The remaining structures and equipment, consisting mainly of the external RCB structure and associated components, as well as uncontaminated below-grade portions of auxiliary facilities, would be backfilled or grouted to minimize void space. The PPA would be backfilled to grade, contoured, and revegetated as necessary to stabilize the ground surface or to prepare the site for future industrial use.

Disposition of Remote-Handled Special Components: The two options being considered under FFTF Decommissioning Alternative 2 are the same options being considered under FFTF Decommissioning Alternative 3 for disposition of the RH-SCs.

Disposition of Bulk Sodium: The two options being considered under FFTF Decommissioning Alternative 2 are the same options being considered under FFTF Decommissioning Alternative 3 for disposition of the bulk sodium.

Table 2 compares the key disposition activities under the FFTF Decommissioning alternatives.

Table 2. Comparison of the FFTF Decommissioning Alternatives

	Alternative 1: No Action	Alternative 2: Entombment	Alternative 3: Removal
Facility Disposition			
Facility equipment and components left in place under inert gas blanket	✓		
Dismantlement of RCB and adjacent support buildings		✓	✓
Removal of reactor vessel (internal piping and equipment, attached depleted-uranium shield)			✓
Onsite disposal of reactor vessel (internal piping and equipment, attached depleted-uranium shield)			✓
Removal and onsite disposal of radioactive or chemical waste	✓	✓	✓
Backfill and revegetation of ancillary facility areas		✓	
Backfill and revegetation of Property Protected Area			✓
Landfill barrier over RCB		✓	
Administrative controls for 100 years	✓		
Postclosure care and/or institutional controls for 100 years		✓	✓
Disposition of Remote-Handled Special Components			
Removal and storage on site per FONSI[a]	✓	✓	✓
Treatment at the Hanford Site		✓	✓
Treatment at Idaho National Laboratory		✓	✓
Onsite disposal		✓	✓
Offsite disposal		✓	✓
Disposition of Bulk Sodium			
Onsite storage	✓	✓	✓
Onsite conversion to caustic sodium hydroxide solution		✓	✓
Offsite conversion to caustic sodium hydroxide solution		✓	✓
Caustic sodium hydroxide solution shipped to the Waste Treatment Plant		✓	✓

[a] Per 2006 FONSI regarding *Environmental Assessment, Sodium Residuals Reaction/Removal and Other Deactivation Work Activities, Fast Flux Test Facility (FFTF) Project, Hanford Site, Richland, Washington* (DOE 2006:Appendix B).

Key: FFTF=Fast Flux Test Facility; FONSI=Finding of No Significant Impact; RCB=Reactor Containment Building.

WASTE MANAGEMENT

The Waste Management alternatives evaluated in this *TC & WM EIS* address the expansion of waste disposal capacity at Hanford to dispose of both on- and offsite waste, thus facilitating cleanup of Hanford and other DOE sites. The major mission components include onsite storage and disposal of Hanford-generated and other sites' LLW and MLLW, onsite storage of Hanford-generated TRU waste, and eventual closure of the waste facilities.

Waste Management Alternative 1: No Action

Storage and Treatment: LLW and MLLW would be stored at the CWC until processed for disposal in low-level radioactive waste burial ground (LLBG) 218-W-5, trenches 31 and 34. TRU waste would be stored at the CWC and disposed of in WIPP. Processing of waste prior to disposal would continue at existing facilities at the CWC, Waste Receiving and Processing Facility (WRAP), and T Plant. No offsite LLW, MLLW, or TRU waste would be received.

Disposal: LLW and MLLW would be disposed of in LLBG 218-W-5, trenches 31 and 34, through 2035. TRU waste would be disposed of in WIPP. Further construction of the 200-East Area IDF (IDF-East) would be discontinued, and IDF-East would be deactivated.

Closure: Administrative control would be implemented for 100 years.

Waste Management Alternative 2: Disposal in IDF, 200-East Area Only

Storage and Treatment: LLW, MLLW, and TRU waste would be stored at the CWC until processed for disposal. Processing of waste prior to disposal would occur at existing and expanding facilities at the CWC, WRAP, and T Plant. No offsite TRU waste would be received. Offsite LLW and MLLW would be received from other DOE sites. A total volume of 62,000 cubic meters (81,000 cubic yards) of LLW and 20,000 cubic meters (26,000 cubic yards) of MLLW was assumed to be received.

Disposal: LLBG 218-W-5, trenches 31 and 34, would continue to operate through 2050. Construction, operations, deactivation, closure, and postclosure care would take place at IDF-East. Waste from tank treatment operations; onsite sources not regulated under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA); FFTF decommissioning; waste management operations; and other DOE sites would be disposed of in IDF-East. Waste from tank farm cleanup operations would be disposed of in the proposed RPPDF. TRU waste would be disposed of in WIPP.

Closure: Disposal facilities would be covered with engineered modified RCRA Subtitle C barriers. Postclosure care would continue for 100 years.

Waste Management Alternative 3: Disposal in IDF, 200-East and 200-West Areas

Storage and Treatment: LLW, MLLW, and TRU waste would be stored at the CWC until processed for disposal. Processing of waste prior to disposal would occur at existing and expanding facilities at the CWC, WRAP, and T Plant. No offsite TRU waste would be received. Offsite LLW and MLLW would be received from other DOE sites. A total volume of 62,000 cubic meters (81,000 cubic yards) of LLW and 20,000 cubic meters (26,000 cubic yards) of MLLW was assumed to be received.

Disposal: LLBG 218-W-5, trenches 31 and 34, would continue to operate through 2050. Construction, operations, deactivation, closure, and postclosure care would take place in IDF-East and an IDF to be constructed in the 200-West Area (IDF-West). Waste from onsite non-CERCLA sources, FFTF decommissioning, waste management, and other DOE sites would be disposed of in IDF-West. Waste from tank farm cleanup operations would be disposed of in the proposed RPPDF. TRU waste would be disposed of in WIPP.

Closure: Disposal facilities would be covered with engineered modified RCRA Subtitle C barriers. Postclosure care would continue for 100 years.

Table 3 outlines key activities by Waste Management alternative for waste storage, treatment, and disposal, as well as facility closure.

Table 3. Comparison of the Waste Management Alternatives

	Alternative 1: No Action	Alternative 2: Disposal in IDF, 200-East Area Only	Alternative 3: Disposal in IDF, 200-East and 200-West Areas
Storage and Treatment			
Existing storage and treatment of LLW, MLLW, and TRU waste at CWC	✓		
Expanded storage and treatment of LLW, MLLW, and TRU waste at CWC		✓	✓
Existing storage and treatment of LLW, MLLW, and TRU waste at WRAP and T Plant	✓		
Expanded storage and treatment of LLW, MLLW, and TRU waste at WRAP and T Plant		✓	✓
Disposal			
Continued disposal of onsite non-CERCLA, nontank LLW and MLLW in onsite lined trenches	✓	✓	✓
Construction of 200-East Area IDF terminated and facility deactivated	✓		
Disposal of tank, onsite non-CERCLA, FFTF decommissioning, waste management, and offsite LLW and MLLW at 200-East Area IDF		✓	
Disposal of tank waste only at 200-East Area IDF and onsite non-CERCLA, FFTF decommissioning, waste management, and offsite LLW and MLLW at 200-West Area IDF			✓
Disposal of rubble, ancillary equipment, and soils (not highly contaminated) from closure activities in the proposed RPPDF		✓	✓
Closure			
None	✓		
Landfill closure of IDF(s) and RPPDF		✓	✓
Administrative control for 100 years	✓		
Postclosure care for 100 years		✓	✓

Key: CERCLA=Comprehensive Environmental Response, Compensation, and Liability Act; CWC=Central Waste Complex; FFTF=Fast Flux Test Facility; IDF=Integrated Disposal Facility; LLW=low-level radioactive waste; MLLW=mixed low-level radioactive waste; RPPDF=River Protection Project Disposal Facility; TRU=transuranic; WRAP=Waste Receiving and Processing Facility.

ROADMAPS TO THE ALTERNATIVES

Tables 4, 5, and 6 are roadmaps to the Tank Closure, FFTF Decommissioning, and Waste Management alternatives analyzed in this *TC & WM EIS*. Key features and potential issues regarding each alternative are identified, along with the sections of Chapters 2, 4, and 5 and Appendices D and E of this EIS where related discussions can be found. The potential issues listed in Tables 4, 5, and 6 are presented only to make readers of this *TC & WM EIS* aware of their existence. These issues are covered in greater detail in the chapters and appendices of this EIS. These tables are not meant to be all-inclusive, but are provided to help readers navigate through the document.

Table 4. Roadmap to the Tank Closure Alternatives

TANK CLOSURE ALTERNATIVE 1: No Action					
	STORAGE	**RETRIEVAL**	**TREATMENT**	**DISPOSAL**	**CLOSURE**
Key Features	• 100-year administrative control	• No retrieval	• No treatment • Waste Treatment Plant construction terminated	• No disposal	• No closure
Potential Issues	• Waste remains in single-shell tanks and double-shell tanks beyond their design lives	• No retrieval of tank waste	• Waste Treatment Plant construction ends before completion • No treatment	• No disposal	• No closure of RCRA units
Description	• 2.2.1 • 2.2.2.1 • 2.5.2.1 • D.1 • E.1	• 2.2.2.1 • 2.5.2.1	• 2.2.2.2 • 2.5.2.1 • E.1	• 2.2.2.3 • 2.5.2.1	• 2.2.2.4 • 2.5.2.1
Impacts	• 4.1.4.1 AQ • 4.1.6.1 WR • 4.1.7.1 ER • 4.1.9.1 S • 4.1.10.1 NO • 4.1.11.1 FA • 4.1.15.1 IS • 5.1.1.1 GW • 5.1.2.1 HH • 5.1.3.1 LER	• None	• 4.1.4.1 AQ • 4.1.7.1 ER • 4.1.9.1 S	• None	• None

Note: "Key Features" include alternative configurations, treatment dates, and assumptions. "Potential Issues" include topics that may be environmental impact drivers or are expected to be of interest to readers. "Description" identifies EIS Chapter 2 and Appendix D and E sections that further describe the Key Features, including the technologies evaluated. Chapter 2 provides an overview of the alternatives. Appendix D provides waste inventories, and Appendix E provides more-detailed information. "Impacts" identify EIS Chapter 4 and 5 sections that describe the impacts of the Key Features and/or Potential Issues.

Key: AQ=Air Quality; EIS=environmental impact statement; ER=Ecological Resources; FA=Facility Accidents; GW=Groundwater; HH=Human Health; IS=Industrial Safety; LER=Long-Term Ecological Risk; NO=Normal Operations; RCRA=Resource Conservation and Recovery Act; S=Socioeconomics; WR=Water Resources.

Table 4. Roadmap to the Tank Closure Alternatives *(continued)*

TANK CLOSURE ALTERNATIVE 2A: Existing WTP Vitrification; No Closure				
STORAGE	**RETRIEVAL**	**TREATMENT**	**DISPOSAL**	**CLOSURE**
Key Features • 28 replacement double-shell tanks • No waste receiver facilities	*Key Features* • 99 percent tank waste retrieval • Liquid-based retrieval technologies • Current leak detection technology • Retrieval leakage rate = 15,120 liters (4,000 gallons) per single-shell tank	*Key Features* • Waste treatment: 2018–2093 • 6 MTG per day (2 HLW melters) × 30 MTG per day (2 LAW melters) • No Tc-99 removal • No sulfate removal • No tank-derived TRU waste treatment	*Key Features* • ILAW disposal on site • IHLW storage includes CSB + 3 additional vaults	*Key Features* • No closure • 100-year administrative control
Potential Issues • New double-shell tanks required	*Potential Issues* • Assumed retrieval leakage rate = 15,120 liters (4,000 gallons) per single-shell tank	*Potential Issues* • WTP replacement • Extended operating period	*Potential Issues* • ILAW disposal on site • Tc-99 in ILAW • No waste acceptance criteria for HLW melters (stored indefinitely)	*Potential Issues* • No closure, 100-year administrative control only
Description • 2.2.1 • 2.2.2.1 • 2.5.2.2.1 • D.1 • E.1	*Description* • 2.2.2.1 • 2.5.2.2.1 • D.1 • E.1	*Description* • 2.2.2.2 • 2.5.2.2.1 • D.1 • E.1	*Description* • 2.2.2.3 • 2.5.2.2.1 • D.1 • E.1	*Description* • 2.2.2.4 • 2.5.2.2.1
Impacts • 4.1.1.2 LR • 4.1.4.2 AQ • 4.1.7.2 ER • 4.1.9.2 S • 4.1.10.2 NO • 4.1.11.2 FA	*Impacts* • 4.1.4.2 AQ • 4.1.6.2 WR • 4.1.9.2 S • 4.1.10.2 NO • 4.1.11.2 FA • 5.1.1.2 GW • 5.1.2.2 HH • 5.1.3.2 LER	*Impacts* • 4.1.1.2 LR • 4.1.4.2 AQ • 4.1.6.2 WR • 4.1.7.2 ER • 4.1.9.2 S • 4.1.10.2 NO • 4.1.11.2 FA • 4.1.14.2 WM • 5.1.1.2 GW • 5.1.2.2 HH • 5.1.3.2 LER	*Impacts* • 4.1.1.2 LR • 4.1.4.2 AQ • 4.1.6.2 WR • 4.1.7.2 ER • 4.1.14.2 WM • 5.1.1.2 GW • 5.1.2.2 HH • 5.1.3.2 LER	*Impacts* • 4.1.4.2 AQ • 4.1.6.2 WR • 4.1.12.2 T • 5.1.1.2 GW • 5.1.2.2 HH • 5.1.3.2 LER

Note: "Key Features" include alternative configurations, treatment dates, and assumptions. "Potential Issues" include topics that may be environmental impact drivers or are expected to be of interest to readers. "Description" identifies EIS Chapter 2 and Appendix D and E sections that further describe the Key Features, including the technologies evaluated. Chapter 2 provides an overview of the alternatives. Appendix D provides waste inventories, and Appendix E provides more-detailed information. "Impacts" identify EIS Chapter 4 and 5 sections that describe the impacts of the Key Features and/or Potential Issues.

Key: AQ=Air Quality; CSB=Canister Storage Building; EIS=environmental impact statement; ER=Ecological Resources; FA=Facility Accidents; GW=Groundwater; HH=Human Health; HLW=high-level radioactive waste; IHLW=immobilized high-level radioactive waste; ILAW=immobilized low-activity waste; LAW=low-activity waste; LER=Long-Term Ecological Risk; LR=Land Resources; MTG=metric tons of glass; NO=Normal Operations; S=Socioeconomics; T=Transportation; Tc-99=technetium-99; TRU=transuranic; WM=Waste Management; WR=Water Resources; WTP=Waste Treatment Plant.

Table 4. Roadmap to the Tank Closure Alternatives *(continued)*

TANK CLOSURE ALTERNATIVE 2B: Expanded WTP Vitrification; Landfill Closure				
STORAGE	**RETRIEVAL**	**TREATMENT**	**DISPOSAL**	**CLOSURE**
Key Features • 4 waste receiver facilities • No new double-shell tanks	*Key Features* • 99 percent tank waste retrieval • Liquid-based retrieval technologies • Current leak detection technology • Retrieval leakage rate = 15,120 liters (4,000 gallons) per single-shell tank	*Key Features* • Waste treatment: 2018–2043 • 6 MTG per day (2 HLW melters) × 90 MTG per day (6 LAW melters) • Tc-99 removal • No sulfate removal • No tank-derived TRU waste treatment	*Key Features* • ILAW disposal on site • IHLW storage includes CSB + 4 additional vaults	*Key Features* • Landfill closure (modified RCRA Subtitle C barrier) • Upper 4.6 meters (15 feet) of soil in BX and SX tank farms and ancillary equipment removed • 100-year postclosure care
Potential Issues • Construction of 4 waste receiver facilities	*Potential Issues* • Retrieval leakage rate = 15,120 liters (4,000 gallons) per single-shell tank	*Potential Issues* • Construction of expanded WTP	*Potential Issues* • ILAW disposal on site • No waste acceptance criteria for HLW melters (stored indefinitely)	*Potential Issues* • Landfill closure of all single-shell tank farms with 1 percent residual waste and adjacent cribs and trenches (ditches) • Benefit of removing upper 4.6 meters (15 feet) of soil in BX and SX tank farms
Description • 2.2.1 • 2.2.2.1 • 2.5.2.2.2 • D.1 • E.1	*Description* • 2.2.2.1 • 2.5.2.2.2 • D.1 • E.1	*Description* • 2.2.2.2 • 2.5.2.2.2 • D.1 • E.1	*Description* • 2.2.2.3 • 2.5.2.2.2 • D.1 • E.1	*Description* • 2.2.2.4 • 2.5.2.2.2 • E.1
Impacts • 4.1.1.3 LR • 4.1.4.3 AQ • 4.1.10.3 NO • 4.1.11.3 FA	*Impacts* • 4.1.4.3 AQ • 4.1.6.3 WR • 4.1.9.3 S • 4.1.10.3 NO • 4.1.11.3 FA • 5.1.1.3 GW • 5.1.2.3 HH • 5.1.3.3 LER	*Impacts* • 4.1.1.3 LR • 4.1.4.3 AQ • 4.1.6.3 WR • 4.1.7.3 ER • 4.1.9.3 S • 4.1.10.3 NO • 4.1.11.3 FA • 4.1.14.3 WM • 5.1.1.3 GW • 5.1.2.3 HH • 5.1.3.3 LER	*Impacts* • 4.1.1.3 LR • 4.1.4.3 AQ • 4.1.6.3 WR • 4.1.7.3 ER • 4.1.11.3 FA • 4.1.12.3 T • 4.1.14.3 WM • 5.1.1.3 GW • 5.1.2.3 HH • 5.1.3.3 LER	*Impacts* • 4.1.4.3 AQ • 4.1.6.3 WR • 4.1.10.3 NO • 4.1.14.3 WM • 5.1.1.3 GW • 5.1.2.3 HH • 5.1.3.3 LER

Note: "Key Features" include alternative configurations, treatment dates, and assumptions. "Potential Issues" include topics that may be environmental impact drivers or are expected to be of interest to readers. "Description" identifies EIS Chapter 2 and Appendix D and E sections that further describe the Key Features, including the technologies evaluated. Chapter 2 provides an overview of the alternatives. Appendix D provides waste inventories, and Appendix E provides more-detailed information. "Impacts" identify EIS Chapter 4 and 5 sections that describe the impacts of the Key Features and/or Potential Issues.

Key: AQ=Air Quality; CSB=Canister Storage Building; EIS=environmental impact statement; ER=Ecological Resources; FA=Facility Accidents; GW=Groundwater; HH=Human Health; HLW=high-level radioactive waste; IHLW=immobilized high-level radioactive waste; ILAW=immobilized low-activity waste; LAW=low-activity waste; LER=Long-Term Ecological Risk; LR=Land Resources; MTG=metric tons of glass; NO=Normal Operations; RCRA=Resource Conservation and Recovery Act; S=Socioeconomics; T=Transportation; Tc-99=technetium-99; TRU=transuranic; WM=Waste Management; WR=Water Resources; WTP=Waste Treatment Plant.

Table 4. Roadmap to the Tank Closure Alternatives *(continued)*

TANK CLOSURE ALTERNATIVE 3A: Existing WTP Vitrification with Thermal Supplemental Treatment (Bulk Vitrification); Landfill Closure				
STORAGE	**RETRIEVAL**	**TREATMENT**	**DISPOSAL**	**CLOSURE**
Key Features • 4 waste receiver facilities • No new double-shell tanks	*Key Features* • 99 percent tank waste retrieval • Liquid-based retrieval technologies • Current leak detection technology • Retrieval leakage rate = 15,120 liters (4,000 gallons) per single-shell tank	*Key Features* • Waste treatment: 2018–2040 • 6 MTG per day (2 HLW melters) × 30 MTG per day (2 LAW melters) • Supplemental treatment (bulk vitrification) • No Tc-99 removal • No sulfate removal • Tank-derived TRU waste treatment	*Key Features* • ILAW disposal on site • IHLW storage includes CSB + 4 additional vaults	*Key Features* • Landfill closure (modified RCRA Subtitle C barrier) • Upper 4.6 meters (15 feet) of soil in BX and SX tank farms and ancillary equipment removed • 100-year postclosure care
Potential Issues • Construction of 4 waste receiver facilities	*Potential Issues* • Retrieval leakage rate = 15,120 liters (4,000 gallons) per single-shell tank	*Potential Issues* • Construction in 200-East and 200-West Areas • Addition of bulk vitrification supplemental treatment capacity	*Potential Issues* • ILAW disposal on site • Tc-99 in ILAW and bulk vitrification • No waste acceptance criteria for HLW melters (stored indefinitely) • Tank-derived TRU waste disposal at WIPP	*Potential Issues* • Landfill closure of all single-shell tank farms with 1 percent residual waste and adjacent cribs and trenches (ditches) • Benefit of removing upper 4.6 meters (15 feet) of soil in BX and SX tank farms
Description • 2.2.1 • 2.2.2.1 • 2.5.2.3.1 • D.1 • E.1 *Impacts* • 4.1.1.4 LR • 4.1.4.4 AQ • 4.1.10.4 NO • 4.1.11.4 FA	*Description* • 2.2.2.1 • 2.5.2.3.1 • D.1 • E.1 *Impacts* • 4.1.4.4 AQ • 4.1.6.4 WR • 4.1.9.4 S • 4.1.10.4 NO • 4.1.11.4 FA • 5.1.1.4 GW • 5.1.2.4 HH • 5.1.3.4 LER	*Description* • 2.2.2.2 • 2.5.2.3.1 • D.1 • E.1 *Impacts* • 4.1.1.4 LR • 4.1.4.4 AQ • 4.1.6.4 WR • 4.1.7.4 ER • 4.1.9.4 S • 4.1.10.4 NO • 4.1.11.4 FA • 4.1.14.4 WM • 5.1.1.4 GW • 5.1.2.4 HH • 5.1.3.4 LER	*Description* • 2.2.2.3 • 2.5.2.3.1 • D.1 • E.1 *Impacts* • 4.1.1.4 LR • 4.1.4.4 AQ • 4.1.6.4 WR • 4.1.7.4 ER • 4.1.11.4 FA • 4.1.12.4 T • 4.1.14.4 WM • 5.1.1.4 GW • 5.1.2.4 HH • 5.1.3.4 LER	*Description* • 2.2.2.4 • 2.5.2.3.1 • E.1 *Impacts* • 4.1.4.4 AQ • 4.1.6.4 WR • 4.1.10.4 NO • 4.1.14.4 WM • 5.1.1.4 GW • 5.1.2.4 HH • 5.1.3.4 LER

Note: "Key Features" include alternative configurations, treatment dates, and assumptions. "Potential Issues" include topics that may be environmental impact drivers or are expected to be of interest to readers. "Description" identifies EIS Chapter 2 and Appendix D and E sections that further describe the Key Features, including the technologies evaluated. Chapter 2 provides an overview of the alternatives. Appendix D provides waste inventories, and Appendix E provides more-detailed information. "Impacts" identify EIS Chapter 4 and 5 sections that describe the impacts of the Key Features and/or Potential Issues.

Key: AQ=Air Quality; CSB=Canister Storage Building; EIS=environmental impact statement; ER=Ecological Resources; FA=Facility Accidents; GW=Groundwater; HH=Human Health; HLW=high-level radioactive waste; IHLW=immobilized high-level radioactive waste; ILAW=immobilized low-activity waste; LAW=low-activity waste; LER=Long-Term Ecological Risk; LR=Land Resources; MTG=metric tons of glass; NO=Normal Operations; RCRA=Resource Conservation and Recovery Act; S=Socioeconomics; T=Transportation; Tc-99=technetium-99; TRU=transuranic; WIPP=Waste Isolation Pilot Plant; WM=Waste Management; WR=Water Resources; WTP=Waste Treatment Plant.

Table 4. Roadmap to the Tank Closure Alternatives *(continued)*

TANK CLOSURE ALTERNATIVE 3B: Existing WTP Vitrification with Nonthermal Supplemental Treatment (Cast Stone); Landfill Closure				
STORAGE	**RETRIEVAL**	**TREATMENT**	**DISPOSAL**	**CLOSURE**
Key Features • 4 waste receiver facilities • No new double-shell tanks	*Key Features* • 99 percent tank waste retrieval • Liquid-based retrieval technologies • Current leak detection technology • Retrieval leakage rate = 15,120 liters (4,000 gallons) per single-shell tank	*Key Features* • Waste treatment: 2018–2040 • 6 MTG per day (2 HLW melters) × 30 MTG per day (2 LAW melters) • Supplemental treatment (cast stone) • Tc-99 removal • No sulfate removal • Tank-derived TRU waste treatment	*Key Features* • ILAW disposal on site • IHLW storage includes CSB + 4 additional vaults	*Key Features* • Landfill closure (modified RCRA Subtitle C barrier) • Upper 4.6 meters (15 feet) of soil in BX and SX tank farms and ancillary equipment removed • 100-year postclosure care
Potential Issues • Construction of 4 waste receiver facilities	*Potential Issues* • Retrieval leakage rate = 120 liters (4,000 gallons) per single-shell tank	*Potential Issues* • Construction in 200-East and 200-West Areas • Addition of cast stone supplemental treatment capacity	*Potential Issues* • ILAW disposal on site • No waste acceptance criteria for HLW melters (stored indefinitely) • Tank-derived TRU waste disposal at WIPP	*Potential Issues* • Landfill closure of all single-shell tank farms with 1 percent residual waste and adjacent cribs and trenches (ditches) • Benefit of removing upper 4.6 meters (15 feet) of soil in BX and SX tank farms
Description • 2.2.1 • 2.2.2.1 • 2.5.2.3.2 • D.1 • E.1 *Impacts* • 4.1.1.5 LR • 4.1.4.5 AQ • 4.1.10.5 NO • 4.1.11.5 FA	*Description* • 2.2.2.1 • 2.5.2.3.2 • D.1 • E.1 *Impacts* • 4.1.4.5 AQ • 4.1.6.5 WR • 4.1.9.5 S • 4.1.10.5 NO • 4.1.11.5 FA • 5.1.1.5 GW • 5.1.2.5 HH • 5.1.3.5 LER	*Description* • 2.2.2.2 • 2.5.2.3.2 • D.1 • E.1 *Impacts* • 4.1.1.5 LR • 4.1.4.5 AQ • 4.1.6.5 WR • 4.1.7.5 ER • 4.1.9.5 S • 4.1.10.5 NO • 4.1.11.5 FA • 4.1.14.5 WM • 5.1.1.5 GW • 5.1.2.5 HH • 5.1.3.5 LER	*Description* • 2.2.2.3 • 2.5.2.3.2 • D.1 • E.1 *Impacts* • 4.1.1.5 LR • 4.1.4.5 AQ • 4.1.6.5 WR • 4.1.7.5 ER • 4.1.11.5 FA • 4.1.12.5 T • 4.1.14.5 WM • 5.1.1.5 GW • 5.1.2.5 HH • 5.1.3.5 LER	*Description* • 2.2.2.4 • 2.5.2.3.2 • E.1 *Impacts* • 4.1.4.5 AQ • 4.1.6.5 WR • 4.1.10.5 NO • 4.1.14.5 WM • 5.1.1.5 GW • 5.1.2.5 HH • 5.1.3.5 LER

Note: "Key Features" include alternative configurations, treatment dates, and assumptions. "Potential Issues" include topics that may be environmental impact drivers or are expected to be of interest to readers. "Description" identifies EIS Chapter 2 and Appendix D and E sections that further describe the Key Features, including the technologies evaluated. Chapter 2 provides an overview of the alternatives. Appendix D provides waste inventories, and Appendix E provides more-detailed information. "Impacts" identify EIS Chapter 4 and 5 sections that describe the impacts of the Key Features and/or Potential Issues.

Key: AQ=Air Quality; CSB=Canister Storage Building; EIS=environmental impact statement; ER=Ecological Resources; FA=Facility Accidents; GW=Groundwater; HH=Human Health; HLW=high-level radioactive waste; IHLW=immobilized high-level radioactive waste; ILAW=immobilized low-activity waste; LAW=low-activity waste; LER=Long-Term Ecological Risk; LR=Land Resources; MTG=metric tons of glass; NO=Normal Operations; RCRA=Resource Conservation and Recovery Act; S=Socioeconomics; T=Transportation; Tc-99=technetium-99; TRU=transuranic; WIPP=Waste Isolation Pilot Plant; WM=Waste Management; WR=Water Resources; WTP=Waste Treatment Plant.

Table 4. Roadmap to the Tank Closure Alternatives *(continued)*

TANK CLOSURE ALTERNATIVE 3C: Existing WTP Vitrification with Thermal Supplemental Treatment (Steam Reforming); Landfill Closure				
STORAGE	**RETRIEVAL**	**TREATMENT**	**DISPOSAL**	**CLOSURE**
Key Features • 4 waste receiver facilities • No new double-shell tanks	*Key Features* • 99 percent tank waste retrieval • Liquid-based retrieval technologies • Current leak detection technology • Retrieval leakage rate = 15,120 liters (4,000 gallons) per single-shell tank	*Key Features* • Waste treatment: 2018–2040 • 6 MTG per day (2 HLW melters) × 30 MTG per day (2 LAW melters) • Supplemental treatment (steam reforming) • No Tc-99 removal • No sulfate removal • Tank-derived TRU waste treatment	*Key Features* • ILAW disposal on site • IHLW storage includes CSB + 4 additional vaults	*Key Features* • Landfill closure (modified RCRA Subtitle C barrier) • Upper 4.6 meters (15 feet) of soil in BX and SX tank farms and ancillary equipment removed • 100-year postclosure care
Potential Issues • Construction of 4 waste receiver facilities	*Potential Issues* • Retrieval leakage rate = 15,120 liters (4,000 gallons) per single-shell tank	*Potential Issues* • Construction in 200-East and 200-West Areas • Addition of steam reforming supplemental treatment capacity	*Potential Issues* • ILAW disposal on site • Tc-99 in ILAW and steam reforming • No waste acceptance criteria for HLW melters (stored indefinitely) • Tank-derived TRU waste disposal at WIPP	*Potential Issues* • Landfill closure of all single-shell tank farms with 1 percent residual waste and adjacent cribs and trenches (ditches) • Benefit of removing upper 4.6 meters (15 feet) of soil in BX and SX tank farms
Description • 2.2.1 • 2.2.2.1 • 2.5.2.3.3 • D.1 • E.1 *Impacts* • 4.1.1.6 LR • 4.1.4.6 AQ • 4.1.10.6 NO • 4.1.11.6 FA	*Description* • 2.2.2.1 • 2.5.2.3.3 • D.1 • E.1 *Impacts* • 4.1.4.6 AQ • 4.1.6.6 WR • 4.1.9.6 S • 4.1.10.6 NO • 4.1.11.6 FA • 5.1.1.6 GW • 5.1.2.6 HH • 5.1.3.6 LER	*Description* • 2.2.2.2 • 2.5.2.3.3 • D.1 • E.1 *Impacts* • 4.1.1.6 LR • 4.1.4.6 AQ • 4.1.6.6 WR • 4.1.7.6 ER • 4.1.9.6 S • 4.1.10.6 NO • 4.1.11.6 FA • 4.1.14.6 WM • 5.1.1.6 GW • 5.1.2.6 HH • 5.1.3.6 LER	*Description* • 2.2.2.3 • 2.5.2.3.3 • D.1 • E.1 *Impacts* • 4.1.1.6 LR • 4.1.4.6 AQ • 4.1.6.6 WR • 4.1.7.6 ER • 4.1.11.6 FA • 4.1.12.6 T • 4.1.14.6 WM • 5.1.1.6 GW • 5.1.2.6 HH • 5.1.3.6 LER	*Description* • 2.2.2.4 • 2.5.2.3.3 • E.1 *Impacts* • 4.1.4.6 AQ • 4.1.6.6 WR • 4.1.10.6 NO • 4.1.14.6 WM • 5.1.1.6 GW • 5.1.2.6 HH • 5.1.3.6 LER

Note: "Key Features" include alternative configurations, treatment dates, and assumptions. "Potential Issues" include topics that may be environmental impact drivers or are expected to be of interest to readers. "Description" identifies EIS Chapter 2 and Appendix D and E sections that further describe the Key Features, including the technologies evaluated. Chapter 2 provides an overview of the alternatives. Appendix D provides waste inventories, and Appendix E provides more-detailed information. "Impacts" identify EIS Chapter 4 and 5 sections that describe the impacts of the Key Features and/or Potential Issues.

Key: AQ=Air Quality; CSB=Canister Storage Building; EIS=environmental impact statement; ER=Ecological Resources; FA=Facility Accidents; GW=Groundwater; HH=Human Health; HLW=high-level radioactive waste; IHLW=immobilized high-level radioactive waste; ILAW=immobilized low-activity waste; LAW=low-activity waste; LER=Long-Term Ecological Risk; LR=Land Resources; MTG=metric tons of glass; NO=Normal Operations; RCRA=Resource Conservation and Recovery Act; S=Socioeconomics; T=Transportation; Tc-99=technetium-99; TRU=transuranic; WIPP=Waste Isolation Pilot Plant; WM=Waste Management; WR=Water Resources; WTP=Waste Treatment Plant.

Table 4. Roadmap to the Tank Closure Alternatives *(continued)*

TANK CLOSURE ALTERNATIVE 4: Existing WTP Vitrification with Supplemental Treatment Technologies; Selective Clean Closure/Landfill Closure				
STORAGE	**RETRIEVAL**	**TREATMENT**	**DISPOSAL**	**CLOSURE**
Key Features • 4 waste receiver facilities • No new double-shell tanks	*Key Features* • 99.9 percent tank waste retrieval • Liquid-based retrieval technologies and new retrieval technology • Current leak detection technology • Retrieval leakage rate = 15,120 liters (4,000 gallons) per single-shell tank	*Key Features* • Waste treatment: 2018–2043 • 6 MTG per day (2 HLW melters) × 30 MTG per day (2 LAW melters) • Supplemental treatment (bulk vitrification and cast stone) • No Tc-99 removal • No sulfate removal • Tank-derived TRU waste treatment	*Key Features* • ILAW disposal on site • IHLW storage includes CSB + 5 additional vaults	*Key Features* • Landfill closure (modified RCRA Subtitle C barrier) • Clean closure of representative (BX and SX) tank farms • 100-year postclosure care of 10 single-shell tank farms
Potential Issues • Construction of 4 waste receiver facilities	*Potential Issues* • Retrieval leakage rate = 15,120 liters (4,000 gallons) per single-shell tank • Additional tank-cleaning process (chemical wash)	*Potential Issues* • Construction in 200-East and 200-West Areas • Addition of bulk vitrification and cast stone supplemental treatment capacity	*Potential Issues* • ILAW disposal on site • Tc-99 in ILAW, bulk vitrification, and cast stone • No waste acceptance criteria for HLW melters (stored indefinitely) • Onsite disposal of waste from clean closure of BX and SX tank farms • Tank-derived TRU waste disposal at WIPP	*Potential Issues* • Landfill closure of 10 single-shell tank farms with 0.1 percent residual waste and adjacent cribs and trenches (ditches)
Description • 2.2.1 • 2.2.2.1 • 2.5.2.4 • D.1 • E.1 *Impacts* • 4.1.1.7 LR • 4.1.4.7 AQ • 4.1.10.7 NO • 4.1.11.7 FA	*Description* • 2.2.2.1 • 2.5.2.4 • D.1 • E.1 *Impacts* • 4.1.4.7 AQ • 4.1.6.7 WR • 4.1.9.7 S • 4.1.10.7 NO • 4.1.11.7 FA • 5.1.1.7 GW • 5.1.2.7 HH • 5.1.3.7 LER	*Description* • 2.2.2.2 • 2.5.2.4 • D.1 • E.1 *Impacts* • 4.1.1.7 LR • 4.1.4.7 AQ • 4.1.6.7 WR • 4.1.7.7 ER • 4.1.9.7 S • 4.1.10.7 NO • 4.1.11.7 FA • 4.1.14.7 WM • 5.1.1.7 GW • 5.1.2.7 HH • 5.1.3.7 LER	*Description* • 2.2.2.3 • 2.5.2.4 • D.1 • E.1 *Impacts* • 4.1.1.7 LR • 4.1.4.7 AQ • 4.1.6.7 WR • 4.1.7.7 ER • 4.1.11.7 FA • 4.1.12.7 T • 4.1.14.7 WM • 5.1.1.7 GW • 5.1.2.7 HH • 5.1.3.7 LER	*Description* • 2.2.2.4 • 2.5.2.4 • E.1 *Impacts* • 4.1.4.7 AQ • 4.1.6.7 WR • 4.1.10.7 NO • 4.1.14.7 WM • 5.1.1.7 GW • 5.1.2.7 HH • 5.1.3.7 LER

Note: "Key Features" include alternative configurations, treatment dates, and assumptions. "Potential Issues" include topics that may be environmental impact drivers or are expected to be of interest to readers. "Description" identifies EIS Chapter 2 and Appendix D and E sections that further describe the Key Features, including the technologies evaluated. Chapter 2 provides an overview of the alternatives. Appendix D provides waste inventories, and Appendix E provides more-detailed information. "Impacts" identify EIS Chapter 4 and 5 sections that describe the impacts of the Key Features and/or Potential Issues.

Key: AQ=Air Quality; CSB=Canister Storage Building; EIS=environmental impact statement; ER=Ecological Resources; FA=Facility Accidents; GW=Groundwater; HH=Human Health; HLW=high-level radioactive waste; IHLW=immobilized high-level radioactive waste; ILAW=immobilized low-activity waste; LAW=low-activity waste; LER=Long-Term Ecological Risk; LR=Land Resources; MTG=metric tons of glass; NO=Normal Operations; RCRA=Resource Conservation and Recovery Act; S=Socioeconomics; T=Transportation; Tc-99=technetium-99; TRU=transuranic; WIPP=Waste Isolation Pilot Plant; WM=Waste Management; WR=Water Resources; WTP=Waste Treatment Plant.

Table 4. Roadmap to the Tank Closure Alternatives *(continued)*

TANK CLOSURE ALTERNATIVE 5: Expanded WTP Vitrification with Supplemental Treatment Technologies; Landfill Closure				
STORAGE	**RETRIEVAL**	**TREATMENT**	**DISPOSAL**	**CLOSURE**
Key Features • 4 waste receiver facilities • 4 new double-shell tanks	*Key Features* • 90 percent tank waste retrieval • Liquid-based retrieval technologies • Current leak detection technology • Retrieval leakage rate = 15,120 liters (4,000 gallons) per single-shell tank	*Key Features* • Waste treatment: 2018–2034 • 6 MTG per day (2 HLW melters) × 45 MTG per day (3 LAW melters) • Supplemental treatment (bulk vitrification and cast stone) • No Tc-99 removal • Sulfate removal • Tank-derived TRU waste treatment	*Key Features* • ILAW disposal on site • IHLW storage includes CSB + 5 additional vaults	*Key Features* • Landfill closure (Hanford barrier) • 100-year postclosure care
Potential Issues • Construction of 4 waste receiver facilities • Construction of 4 new double-shell tanks	*Potential Issues* • Retrieval leakage rate = 15,120 liters (4,000 gallons) per single-shell tank • Reduced tank retrieval volume	*Potential Issues* • Construction of expanded Waste Treatment Plant • Construction in 200-East and 200-West Areas • Addition of bulk vitrification and cast stone supplemental treatment capacity	*Potential Issues* • ILAW disposal on site • Tc-99 in ILAW, bulk vitrification, and cast stone • No waste acceptance criteria for HLW melters (stored indefinitely) • Disposal of sulfate grout waste form on site • Tank-derived TRU waste disposal at WIPP	*Potential Issues* • Landfill closure of all single-shell tank farms and adjacent cribs and trenches (ditches) using improved barrier • Increased waste residues remaining in closed tanks (10 percent)
Description • 2.2.1 • 2.2.2.1 • 2.5.2.5 • D.1 • E.1 *Impacts* • 4.1.1.8 LR • 4.1.4.8 AQ • 4.1.10.8 NO • 4.1.11.8 FA	*Description* • 2.2.2.1 • 2.5.2.5 • D.1 • E.1 *Impacts* • 4.1.4.8 AQ • 4.1.6.8 WR • 4.1.9.8 S • 4.1.10.8 NO • 4.1.11.8 FA • 5.1.1.8 GW • 5.1.2.8 HH • 5.1.3.8 LER	*Description* • 2.2.2.2 • 2.5.2.5 • D.1 • E.1 *Impacts* • 4.1.1.8 LR • 4.1.4.8 AQ • 4.1.6.8 WR • 4.1.7.8 ER • 4.1.9.8 S • 4.1.10.8 NO • 4.1.11.8 FA • 4.1.14.8 WM • 5.1.1.8 GW • 5.1.2.8 HH • 5.1.3.8 LER	*Description* • 2.2.2.3 • 2.5.2.5 • D.1 • E.1 *Impacts* • 4.1.1.8 LR • 4.1.4.8 AQ • 4.1.6.8 WR • 4.1.7.8 ER • 4.1.11.8 FA • 4.1.12.8 T • 4.1.14.8 WM • 5.1.1.8 GW • 5.1.2.8 HH • 5.1.3.8 LER	*Description* • 2.2.2.4 • 2.5.2.5 • E.1 *Impacts* • 4.1.4.8 AQ • 4.1.6.8 WR • 4.1.10.8 NO • 4.1.14.8 WM • 5.1.1.8 GW • 5.1.2.8 HH • 5.1.3.8 LER

Note: "Key Features" include alternative configurations, treatment dates, and assumptions. "Potential Issues" include topics that may be environmental impact drivers or are expected to be of interest to readers. "Description" identifies EIS Chapter 2 and Appendix D and E sections that further describe the Key Features, including the technologies evaluated. Chapter 2 provides an overview of the alternatives. Appendix D provides waste inventories, and Appendix E provides more-detailed information. "Impacts" identify EIS Chapter 4 and 5 sections that describe the impacts of the Key Features and/or Potential Issues.

Key: AQ=Air Quality; CSB=Canister Storage Building; EIS=environmental impact statement; ER=Ecological Resources; FA=Facility Accidents; GW=Groundwater; HH=Human Health; HLW=high-level radioactive waste; IHLW=immobilized high-level radioactive waste; ILAW=immobilized low-activity waste; LAW=low-activity waste; LER=Long-Term Ecological Risk; LR=Land Resources; MTG=metric tons of glass; NO=Normal Operations; S=Socioeconomics; T=Transportation; Tc-99=technetium-99; TRU=transuranic; WIPP=Waste Isolation Pilot Plant; WM=Waste Management; WR=Water Resources; WTP=Waste Treatment Plant.

Table 4. Roadmap to the Tank Closure Alternatives *(continued)*

TANK CLOSURE ALTERNATIVE 6A: All Vitrification/No Separations; Clean Closure (Base and Option Cases)									
STORAGE		**RETRIEVAL**		**TREATMENT**		**DISPOSAL**		**CLOSURE**	
Key Features • 84 new double-shell tanks (replacements)		*Key Features* • 99.9 percent tank waste retrieval • Liquid-based retrieval technologies and new retrieval technology • Current leak detection technology • Retrieval leakage rate = 15,120 liters (4,000 gallons) per single-shell tank		*Key Features* • Waste treatment: 2018–2163 • 15 MTG per day (5 HLW melters) • No Tc-99 removal • No sulfate removal • No tank-derived TRU waste treatment • No supplemental treatment technology		*Key Features* • IHLW storage includes CSB + 65 additional vaults and 148 replacements • IHLW tank debris storage • PPF glass disposed of on site		*Key Features* • Clean closure of single-shell tank farms and landfill closure (modified RCRA Subtitle C barrier) of adjacent cribs and trenches (ditches) (option includes clean closure of adjacent cribs and trenches [ditches]) • Future use	
Potential Issues • Construction of 84 new double-shell tanks • Extended operating period		*Potential Issues* • Retrieval leakage rate = 15,120 liters (4,000 gallons) per single-shell tank • Additional tank-cleaning process (chemical wash)		*Potential Issues* • Construction of additional IHLW Waste Treatment Plant capacity and replacements • All waste treated as HLW; large number of HLW containers • Extended operating period		*Potential Issues* • No waste acceptance criteria for HLW melters (stored indefinitely) • No waste acceptance criteria for HLW resulting from clean closure activities		*Potential Issues* • Clean closure	
Description • 2.2.1 • 2.2.2.1 • 2.5.2.6.1 • D.1 • E.1	*Impacts* • 4.1.1.9 LR • 4.1.4.9 AQ • 4.1.7.9 ER • 4.1.9.9 S • 4.1.10.9 NO • 4.1.11.9 FA	*Description* • 2.2.2.1 • 2.5.2.6.1 • D.1 • E.1	*Impacts* • 4.1.4.9 AQ • 4.1.6.9 WR • 4.1.9.9 S • 4.1.10.9 NO • 4.1.11.9 FA • 5.1.1.9 GW • 5.1.2.9 HH • 5.1.3.9 LER	*Description* • 2.2.2.2 • 2.5.2.6.1 • D.1 • E.1	*Impacts* • 4.1.1.9 LR • 4.1.4.9 AQ • 4.1.6.9 WR • 4.1.7.9 ER • 4.1.9.9 S • 4.1.10.9 NO • 4.1.11.9 FA • 4.1.14.9 WM • 5.1.1.9 GW • 5.1.2.9 HH • 5.1.3.9 LER	*Description* • 2.2.2.3 • 2.5.2.6.1 • D.1 • E.1	*Impacts* • 4.1.1.9 LR • 4.1.4.9 AQ • 4.1.6.9 WR • 4.1.7.9 ER • 4.1.9.9 S • 4.1.11.9 FA • 4.1.12.9 T • 4.1.14.9 WM • 5.1.1.9 GW • 5.1.2.9 HH • 5.1.3.9 LER	*Description* • 2.2.2.4 • 2.5.2.6.1 • E.1	*Impacts* • 4.1.4.9 AQ • 4.1.6.9 WR • 4.1.9.9 S • 4.1.10.9 NO • 4.1.14.9 WM • 5.1.1.9 GW • 5.1.2.9 HH • 5.1.3.9 LER

Note: "Key Features" include alternative configurations, treatment dates, and assumptions. "Potential Issues" include topics that may be environmental impact drivers or are expected to be of interest to readers. "Description" identifies EIS Chapter 2 and Appendix D and E sections that further describe the Key Features, including the technologies evaluated. Chapter 2 provides an overview of the alternatives. Appendix D provides waste inventories, and Appendix E provides more-detailed information. "Impacts" identify EIS Chapter 4 and 5 sections that describe the impacts of the Key Features and/or Potential Issues.

Key: AQ=Air Quality; CSB=Canister Storage Building; EIS=environmental impact statement; ER=Ecological Resources; FA=Facility Accidents; GW=Groundwater; HH=Human Health; HLW=high-level radioactive waste; IHLW=immobilized high-level radioactive waste; LER=Long-Term Ecological Risk; LR=Land Resources; MTG=metric tons of glass; NO=Normal Operations; PPF=Preprocessing Facility; RCRA=Resource Conservation and Recovery Act; S=Socioeconomics; T=Transportation; Tc-99=technetium-99; TRU=transuranic; WM=Waste Management; WR=Water Resources.

Table 4. Roadmap to the Tank Closure Alternatives *(continued)*

<table>
<tr><th colspan="10">TANK CLOSURE ALTERNATIVE 6B:
All Vitrification with Separations; Clean Closure (Base and Option Cases)</th></tr>
<tr><th colspan="2">STORAGE</th><th colspan="2">RETRIEVAL</th><th colspan="2">TREATMENT</th><th colspan="2">DISPOSAL</th><th colspan="2">CLOSURE</th></tr>
<tr>
<td colspan="2">Key Features
• 4 waste receiver facilities
• No new double-shell tanks</td>
<td colspan="2">Key Features
• 99.9 percent tank waste retrieval
• Liquid-based retrieval technologies and new retrieval technology
• Current leak detection technology
• Retrieval leakage rate = 15,120 liters (4,000 gallons) per single-shell tank</td>
<td colspan="2">Key Features
• Waste treatment: 2018–2043
• 6 MTG per day (2 HLW melters) × 90 MTG per day (6 LAW melters)
• No Tc-99 removal
• No sulfate removal
• No tank-derived TRU waste treatment
• No supplemental treatment technology</td>
<td colspan="2">Key Features
• No ILAW disposal on site
• ILAW storage facilities
• IHLW storage includes CSB + 4 additional vaults
• IHLW tank debris storage
• PPF glass disposed of on site</td>
<td colspan="2">Key Features
• Clean closure of single-shell tank farms and landfill closure (modified RCRA Subtitle C barrier) of adjacent cribs and trenches (ditches) (option includes clean closure of adjacent cribs and trenches [ditches])
• Future use</td>
</tr>
<tr>
<td colspan="2">Potential Issues
• Construction of 4 waste receiver facilities</td>
<td colspan="2">Potential Issues
• Retrieval leakage rate = 15,120 liters (4,000 gallons) per single-shell tank
• Additional tank-cleaning process (chemical wash)</td>
<td colspan="2">Potential Issues
• Construction of expanded Waste Treatment Plant
• All waste treated as HLW; large number of ILAW containers</td>
<td colspan="2">Potential Issues
• No waste acceptance criteria for HLW and LAW melters (stored indefinitely)
• No waste acceptance criteria for HLW resulting from clean closure activities
• No ILAW disposition</td>
<td colspan="2">Potential Issues
• Clean closure</td>
</tr>
<tr>
<td>Description
• 2.2.1
• 2.2.2.1
• 2.5.2.6.2
• D.1
• E.1</td>
<td>Impacts
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• 4.1.4.10 AQ
• 4.1.7.10 ER
• 4.1.9.10 S
• 4.1.10.10 NO
• 4.1.11.10 FA</td>
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• D.1
• E.1</td>
<td>Impacts
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• 4.1.6.10 WR
• 4.1.9.10 S
• 4.1.10.10 NO
• 4.1.11.10 FA
• 5.1.1.10 GW
• 5.1.2.10 HH
• 5.1.3.10 LER</td>
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• 2.5.2.6.2
• D.1
• E.1</td>
<td>Impacts
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• 4.1.4.10 AQ
• 4.1.6.10 WR
• 4.1.7.10 ER
• 4.1.9.10 S
• 4.1.10.10 NO
• 4.1.11.10 FA
• 4.1.14.10 WM
• 5.1.1.10 GW
• 5.1.2.10 HH
• 5.1.3.10 LER</td>
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• 2.5.2.6.2
• D.1
• E.1</td>
<td>Impacts
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• 4.1.4.10 AQ
• 4.1.6.10 WR
• 4.1.7.10 ER
• 4.1.9.10 S
• 4.1.11.10 FA
• 4.1.12.10 T
• 4.1.14.10 WM
• 5.1.1.10 GW
• 5.1.2.10 HH
• 5.1.3.10 LER</td>
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• E.1</td>
<td>Impacts
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• 4.1.6.10 WR
• 4.1.9.10 S
• 4.1.10.10 NO
• 4.1.14.10 WM
• 5.1.1.10 GW
• 5.1.2.10 HH
• 5.1.3.10 LER</td>
</tr>
</table>

Note: "Key Features" include alternative configurations, treatment dates, and assumptions. "Potential Issues" include topics that may be environmental impact drivers or are expected to be of interest to readers. "Description" identifies EIS Chapter 2 and Appendix D and E sections that further describe the Key Features, including the technologies evaluated. Chapter 2 provides an overview of the alternatives. Appendix D provides waste inventories, and Appendix E provides more-detailed information. "Impacts" identify EIS Chapter 4 and 5 sections that describe the impacts of the Key Features and/or Potential Issues.

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Table 4. Roadmap to the Tank Closure Alternatives *(continued)*

TANK CLOSURE ALTERNATIVE 6C: All Vitrification with Separations; Landfill Closure									
STORAGE		**RETRIEVAL**		**TREATMENT**		**DISPOSAL**		**CLOSURE**	
Key Features • 4 waste receiver facilities • No new double-shell tanks		*Key Features* • 99 percent tank waste retrieval • Liquid-based retrieval technologies • Current leak detection technology • Retrieval leakage rate = 15,120 liters (4,000 gallons) per single-shell tank		*Key Features* • Waste treatment: 2018–2043 • 6 MTG per day (2 HLW melters) × 90 MTG per day (6 LAW melters) • No Tc-99 removal • No sulfate removal • No tank-derived TRU waste treatment		*Key Features* • No ILAW disposal on site • ILAW storage facilities • IHLW storage includes CSB + 4 additional vaults		*Key Features* • Landfill closure (modified RCRA Subtitle C barrier) • Upper 4.6 meters (15 feet) of soil in BX and SX tank farms and ancillary equipment removed • 100-year postclosure care	
Potential Issues • Construction of 4 waste receiver facilities		*Potential Issues* • Retrieval leakage rate = 15,120 liters (4,000 gallons) per single-shell tank		*Potential Issues* • Construction of expanded Waste Treatment Plant • All waste treated as HLW; large number of ILAW containers		*Potential Issues* • No waste acceptance criteria for HLW and LAW melters (stored indefinitely) • No ILAW disposition		*Potential Issues* • Landfill closure of all single-shell tank farms with 1 percent residual waste	
Description • 2.2.1 • 2.2.2.1 • 2.5.2.6.3 • D.1 • E.1	*Impacts* • 4.1.1.11 LR • 4.1.4.11 AQ • 4.1.10.11 NO • 4.1.11.11 FA	*Description* • 2.2.2.1 • 2.5.2.6.3 • D.1 • E.1	*Impacts* • 4.1.4.11 AQ • 4.1.6.11 WR • 4.1.9.11 S • 4.1.10.11 NO • 4.1.11.11 FA • 5.1.1.11 GW • 5.1.2.11 HH • 5.1.3.11 LER	*Description* • 2.2.2.2 • 2.5.2.6.3 • D.1 • E.1	*Impacts* • 4.1.1.11 LR • 4.1.4.11 AQ • 4.1.6.11 WR • 4.1.7.11 ER • 4.1.9.11 S • 4.1.10.11 NO • 4.1.11.11 FA • 4.1.14.11 WM • 5.1.1.11 GW • 5.1.2.11 HH • 5.1.3.11 LER	*Description* • 2.2.2.3 • 2.5.2.6.3 • D.1 • E.1	*Impacts* • 4.1.1.11 LR • 4.1.4.11 AQ • 4.1.6.11 WR • 4.1.7.11 ER • 4.1.9.11 S • 4.1.11.11 FA • 4.1.12.11 T • 4.1.14.11WM • 5.1.1.11 GW • 5.1.2.11 HH • 5.1.3.11 LER	*Description* • 2.2.2.4 • 2.5.2.6.3 • E.1	*Impacts* • 4.1.4.11 AQ • 4.1.6.11 WR • 4.1.10.11 NO • 4.1.14.11 WM • 5.1.1.11 GW • 5.1.2.11 HH • 5.1.3.11 LER

Note: "Key Features" include alternative configurations, treatment dates, and assumptions. "Potential Issues" include topics that may be environmental impact drivers or are expected to be of interest to readers. "Description" identifies EIS Chapter 2 and Appendix D and E sections that further describe the Key Features, including the technologies evaluated. Chapter 2 provides an overview of the alternatives. Appendix D provides waste inventories, and Appendix E provides more-detailed information. "Impacts" identify EIS Chapter 4 and 5 sections that describe the impacts of the Key Features and/or Potential Issues.

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Table 5. Roadmap to the FFTF Decommissioning Alternatives

<table>
<tr><th colspan="6">FFTF DECOMMISSIONING ALTERNATIVE 1:
No Action</th></tr>
<tr><th colspan="2">FACILITY DISPOSITION</th><th colspan="2">DISPOSITION OF REMOTE-HANDLED SPECIAL COMPONENTS</th><th colspan="2">DISPOSITION OF BULK SODIUM</th></tr>
<tr><td colspan="2">Key Features
• FFTF Reactor Containment Building and buildings in Property Protected Area maintained under administrative control
• Reactor vessel, piping systems, special components, and tanks left in place</td><td colspan="2">Key Features
• Remote-handled special components left in place</td><td colspan="2">Key Features
• Bulk sodium from FFTF deactivation activities stored as a solid in tanks in the Sodium Storage Facility
• Hallam Reactor and Sodium Reactor Experiment sodium remain in storage</td></tr>
<tr><td colspan="2">Potential Issues
• FFTF Reactor Containment Building not decommissioned as planned</td><td colspan="2">Potential Issues
• No final disposition of remote-handled special components</td><td colspan="2">Potential Issues
• No final disposition of stored sodium</td></tr>
<tr><td>Description
• 2.3.1
• 2.3.2
• 2.3.3.1
• 2.5.3.1
• D.2.2
• E.2</td><td>Impacts
• 4.2.1.1 LR
• 4.2.4.1 AQ
• 4.2.6.1 WR
• 4.2.7.1 ER
• 4.2.10.1 NO
• 4.2.11.1 FA
• 5.2.1.1 GW
• 5.2.2.1 HH
• 5.2.3.1 LER</td><td>Description
• 2.3.3.2
• 2.5.3.1
• D.2.2
• E.2</td><td>Impacts
• None</td><td>Description
• 2.3.3.3
• 2.5.3.1
• D.2.2
• E.2</td><td>Impacts
• None</td></tr>
</table>

Note: "Key Features" include alternative configurations and assumptions. "Potential Issues" include topics that may be environmental impact drivers or are expected to be of interest to readers. "Description" identifies EIS Chapter 2 and Appendix D and E sections that further describe the Key Features, including the technologies evaluated. Chapter 2 provides an overview of the alternatives. Appendix D provides waste inventories, and Appendix E provides more-detailed information. "Impacts" identify EIS Chapter 4 and 5 sections that describe the impacts of the Key Features and/or Potential Issues.

Key: AQ=Air Quality; EIS=environmental impact statement; ER=Ecological Resources; FA=Facility Accidents; FFTF=Fast Flux Test Facility; GW=Groundwater; HH=Human Health; LER=Long-Term Ecological Risk; LR=Land Resources; NO=Normal Operations; WR=Water Resources.

Table 5. Roadmap to the FFTF Decommissioning Alternatives *(continued)*

<table>
<tr><th colspan="6">FFTF DECOMMISSIONING ALTERNATIVE 2:
Entombment</th></tr>
<tr><th colspan="2">FACILITY DISPOSITION</th><th colspan="2">DISPOSITION OF REMOTE-HANDLED SPECIAL COMPONENTS</th><th colspan="2">DISPOSITION OF BULK SODIUM</th></tr>
<tr><td colspan="2">Key Features
• FFTF Reactor Containment Building and buildings in Property Protected Area decommissioned
• All above-grade structures dismantled and filled
• Special components and small-diameter pipes removed
• Reactor vessel left in place and grouted
• Modified RCRA Subtitle C barrier placed over filled area</td><td colspan="2">Key Features
• Remote-handled special components removed and processed for disposal
• Hanford Option: processing of remote-handled special components occurs at a new facility at the Hanford Site
• Idaho Option: processing of remote-handled special components at Idaho National Laboratory's Idaho Nuclear Technology and Engineering Center</td><td colspan="2">Key Features
• Bulk sodium from FFTF deactivation activities, SRE sodium, and Hallam Reactor sodium converted to a caustic (sodium hydroxide) solution for use in the Waste Treatment Plant pretreatment process
• Hanford Reuse Option: conversion of sodium at a new facility at the Hanford Site
• Idaho Reuse Option: conversion of sodium at the Sodium Processing Facility at Idaho National Laboratory's Materials and Fuels Complex</td></tr>
<tr><td colspan="2">Potential Issues
• Reactor vessel left in place
• Postclosure care required after placement of barrier (not released for unrestricted use)</td><td colspan="2">Potential Issues
• Transportation of special components to Idaho
• Building of new facility at the Hanford Site</td><td colspan="2">Potential Issues
• Transportation of sodium to Idaho
• Building of new facility at the Hanford Site</td></tr>
<tr><td>Description
• 2.3.1
• 2.3.2
• 2.3.3.1
• 2.5.3.2
• D.2.3
• E.2</td><td>Impacts
• 4.2.1.2 LR
• 4.2.4.2 AQ
• 4.2.6.2 WR
• 4.2.7.2 ER
• 4.2.9.2 S
• 4.2.10.2 NO
• 4.2.11.2 FA
• 4.2.12.2 T
• 4.2.14.2 WM
• 5.2.1.2 GW
• 5.2.2.2 HH
• 5.2.3.2 LER</td><td>Description
• 2.3.3.2
• 2.5.3.2
• D.2.3
• E.2</td><td>Impacts
• 4.2.1.2 LR
• 4.2.10.2 NO
• 4.2.11.2 FA
• 4.2.12.2 T
• 4.2.14.2 WM
• 5.2.1.2 GW
• 5.2.2.2 HH
• 5.2.3.2 LER</td><td>Description
• 2.3.3.3
• 2.5.3.2
• D.2.3
• E.2</td><td>Impacts
• 4.2.1.2 LR
• 4.2.6.2 WR
• 4.2.10.2 NO
• 4.2.11.2 FA
• 4.2.12.2 T
• 4.2.14.2 WM
• 5.2.1.2 GW
• 5.2.2.2 HH
• 5.2.3.2 LER</td></tr>
</table>

Note: "Key Features" include alternative configurations and assumptions. "Potential Issues" include topics that may be environmental impact drivers or are expected to be of interest to readers. "Description" identifies EIS Chapter 2 and Appendix D and E sections that further describe the Key Features, including the technologies evaluated. Chapter 2 provides an overview of the alternatives. Appendix D provides waste inventories, and Appendix E provides more-detailed information. "Impacts" identify EIS Chapter 4 and 5 sections that describe the impacts of the Key Features and/or Potential Issues.

Key: AQ=Air Quality; EIS=environmental impact statement; ER=Ecological Resources; FA=Facility Accidents; FFTF=Fast Flux Test Facility; GW=Groundwater; HH=Human Health; LER=Long-Term Ecological Risk; LR=Land Resources; NO=Normal Operations; RCRA=Resource Conservation and Recovery Act; S=Socioeconomics; SRE=Sodium Reactor Experiment; T=Transportation; WM=Waste Management; WR=Water Resources.

Table 5. Roadmap to the FFTF Decommissioning Alternatives *(continued)*

FFTF DECOMMISSIONING ALTERNATIVE 3: Removal					
FACILITY DISPOSITION		**DISPOSITION OF REMOTE-HANDLED SPECIAL COMPONENTS**		**DISPOSITION OF BULK SODIUM**	
Key Features • FFTF Reactor Containment Building and buildings in Property Protected Area decommissioned • Reactor Containment Building and support facilities demolished to 0.91 meters (3 feet) below grade • Remote-handled special components and small-diameter pipes removed • Remaining portion of buildings backfilled and area revegetated		*Key Features* • Remote-handled special components removed and processed for disposal • Hanford Option: processing of remote-handled special components at a new facility at the Hanford Site • Idaho Option: processing of remote-handled special components at Idaho National Laboratory's Idaho Nuclear Technology and Engineering Center		*Key Features* • Bulk sodium from FFTF deactivation activities, SRE sodium, and Hallam Reactor sodium converted to a caustic (sodium hydroxide) solution for use in the Waste Treatment Plant pretreatment process • Hanford Reuse Option: conversion of sodium at a new facility at the Hanford Site • Idaho Reuse Option: conversion of sodium at the Sodium Processing Facility at Idaho National Laboratory's Materials and Fuels Complex	
Potential Issues • Reactor vessel disposed of on site • Revegetated area may still require postclosure care		*Potential Issues* • Transportation of special components to Idaho • Building of new facility at the Hanford Site		*Potential Issues* • Transportation of sodium to Idaho • Building of new facility at the Hanford Site	
Description • 2.3.1 • 2.3.2 • 2.3.3.1 • 2.5.3.3 • D.2.4 • E.2	*Impacts* • 4.2.1.3 LR • 4.2.4.3 AQ • 4.2.6.3 WR • 4.2.7.3 ER • 4.2.9.3 S • 4.2.10.3 NO • 4.2.11.3 FA • 4.2.12.3 T • 4.2.14.3 WM • 5.2.1.3 GW • 5.2.2.3 HH • 5.2.3.3 LER	*Description* • 2.3.3.2 • 2.5.3.3 • D.2.4 • E.2	*Impacts* • 4.2.1.3 LR • 4.2.4.3 AQ • 4.2.9.3 S • 4.2.10.3 NO • 4.2.11.3 FA • 4.2.12.3 T • 4.2.14.3 WM • 5.2.1.3 GW • 5.2.2.3 HH • 5.2.3.3 LER	*Description* • 2.3.3.3 • 2.5.3.3 • D.2.4 • E.2	*Impacts* • 4.2.1.3 LR • 4.2.4.3 AQ • 4.2.9.3 S • 4.2.10.3 NO • 4.2.11.3 FA • 4.2.12.3 T • 4.2.14.3 WM • 5.2.1.3 GW • 5.2.2.3 HH • 5.2.3.3 LER

Note: "Key Features" include alternative configurations and assumptions. "Potential Issues" include topics that may be environmental impact drivers or are expected to be of interest to readers. "Description" identifies EIS Chapter 2 and Appendix D and E sections that further describe the Key Features, including the technologies evaluated. Chapter 2 provides an overview of the alternatives. Appendix D provides waste inventories, and Appendix E provides more-detailed information. "Impacts" identify EIS Chapter 4 and 5 sections that describe the impacts of the Key Features and/or Potential Issues.

Key: AQ=Air Quality; EIS=environmental impact statement; ER=Ecological Resources; FA=Facility Accidents; FFTF=Fast Flux Test Facility; GW=Groundwater; HH=Human Health; LER=Long-Term Ecological Risk; LR=Land Resources; NO=Normal Operations; S=Socioeconomics; SRE=Sodium Reactor Experiment; T=Transportation; WM=Waste Management; WR=Water Resources.

Table 6. Roadmap to the Waste Management Alternatives

WASTE MANAGEMENT ALTERNATIVE 1: No Action					
STORAGE AND TREATMENT		**DISPOSAL**		**CLOSURE**	
Key Features • Continued storage/treatment of LLW, MLLW, and TRU waste at the CWC to process for disposal • Continued storage/treatment of LLW, MLLW, and TRU waste at WRAP and the T Plant complex • No offsite shipments of TRU waste or LLW/MLLW		*Key Features* • Continued disposal of LLW and MLLW in lined trenches 31 and 34 in LLBG 218-W-5 • Discontinued construction of IDF-East		*Key Features* • Administrative control for 100 years after operations cease	
Potential Issues • No additional storage capacity for onsite waste		*Potential Issues* • No additional disposal capacity for on- or offsite waste		*Potential Issues* • No issues	
Description • 2.4.1 • 2.4.2 • 2.5.4.1 • D.3.2 • E.3	*Impacts* • 4.3.1.1 LR • 4.3.4.1 AQ • 4.3.6.1 WR • 4.3.9.1 S • 4.3.10.1 NO • 4.3.11.1 FA • 4.3.12.1 T • 4.3.14.1 WM • 5.3.1.1 GW • 5.3.2.1 HH • 5.3.3.1 LER	*Description* • 2.4.1 • 2.4.2 • 2.5.4.1 • E.3	*Impacts* • 4.3.1.1 LR • 4.3.4.1 AQ • 4.3.6.1 WR • 4.3.10.1 NO • 4.3.11.1 FA • 4.3.12.1 T • 4.3.14.1 WM • 5.3.1.1 GW • 5.3.2.1 HH • 5.3.3.1 LER	*Description* • 2.4.2.5 • 2.5.4.1	*Impacts* • 4.3.4.1 AQ • 4.3.6.1 WR • 4.3.12.1 T • 4.3.14.1 WM • 5.3.1.1 GW • 5.3.2.1 HH • 5.3.3.1 LER

Note: "Key Features" include alternative configurations, treatment dates, and assumptions. "Potential Issues" include topics that may be environmental impact drivers or are expected to be of interest to readers. "Description" identifies EIS Chapter 2 and Appendix D and E sections that further describe the Key Features, including the technologies evaluated. Chapter 2 provides an overview of the alternatives. Appendix D provides waste inventories, and Appendix E provides more-detailed information. "Impacts" identify EIS Chapter 4 and 5 sections that describe the impacts of the Key Features and/or Potential Issues.

Key: AQ=Air Quality; CWC=Central Waste Complex; EIS=environmental impact statement; FA=Facility Accidents; GW=Groundwater; HH=Human Health; IDF-East=200-East Area Integrated Disposal Facility; LER=Long-Term Ecological Risk; LLBG=low-level radioactive waste burial ground; LLW=low-level radioactive waste; LR=Land Resources; MLLW=mixed low-level radioactive waste; NO=Normal Operations; S=Socioeconomics; T=Transportation; TRU=transuranic; WM=Waste Management; WR=Water Resources; WRAP=Waste Receiving and Processing Facility.

Table 6. Roadmap to the Waste Management Alternatives *(continued)*

WASTE MANAGEMENT ALTERNATIVE 2: Disposal in IDF, 200-East Area Only					
STORAGE AND TREATMENT		**DISPOSAL**		**CLOSURE**	
Key Features • Continued storage/treatment of LLW, MLLW, and TRU waste at the CWC, WRAP, and T Plant • Construction of expansions of the CWC, WRAP, and T Plant complex • No offsite shipments of TRU waste • Offsite shipments of LLW and MLLW		*Key Features* • Continued disposal of LLW and MLLW in lined trenches 31 and 34 in LLBG 218-W-5 • IDF construction in 200-East Area for tank, onsite non-CERCLA, FFTF decommissioning, waste management, and offsite LLW and MLLW • RPPDF construction in 200 Areas for lightly contaminated equipment and soils resulting from tank-related closure activities		*Key Features* • Modified RCRA Subtitle C barriers for IDF-East and the proposed RPPDF and 100 years of postclosure care	
Potential Issues • Transportation of offsite waste		*Potential Issues* • Disposal of offsite waste • Disposal of tank closure treated waste forms		*Potential Issues* • No issues	
Description • 2.4.1 • 2.4.2 • 2.5.4.2 • D.3.3 • E.3	*Impacts* • 4.3.1.2 LR • 4.3.4.2 AQ • 4.3.5.2 GS • 4.3.6.2 WR • 4.3.7.2 ER • 4.3.9.2 S • 4.3.10.2 NO • 4.3.11.2 FA • 4.3.12.2 T • 4.3.14.2 WM • 5.3.1.2 GW • 5.3.2.2 HH • 5.3.3.2 LER	*Description* • 2.4.1 • 2.4.2 • 2.5.4.2 • E.3	*Impacts* • 4.3.1.2 LR • 4.3.4.2 AQ • 4.3.5.2 GS • 4.3.6.2 WR • 4.3.7.2 ER • 4.3.9.2 S • 4.3.10.2 NO • 4.3.11.2 FA • 4.3.12.2 T • 4.3.14.2 WM • 5.3.1.2 GW • 5.3.2.2 HH • 5.3.3.2 LER	*Description* • 2.4.2.5 • 2.5.4.2	*Impacts* • 4.3.1.2 LR • 4.3.4.2 AQ • 4.3.5.2 GS • 4.3.6.2 WR • 4.3.7.2 ER • 4.3.14.2 WM • 5.3.1.2 GW • 5.3.2.2 HH • 5.3.3.2 LER

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Key: AQ=Air Quality; CERCLA=Comprehensive Environmental Response, Compensation, and Liability Act; CWC=Central Waste Complex; EIS=environmental impact statement; ER=Ecological Resources; FA=Facility Accidents; FFTF=Fast Flux Test Facility; GS=Geology and Soils; GW=Groundwater; HH=Human Health; IDF=Integrated Disposal Facility; IDF-East=200-East Area Integrated Disposal Facility; LER=Long-Term Ecological Risk; LLBG=low-level radioactive waste burial ground; LLW=low-level radioactive waste; LR=Land Resources; MLLW=mixed low-level radioactive waste; NO=Normal Operations; RCRA=Resource Conservation and Recovery Act; RPPDF=River Protection Project Disposal Facility; S=Socioeconomics; T=Transportation; TRU=transuranic; WM=Waste Management; WR=Water Resources; WRAP=Waste Receiving and Processing Facility.

Table 6. Roadmap to the Waste Management Alternatives *(continued)*

<table>
<tr><th colspan="4">WASTE MANAGEMENT ALTERNATIVE 3:
Disposal in IDF, 200-East and 200-West Areas</th></tr>
<tr><th colspan="2">STORAGE AND TREATMENT</th><th colspan="2">DISPOSAL</th><th colspan="2">CLOSURE</th></tr>
<tr><td colspan="2">Key Features
• Continued storage/treatment of LLW, MLLW, and TRU waste at the CWC, WRAP, and T Plant
• Construction of expansions of the CWC, WRAP, and T Plant complex
• No offsite shipments of TRU waste
• Offsite shipments of LLW and MLLW</td><td colspan="2">Key Features
• Continued disposal of LLW and MLLW in lined trenches 31 and 34 in LLBG 218-W-5
• IDF construction in 200-East Area for tank waste
• IDF construction in 200-West Area for onsite non-CERCLA, FFTF decommissioning, waste management, and offsite LLW and MLLW
• RPPDF construction in 200 Areas for lightly contaminated equipment and soils resulting from tank-related closure activities</td><td colspan="2">Key Features
• Modified RCRA Subtitle C barriers for IDF-East and the proposed RPPDF and 100 years of postclosure care</td></tr>
<tr><td colspan="2">Potential Issues
• Transportation of offsite waste</td><td colspan="2">Potential Issues
• Two onsite disposal locations
• Disposal of offsite waste
• Disposal of tank closure treated waste forms</td><td colspan="2">Potential Issues
• No issues</td></tr>
<tr><td>Description
• 2.4.1
• 2.4.2
• 2.5.4.3
• D.3.4
• E.3</td><td>Impacts
• 4.3.1.3 LR
• 4.3.4.3 AQ
• 4.3.5.3 GS
• 4.3.6.3 WR
• 4.3.7.3 ER
• 4.3.9.3 S
• 4.3.10.3 NO
• 4.3.11.3 FA
• 4.3.12.3 T
• 4.3.14.3 WM
• 5.3.1.3 GW
• 5.3.2.3 HH
• 5.3.3.3 LER</td><td>Description
• 2.4.1
• 2.4.2
• 2.5.4.3
• E.3</td><td>Impacts
• 4.3.1.3 LR
• 4.3.4.3 AQ
• 4.3.5.3 GS
• 4.3.6.3 WR
• 4.3.7.3 ER
• 4.3.9.3 S
• 4.3.10.3 NO
• 4.3.11.3 FA
• 4.3.12.3 T
• 4.3.14.3 WM
• 5.3.1.3 GW
• 5.3.2.3 HH
• 5.3.3.3 LER</td><td>Description
• 2.4.1
• 2.4.2
• 2.4.2.5
• 2.5.4.3</td><td>Impacts
• 4.3.1.3 LR
• 4.3.4.3 AQ
• 4.3.5.3 GS
• 4.3.6.3 WR
• 4.3.7.3 ER
• 4.3.14.3 WM
• 5.3.1.3 GW
• 5.3.2.3 HH
• 5.3.3.3 LER</td></tr>
</table>

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ORGANIZATION OF THIS *TC & WM EIS*

This *TC & WM EIS* is organized as described below.

- **Summary—**The Summary, a separate volume, summarizes the key information provided in this *TC & WM EIS*. It includes the background on, and regulatory history of, past activities at Hanford; the purpose and need for agency action; a characterization of the comments on the *Draft TC & WM EIS*; a description of the changes since the *Draft TC & WM EIS* publication; a description and comparison of the alternatives; an overview of the tank farm systems, FFTF decommissioning activities, and Solid Waste Operations Complex; technologies and options not evaluated; summaries of potential short- and long-term impacts of the alternatives, key environmental findings, mitigation measures, costs of the alternatives, and the Preferred Alternatives; and a guide to the contents of this EIS.

- **Chapter 1—Proposed Actions: Background, Purpose and Need.** Chapter 1 provides background information regarding the preparation of this *TC & WM EIS*, including the purpose and need for agency action regarding SST system closure, FFTF decommissioning, and final waste disposition; the cooperating agencies; the decisions to be made based on the EIS analyses; a summary of the issues identified during scoping; a description of the changes since the *Draft TC & WM EIS* publication; the scope of this EIS, including brief summaries of the alternatives; the relationship of the proposed actions to other actions or programs; and the organization of this EIS.

- **Chapter 2—Proposed Actions and Alternatives.** Chapter 2 describes the alternatives evaluated in this EIS and identifies the Preferred Alternatives. This chapter also includes a description of the processes and facilities that could be used to implement each of the alternatives and a summary of the short- and long-term environmental impacts, key environmental findings, and cost estimates of each alternative.

- **Chapter 3—Affected Environment.** Chapter 3 describes the existing Hanford and INL environments that may be affected by the alternatives under consideration. In general, Hanford as a whole is described first, followed by the 200 and 400 Areas. The existing environments described include human, air, and surface and subsurface media that could be affected by activities related to tank waste storage, retrieval, treatment, and disposal; SST system closure; FFTF decommissioning; and waste management.

- **Chapter 4—Short-Term Environmental Consequences.** Chapter 4 discusses the short-term environmental impacts associated with the various EIS alternatives for tank closure, FFTF decommissioning, and waste management. Impacts produced by construction, operations, decontamination, and decommissioning are considered.

- **Chapter 5—Long-Term Environmental Consequences.** Chapter 5 discusses the long-term environmental impacts associated with the various EIS alternatives for tank closure, FFTF decommissioning, and waste management, focusing on long-term environmental impacts on groundwater and human health, as well as ecological risks.

- **Chapter 6—Cumulative Impacts.** Chapter 6 discusses the cumulative impacts associated with the various EIS alternatives.

- **Chapter 7—Environmental Consequences and Mitigation Discussion.** Chapter 7 discusses possible measures to mitigate impacts identified in Chapters 4, 5, and 6; unavoidable, adverse environmental impacts; irreversible and irretrievable resource commitments; and the relationship between short-term use of the environment and long-term productivity.

- **Chapter 8—Potentially Applicable Laws, Regulations, and Other Requirements.** Chapter 8 describes the environmental laws, regulations, permits, and consultations that are potentially applicable to the various activities related to tank waste storage, retrieval, treatment, and disposal and SST system closure; FFTF decommissioning; and waste management associated with the alternatives. Federal laws and regulations; Executive orders; DOE directives, orders, and guidance; and other compliance actions related to protection of the environment also are described.

- **Chapter 9—Glossary.** Chapter 9 contains definitions of important technical terms that may not be commonly used, including both discipline-specific and DOE- and Hanford-unique terms.

- **Chapter 10—List of Preparers.** Chapter 10 identifies the DOE and contractor preparers of this EIS. Information is provided for each preparer in the following areas: (1) affiliation, (2) name, (3) EIS responsibility, (4) education, and (5) experience.

- **Chapter 11—Distribution List.** Chapter 11 contains the external distribution list for this EIS, which includes Federal, state, and local elected and appointed officials and agencies; American Indian representatives; environmental and public interest groups; and organizations and individuals who requested/were sent a copy of this EIS.

- **Chapter 12—Index.** Chapter 12 contains the index of key words and terms found in this EIS.

The following appendices are provided to support these chapters:

- Appendix A—*Federal Register* and Other Public Notices
- Appendix B—Contractor and Subcontractor National Environmental Policy Act Disclosure Statements
- Appendix C—Cooperating Agency, Consultation, and Other Interaction Documentation
- Appendix D—Waste Inventories
- Appendix E—Descriptions of Facilities, Operations, and Technologies
- Appendix F—Direct and Indirect Impacts: Assessment Methodology
- Appendix G—Air Quality Analysis
- Appendix H—Transportation
- Appendix I—Workforce Estimates
- Appendix J—Environmental Justice
- Appendix K—Short-Term Human Health Risk Analysis
- Appendix L—Groundwater Flow Field Development
- Appendix M—Release to Vadose Zone
- Appendix N—Vadose Zone Flow and Transport
- Appendix O—Groundwater Transport Analysis

- Appendix P—Ecological Resources and Risk Analysis
- Appendix Q—Long-Term Human Health Dose and Risk Analysis
- Appendix R—Cumulative Impacts: Assessment Methodology
- Appendix S—Waste Inventories for Cumulative Impact Analyses
- Appendix T—Supporting Information for the Short-Term Cumulative Impact Analyses
- Appendix U—Supporting Information for the Long-Term Cumulative Impact Analyses
- Appendix V—Recharge Sensitivity Analysis
- Appendix W—American Indian Tribal Perspectives and Scenarios
- Appendix X—Supplement Analysis of the *Draft Tank Closure and Waste Management Environmental Impact Statement for the Hanford Site, Richland, Washington*

At the end of the Summary and each chapter and appendix of this EIS is a list of references used in development of that section.

In addition, a Comment-Response Document that includes all public comments received on the *Draft TC & WM EIS,* as well as DOE's responses to those comments, is provided in Volume 3 of this final EIS. Section 2 of Volume 3 presents topics of interest identified from the public comments received on the *Draft TC & WM EIS* and DOE's responses to each topic.

REFERENCES

DOE (U.S. Department of Energy), 1997, *Supplement Analysis for the Proposed Upgrades to the Tank Farm Ventilation, Instrumentation, and Electrical Systems Under Project W-314 in Support of Tank Farm Restoration and Safe Operations*, DOE/EIS-0189-SA1, Richland Operations Office, Richland, Washington, May.

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AVAILABILITY OF THIS *FINAL TC & WM EIS*

A complete copy of this *TC & WM EIS* and a list of reference documents are available in public reading rooms. References are available upon request. Copies can also be obtained as indicated below.

For copies of, or additional information regarding, this *Final TC & WM EIS*, contact:

Mary Beth Burandt, Document Manager
Office of River Protection
U.S. Department of Energy
Post Office Box 1178
Richland, WA 99352
Attention: *TC & WM EIS*
Email: TC&WMEIS@saic.com
Fax: 509-372-7701
Telephone and voicemail: 888-829-6347

For general information regarding DOE's NEPA process, contact:

Carol M. Borgstrom, Director
Office of NEPA Policy and Compliance (GC-54)
U.S. Department of Energy
1000 Independence Avenue, SW
Washington, DC 20585
Telephone: 202-586-4600,
or leave a message at 800-472-2756