Link to Main Report

DOE/EIS-0286D2

Revised Draft Hanford Site Solid (Radioactive and Hazardous) Waste Program Environmental Impact Statement Richland, Washington

Summary

U.S. Department of Energy
Richland Operations Office
Richland, Washington

March 2003

Cover Photographs:

1. Hanford workers preparing to retrieve and repackage TRU waste drums
2. Drums of transuranic waste in a retrievable storage trench
3. A partial aerial view of Hanford's Low Level Burial Grounds
4. Waste Receiving and Processing Facility inspection and repackaging glove boxes
5. Hanford's Mixed Low-Level Waste disposal facility
6. Placing TRU waste into a TRUPACT shipping container for shipment to the Waste Isolation Pilot Plant

RESPONSIBLE AGENCY: **COVER SHEET**

U.S. Department of Energy, Richland Operations Office

TITLE:

Revised Draft Hanford Site Solid (Radioactive and Hazardous) Waste Program Environmental Impact Statement, Richland, Benton County, Washington (DOE/EIS-0286D2)

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ABSTRACT:

The revised draft of the Hanford Site Solid (Radioactive and Hazardous) Waste Program Environmental Impact Statement (HSW EIS) provides environmental and technical information concerning U.S. Department of Energy (DOE) proposed waste management practices at the Hanford Site. DOE issued the Notice of Intent to prepare the EIS on October 27, 1997, and held public meetings during the scoping period that extended through January 30, 1998. The HSW EIS updates analyses of environmental consequences from previous documents and provides evaluations for activities that may be implemented consistent with the Waste Management Programmatic Environmental Impact Statement (WM PEIS) Records of Decision (RODs). Waste types considered in the HSW EIS include operational low-level radioactive waste (LLW), mixed low-level waste (MLLW), immobilized low-activity waste (ILAW), and transuranic (TRU) waste. MLLW contains chemically hazardous components in addition to radionuclides. In April 2002, DOE issued the first draft of the HSW EIS. During the public comment period that started in May 2002, DOE received a large number of comments from regulators, area tribes, stakeholders, and the public. The revised draft of the HSW EIS was prepared to address these public comments and add the ILAW scope. Alternatives for management of these wastes at the Hanford Site, including the alternative of No Action, are analyzed in detail. The LLW, MLLW, and TRU waste alternatives are evaluated for a range of waste volumes, representing quantities of waste that could be managed at the Hanford Site. A single maximum forecast volume is evaluated for ILAW waste. The No Action Alternative considers continuation of ongoing waste management practices at the Hanford Site and ceasing some operations when the limits of existing capabilities are reached. The No Action Alternative provides for continued storage of some waste types. The other alternatives evaluate waste management practices including treatment and disposal of most wastes. The potential environmental consequences of the alternatives are generally similar. The major differences occur with respect to the consequences of disposal versus continued storage and with respect to the range of waste volumes managed under the alternatives. The revised draft HSW EIS is being issued for public review and comment, after which DOE will prepare the final EIS. Dates, times, and locations for public meetings will be announced in the *Federal Register* and local media. The RODs will be published in the *Federal Register* no sooner than 30 days after publication of the Environmental Protection Agency Notice of Availability of the final EIS. DOE's preferred alternative is to dispose of LLW, MLLW, and ILAW in a single, lined facility on Hanford's Central Plateau; treat MLLW using a combination of onsite and offsite facilities; and certify TRU waste using a combination of existing and upgraded facilities onsite.

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Summary

This *Revised Draft Hanford Site Solid (Radioactive and Hazardous) Waste Program Environmental Impact Statement* (HSW EIS) covers three primary aspects of waste management at Hanford – waste treatment, storage, and disposal. It also addresses four kinds of solid waste – low-level waste (LLW), mixed (radioactive and chemically hazardous) low-level waste (MLLW), transuranic (TRU) waste, and immobilized low-activity waste (ILAW). It fundamentally asks the question: how should we manage the waste we have now and will have in the future? This EIS analyzes the impacts of the LLW, MLLW, TRU waste, and ILAW we currently have in storage, will generate, or expect to receive at Hanford. The HSW EIS is intended to help us determine what specific facilities we will continue to use, modify, or construct to treat, store, and dispose of these wastes (Figure S.1). Because radioactive and chemically hazardous waste management is a complex, technical, and difficult subject, we have made every effort to minimize the use of acronyms (making an exception for our four waste types listed above), use more commonly understood words, and provide the "big picture" in this summary. An acronym list, glossary of terms, and conversions for units of measure are provided in a readers guide in Volume 1 of this EIS.

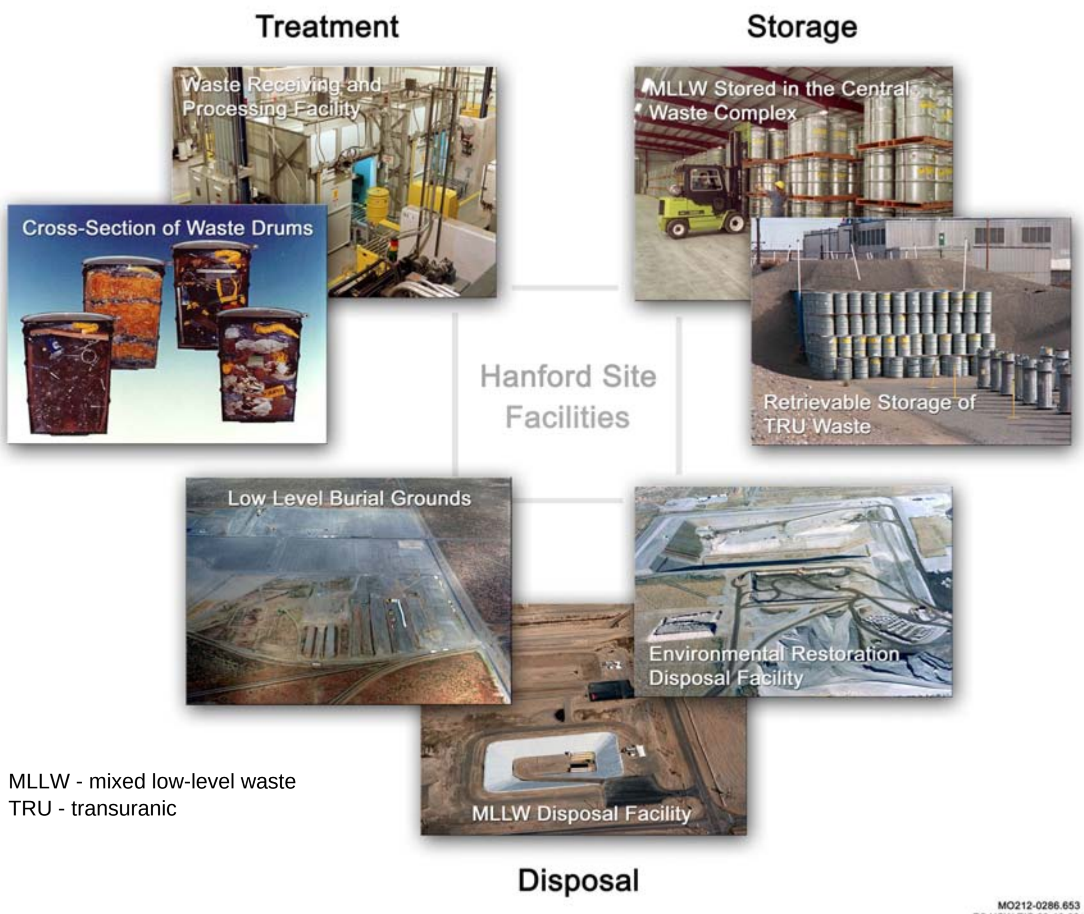

Figure S.1. Hanford Site Treatment, Storage, and Disposal Facilities

We have a number of reasons for preparing this HSW EIS. Foremost is our need to treat and dispose of the waste we are generating from ongoing Hanford cleanup operations, including retrieval of some of our own buried waste. We also support cleanup and early closure of other DOE sites across the country. Just as we were during the days of nuclear weapons production, Hanford is connected to and dependent on other sites.

For example, Hanford will send its high-level waste (HLW) and spent nuclear fuel (SNF) to a national geologic repository, which has been approved by Congress for development at Yucca Mountain in Nevada. In addition, we are now sending our TRU waste to the Waste Isolation Pilot Plant in New Mexico and have sent all of our usable uranium to the Portsmouth Site in Ohio. Hanford has long received LLW, MLLW, and TRU waste from offsite sources. The *Waste Management Programmatic Environmental Impact Statement* (WM PEIS) Record of Decision issued in February 2000 designated Hanford as one of the disposal sites for LLW and MLLW from around the DOE complex. We are currently accepting LLW from various DOE sites and MLLW from the U.S. Navy. Hanford is also receiving TRU waste from "small-quantity" sites for certification and eventual transport to the Waste Isolation Pilot Plant. This HSW EIS considers waste volumes from "Hanford Only" waste and two additional offsite waste volumes. It analyzes the potential environmental impacts associated with various alternatives for storing and disposing of both existing and offsite waste at Hanford.

Solid radioactive waste activities at Hanford have been evaluated in a number of previous Hanford National Environmental Policy Act (NEPA) documents. This HSW EIS updates the evaluations of a number of waste management options, including whether to build a new facility to treat waste or modify an existing structure. We also evaluate alternative sizes and designs of disposal facilities, including whether to use lined or unlined trenches. In addition, if multi-use disposal facilities are operationally and environmentally desirable, we considered alternative locations for such facilities. We have used the detailed analysis performed within this HSW EIS combined with previously performed analyses from other NEPA documentation, Comprehensive Environmental, Response, Compensation and Liability Act (CERCLA) decision documents, and other DOE sources to show how the HSW EIS alternatives fit into the overall Hanford cleanup.

While we understand some readers wanted the more detailed discussions found in other documents, we believe that the readability of this document is enhanced by not repeating all of these discussions here. We provided hard copies, web links, compact disks, etc. for readers interested in the other analyses referred to or incorporated by reference in this HSW EIS. Material incorporated by reference is briefly summarized. All references cited in this EIS are available in the DOE public reading rooms. If you are having difficulty obtaining a specific reference, please contact our HSW EIS document manager (identified on the cover sheet) for assistance. We appreciate your taking the time to learn about the important issues addressed by this document and helping us make the best decisions we can on waste management at Hanford.

S.1 Purpose and Need for Agency Action

We need to provide capabilities to continue, or modify, the way we treat, store, and/or dispose of existing and anticipated quantities of solid LLW, MLLW, TRU waste, ILAW, and melters at the Hanford

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Site. These capabilities are needed to protect human health and the environment while enabling us to clean up Hanford and assist other DOE sites in completing their cleanup programs. Our proposed actions will allow us to comply with local, State, and federal laws and meet other legal obligations such as the Hanford Federal Facility Agreement and Consent Order (the Tri-Party Agreement).

To address our anticipated needs for waste management capabilities, we propose to

- continue to operate our existing treatment, storage, and disposal facilities

- develop additional capabilities both to treat MLLW and to certify TRU waste for disposal at the Waste Isolation Pilot Plant in New Mexico

- construct additional disposal capacity for LLW, MLLW, ILAW, and tank waste treatment plant melters

- close onsite disposal facilities and provide for post-closure stewardship of disposal sites.

Alternatives for accomplishing DOE's proposed action, along with an analysis of potential environmental impacts, are detailed in this revised HSW EIS. The No Action Alternative is also evaluated as required by NEPA. Through this analysis, we will have the foundation to decide whether to use or modify existing Hanford facilities, build new facilities, or use offsite facilities.

S.2 Background

The Hanford Site (Figure S.2) was established in 1943 as part of the World War II nuclear weapons production effort called the Manhattan Project. Through the 1980s, DOE produced plutonium in nine nuclear reactors along the Columbia River. In 1988, we stopped plutonium production and shifted our mission to cleanup. Throughout this timeframe radioactive waste management has been an ongoing component of Hanford Site operations.

Hanford Cleanup Progress and New Initiatives

The DOE nationwide cleanup program is an immense and complex effort with many technical, financial, political, and regulatory issues. Hanford is a major part of that program. In the last five years, DOE nationwide has made substantial progress in systematically defining the scope, schedules, and life-cycle costs to meet this challenge as well as in creating an environment for further reform of the cleanup program by accelerating cleanup and risk-reduction actions, improving schedules and cost efficiencies, and driving all sites toward closure. At Hanford, we have made significant progress in our cleanup mission. We have

- cleaned up over 200 contaminated soil and waste sites

- decommissioned over 500 inactive facilities

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- decommissioned over 500 inactive facilities

Figure S.2. Hanford Site Location Map

- placed two production reactors into interim safe storage and begun work on the rest

- disposed of about 4 million tons of environmental restoration waste in a permitted facility

- stabilized and moved more than 1,000 metric tons of the 2,100 metric tons of production reactor fuel from the K Basins to storage on the Central Plateau

- shipped nearly 900 metric tons of uranium to an offsite storage facility

- initiated construction of the tank waste treatment plant for treatment of Hanford's tank waste

- continued treatment and disposal of MLLW in permitted facilities

- continued retrieval of TRU waste

- continued stabilization of plutonium material

- continued certification of TRU waste and shipment to the Waste Isolation Pilot Plant

- continued treatment of contaminated groundwater—more than 4 billion liters of groundwater had been treated to remove substantial amounts of chromium, carbon tetrachloride, nitrate, uranium, technetium-99, and strontium-90 contamination

- removed 77,000 kilograms of carbon tetrachloride from the soil by vapor extraction to prevent future groundwater contamination and to reduce worker exposure.

While DOE cleanup actions are progressing across the nation and at Hanford, there has been dissatisfaction with the pace and cost of cleanup. Some felt that cleanup completion was too far in the future, required unrealistic levels of funding, and was slow to reduce near-term risk. To address this concern, DOE initiated actions to reform the cleanup program.

One of those actions was to develop accelerated cleanup plans with the regulators. The *Performance Management Plan for the Accelerated Cleanup of the Hanford Site* (DOE-RL 2002) created six strategic initiatives that we believe can move the completion date of the Hanford cleanup mission from 2070 to 2035, and possibly to 2025. The six initiatives would accelerate 1) River Corridor cleanup, 2) tank waste retrieval, treatment, and closure, 3) nuclear materials stabilization and inventory reduction, 4) waste disposal, 5) Central Plateau cleanup, and 6) groundwater cleanup and protection. We will do this without compromising the quality of the cleanup and in compliance with applicable requirements and cleanup standards.

Each of these initiatives may impact Hanford's Solid Waste Program, but activities included in the strategic initiative to accelerate waste disposal (item 4 above) are most relevant to the alternatives analyzed in this HSW EIS. Specific performance milestones within that initiative include the following:

- complete retrieval, designation, and storage/disposal of 15,000 drum-equivalents of suspect TRU waste by September 2006, 4 years early

- complete treatment and/or disposal of all stored MLLW (about 7000 cubic meters) and newly generated MLLW (forecasted to be about 7000 cubic meters) by September 2008, 4 years early

- complete certification and shipment of all legacy, contact-handled TRU waste (about 7500 cubic meters) to the Waste Isolation Pilot Plant by September 2015, 12 years early

- complete construction and initiate use of lined MLLW/LLW disposal facilities by September 2007.

Some of the acceleration activities described in our performance management plan could be implemented immediately. Others could be implemented following completion of this HSW EIS. Still others may require further planning, changes to existing permits and Tri-Party Agreement Milestones, and preparation of additional environmental analyses.

While our performance management plan targets a cleanup completion date of 2035 or sooner, our technical baseline, which includes the basis for our forecasted waste volumes, has not yet been updated to accommodate all of the acceleration initiatives. In fact, the plan requires this next level of detail to be completed by January 2004. Therefore, in Appendixes B and C of this HSW EIS we have provided our current basis of analysis for the waste volume forecasts. We believe these volumes are conservative. While the acceleration initiatives may impact the timing of actions, the overall waste volumes will likely remain fairly constant.

Disposition of Waste Across the DOE Complex and at Hanford

Hanford is part of a nationwide complex of DOE sites undergoing cleanup operations and disposing of radioactive waste (Figure S.3). The WM PEIS (DOE 1997a) was a DOE-wide study examining the environmental impacts of managing an estimated 2,000,000 cubic meters of radioactive and hazardous waste from past, present, and reasonably foreseeable DOE activities across the nation. DOE's goal in preparing the WM PEIS was to develop a nationwide strategy to treat, store, and dispose of the waste in a safe, responsible, and efficient manner that minimized the impacts to workers, the public, and the environment. Wastes analyzed in the WM PEIS included MLLW, LLW, TRU waste, HLW, and hazardous waste.

Waste Management Programmatic EIS

The WM PEIS provides information on the impacts of various alternatives that DOE used to decide at which sites to consolidate or decentralize treatment, storage, and disposal activities for each waste type. However, the specific location of new facilities at selected sites would be based on existing or additional site-specific NEPA reviews.

In the Records of Decision resulting from the final WM PEIS, DOE decided the following:

- Sites with existing disposal capabilities for LLW and MLLW will continue to dispose of their wastes in their onsite facilities. Sites with these capabilities include the Idaho National Engineering and Environmental Laboratory, the Oak Ridge Reservation in Tennessee, the Savannah River Site in South Carolina, the Los Alamos National Laboratory in New Mexico, the Nevada Test Site, and the Hanford Site.

- The Record of Decision for management of LLW and MLLW identified the Hanford Site and the Nevada Test Site as potential disposal facilities for wastes from sites that do not have disposal capability. The Nevada Test Site is expected to take the bulk of the LLW that would be sent offsite from other DOE generators. For example, over the 5-year time period (2002 to 2006) it is estimated that the Nevada Test Site will receive approximately 423,000 cubic meters of LLW. This amount (for just this 5-year period) is more than the entire offsite volume of LLW and MLLW we would receive at Hanford under the Upper Bound waste volume estimate and over 20 times the amount of offsite waste that we would receive using the Lower Bound waste volume estimate.

- For management of TRU waste, each site would prepare and certify waste generated at that site for disposal at the Waste Isolation Pilot Plant in New Mexico. Subsequently, DOE amended this Record of Decision for TRU waste to allow for temporary storage, characterization, and certification of TRU waste from small generator sites at the Savannah River Site and the Hanford Site. The Hanford Site was authorized to receive approximately 170 drums of waste (36 cubic meters) from the Battelle West Jefferson North Site in Ohio and the Energy Technology and Engineering Center in California for treatment, certification, and storage prior to being shipped to the Waste Isolation Pilot Plant for disposal.

- DOE would continue the current practice of managing non-radioactive hazardous waste at commercial treatment and disposal facilities.

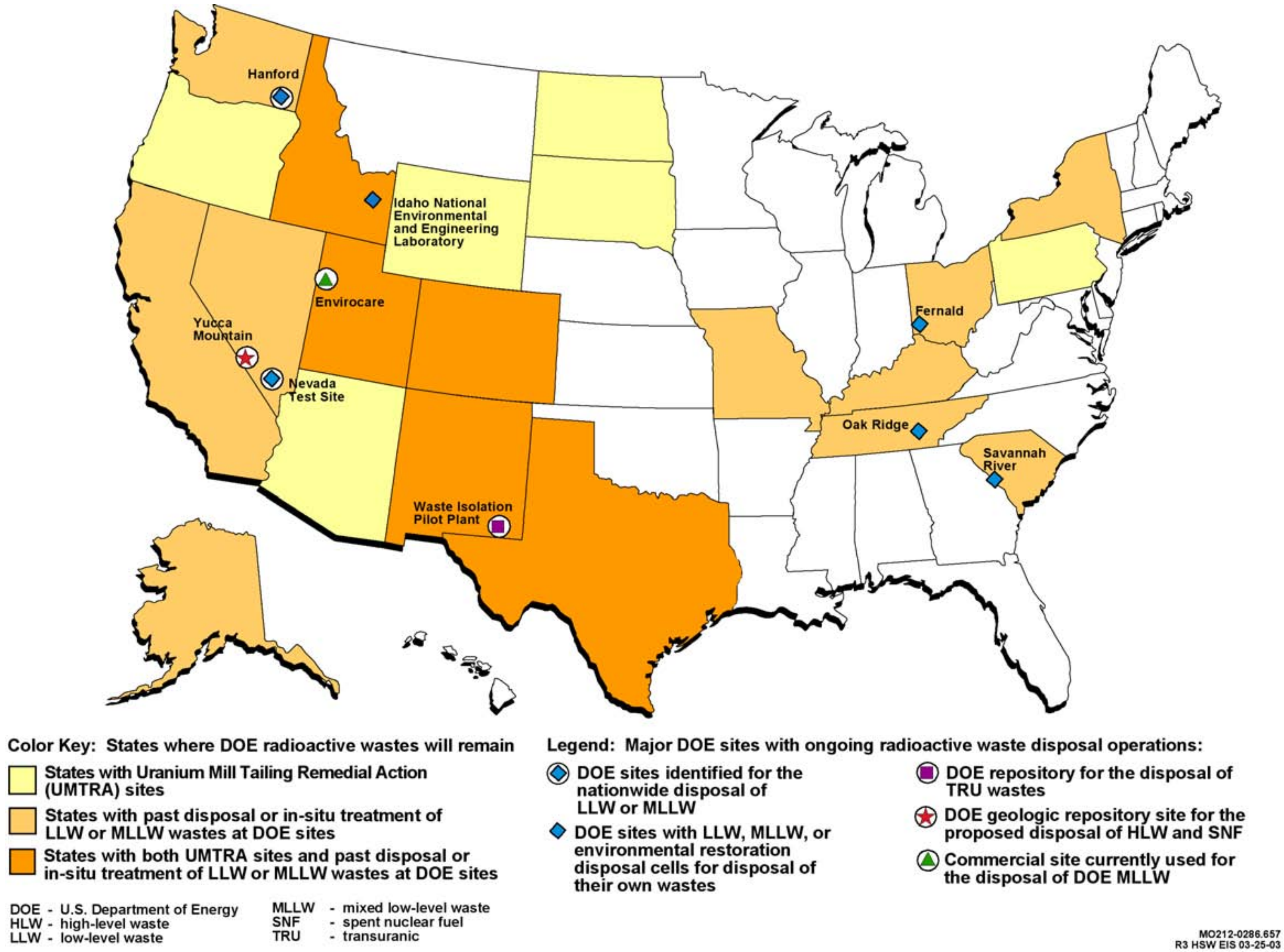


Figure S.3. States with Radioactive Waste Disposal Activities

Hanford's Waste Management Plans

Hanford's waste management challenges are significant, but through the Hanford Performance Management Plan, this HSW EIS, and other decision documents, we are making progress. We have disposition plans for our waste types and materials, which are illustrated in Figure S.4 and discussed by waste type below. The text boxes in this section also highlight which waste types are analyzed in detail in this HSW EIS and which are not.

What wastes are included in the HSW EIS and how are they defined?

Low-level waste (LLW) is radioactive waste that is not high-level waste, spent nuclear fuel, transuranic waste, or byproduct material (as defined under the Atomic Energy Act of 1954) or naturally occurring radioactive material. LLW is technically defined by what it is not, and has a wide range of forms, concentrations, and hazards. LLW can range from very low to very high concentrations, but is generally the kind of waste acceptable for shallow-land disposal.

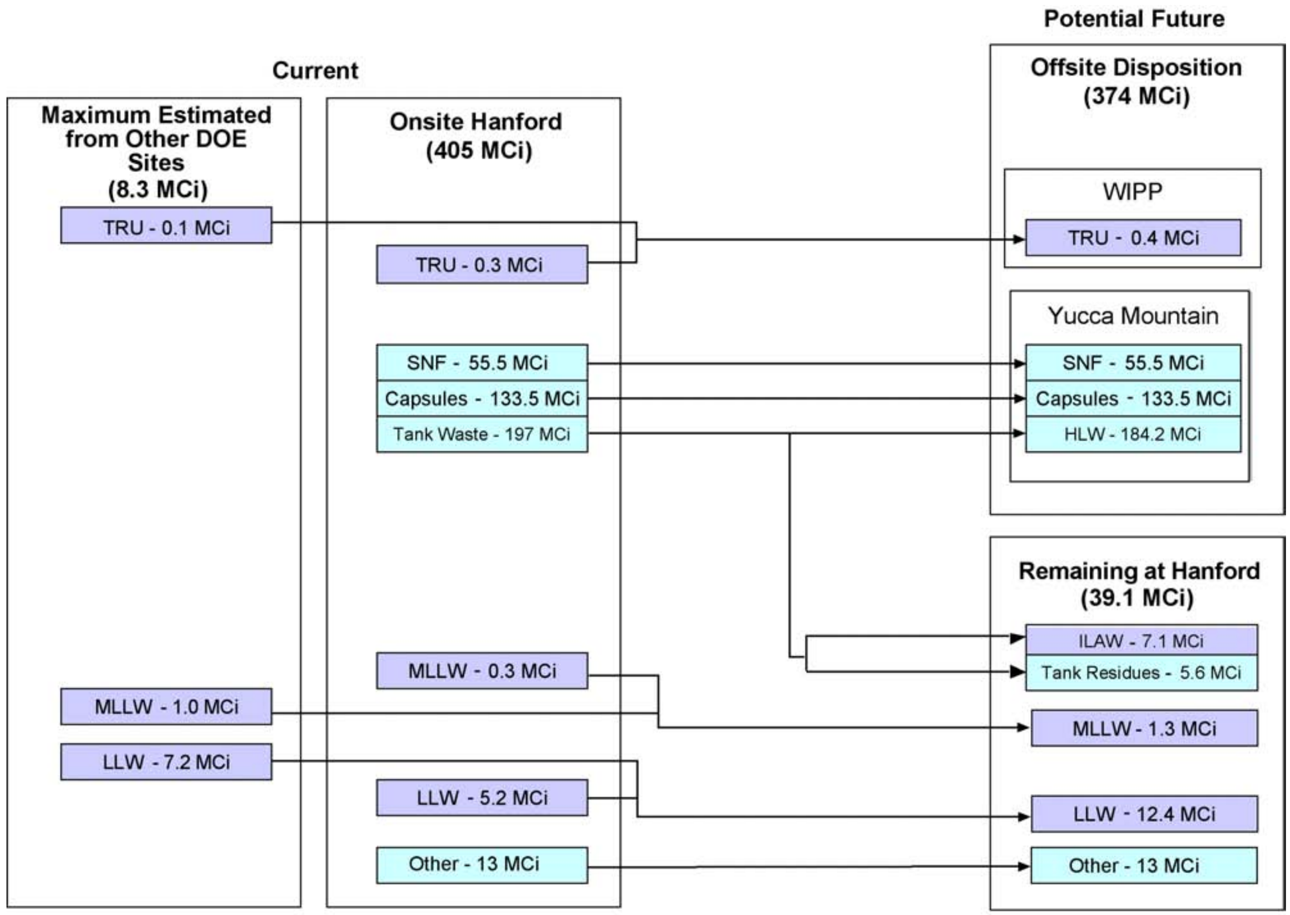
Mixed low-level waste (MLLW) is LLW that contains both radionuclides subject to the Atomic Energy Act of 1954, and a hazardous component subject to the Resource Conservation and Recovery Act (RCRA) and applicable Washington State Dangerous Waste Regulations.

Immobilized low-activity waste (ILAW) is the solidified low-activity waste from the treatment and immobilization of Hanford tank wastes. Low-activity waste is the waste that remains after separating from high-level waste (HLW) as much of the radioactivity as practicable, and that when solidified may be disposed of as low-activity waste in a near-surface facility in accordance with DOE requirements (DOE 2001b). The ILAW will be disposed of on the Hanford Site or at a qualified offsite facility. The HLW will be vitrified and poured into canisters for interim storage and eventual shipment to a national geologic repository.

Transuranic (TRU) waste is radioactive waste containing more than 100 nanocuries (3700 becquerels) of alpha-emitting transuranic isotopes per gram of waste, with half-lives greater than 20 years, except for the following:

- high-level radioactive waste
- waste that the Secretary of Energy has determined, with the concurrence of the Administrator of the Environmental Protection Agency, does not need the degree of isolation required by the 40 CFR Part 191 disposal regulations
- waste that the Nuclear Regulatory Commission has approved for disposal on a case-by-case basis in accordance with 10 CFR 61 (DOE 2001c).

High-Level Waste, Spent Nuclear Fuel, and Other Nuclear Materials: We plan to send DOE HLW and spent nuclear fuel to a deep geologic repository, which has been approved by Congress for development at Yucca Mountain in Nevada, and which, under current DOE plans, subject to Nuclear Regulatory Commission licensing, would begin accepting waste in 2010. Our useable uranium has already been shipped to the Portsmouth Site in Ohio.



Notes:
- Hanford ER wastes (e.g., wastes buried at ERDF or isolated in place) are not included in this figure (with the exception of TRU waste from the 618-10 and 618-11 Burial Grounds).
- Non-DOE commercial waste and material disposed of at the US Ecology site are not included.
- The curie estimates are based on levels decayed to the end of 1999.
- The other waste category is the vitrified waste, referred to as "German logs" and Pu material.

Within Scope of HSW EIS
Not in Scope of HSW EIS

ER = environmental restoration
ERDF = Environmental Restoration Disposal Facility
HLW = high-level waste
HSW EIS = Hanford Solid Waste Environmental Impact Statement
ILAW = immobilized low-activity waste
LLW = low-level waste
MLLW = mixed low-level waste
MCi = mega curies
Pu = plutonium
SNF = spent nuclear fuel
TRU = transuranic waste

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Figure S.4. Waste and Materials Coming to and Leaving Hanford (in megacuries)

Transuranic Waste: TRU waste from DOE sites across the nation is going to the Waste Isolation Pilot Plant in New Mexico, an underground repository that opened in 1999. The Hanford Site, Idaho National Engineering and Environmental Laboratory, Savannah River Site, Los Alamos National Laboratory, and Rocky Flats Environmental Technology Center (in Colorado) have begun shipping to the Waste Isolation Pilot Plant.

Hanford has also received some TRU waste from other DOE sites that needed to take advantage of our existing and planned certification and storage capabilities. However, all TRU waste sent to Hanford will eventually be shipped to the Waste Isolation Pilot Plant. Our planned shipments from Hanford to the Waste Isolation Pilot Plant include the following:

- TRU waste currently stored in the Central Waste Complex
- TRU waste generated as a result of decommissioning and demolition of facilities such as the Plutonium Finishing Plant
- sludge from the K Basins
- retrievably stored TRU waste currently located in the Low Level Burial Grounds
- TRU waste currently buried in the 618-10 and 618-11 Burial Grounds
- TRU waste sent to Hanford from other DOE sites to take advantage of existing and planned certification storage capabilities prior to transshipment to the Waste Isolation Pilot Plant
- TRU waste retrieved as a result of CERCLA remediation decisions.

What waste types are not included in the analysis of HSW EIS alternatives?*

- High-level radioactive waste
- Most liquid wastes
- Spent nuclear fuel
- Naval reactor compartments
- Non-radioactive hazardous wastes
- Most environmental restoration wastes generated as part of the CERCLA process
- Commercial LLW destined for US Ecology

*While these wastes are not considered in the detailed alternative analysis, they are considered in the cumulative impacts analyses.

Low-Level and Mixed Low-Level Waste: We plan to do the following with these waste types:

- Continue to dispose of our own LLW and MLLW onsite.
- For the waste generated by environmental restoration activities (e.g., contaminated soils and building demolition debris), continue to dispose of these wastes in a specially designed Environmental Restoration Disposal Facility.
- Accept some DOE LLW and MLLW from sites that do not have disposal capability. The Nevada Test Site and commercial disposal facilities such as Envirocare in Utah would also receive such waste.

The scope of the HSW EIS does not include commercial LLW disposed of on land we lease to the State of Washington. The State permits US Ecology to operate a low-level waste burial ground for commercial waste on Hanford's Central Plateau. This operation is independent of our DOE cleanup and waste management operations at Hanford. However, we do consider the US Ecology facility in the cumulative impacts analysis in this EIS.

Figure S.5 provides an overview of Hanford's waste and material disposal paths. It provides references to the existing NEPA documentation associated with each waste stream or source, including this HSW EIS.

S.3 Development of the Revised Draft HSW EIS

Last year, we issued our first draft of the HSW EIS for public comment. During the public comment period, we received a large number of comments (approximately 3,800) from tribal governments, regulators, stakeholders, and the public. Comments focused predominantly on the following:

- importation of waste to the Hanford Site from offsite locations and the impact that waste would have on the environment

- how Hanford cleanup plans are affected by this EIS

- disposal facility design and long-term performance: there were numerous concerns regarding the use of unlined trenches for disposal of LLW, as well as concerns about contamination of groundwater and the Columbia River

- whether the document adequately analyzed the cumulative impacts of waste coming from offsite along with the wastes that are already here

- scope of transportation analysis: comments questioned the appropriateness of the WM PEIS transportation analysis and the decision not to repeat that nationwide analysis in the HSW EIS

- technical content and scope of the HSW EIS: comments 1) pointed out perceived omissions or inaccuracies in the HSW EIS technical analyses alternatives and scope of the EIS, and 2) requested evaluation of additional alternatives for waste treatment and disposal, including alternative disposal facility designs

- why all other waste types at Hanford were not specifically analyzed, including disposal of the ILAW stream.

We have prepared a revised draft of the HSW EIS to address these comments and give the public the information needed to better understand the decisions we need to make. This draft incorporates substantial changes that respond to the concerns we heard. Key changes included the following:

- expanding the range and depth of alternatives and supporting analyses to include ILAW disposal alternatives

The scope of the HSW EIS does not include commercial LLW disposed of on land we lease to the State of Washington. The State permits US Ecology to operate a low-level waste burial ground for commercial waste on Hanford's Central Plateau. This operation is independent of our DOE cleanup and waste management operations at Hanford. However, we do consider the US Ecology facility in the cumulative impacts analysis in this EIS.

Figure S.5 provides an overview of Hanford's waste and material disposal paths. It provides references to the existing NEPA documentation associated with each waste stream or source, including this HSW EIS.

S.3 Development of the Revised Draft HSW EIS

Last year, we issued our first draft of the HSW EIS for public comment. During the public comment period, we received a large number of comments (approximately 3,800) from tribal governments, regulators, stakeholders, and the public. Comments focused predominantly on the following:

- importation of waste to the Hanford Site from offsite locations and the impact that waste would have on the environment

- how Hanford cleanup plans are affected by this EIS

- disposal facility design and long-term performance: there were numerous concerns regarding the use of unlined trenches for disposal of LLW, as well as concerns about contamination of groundwater and the Columbia River

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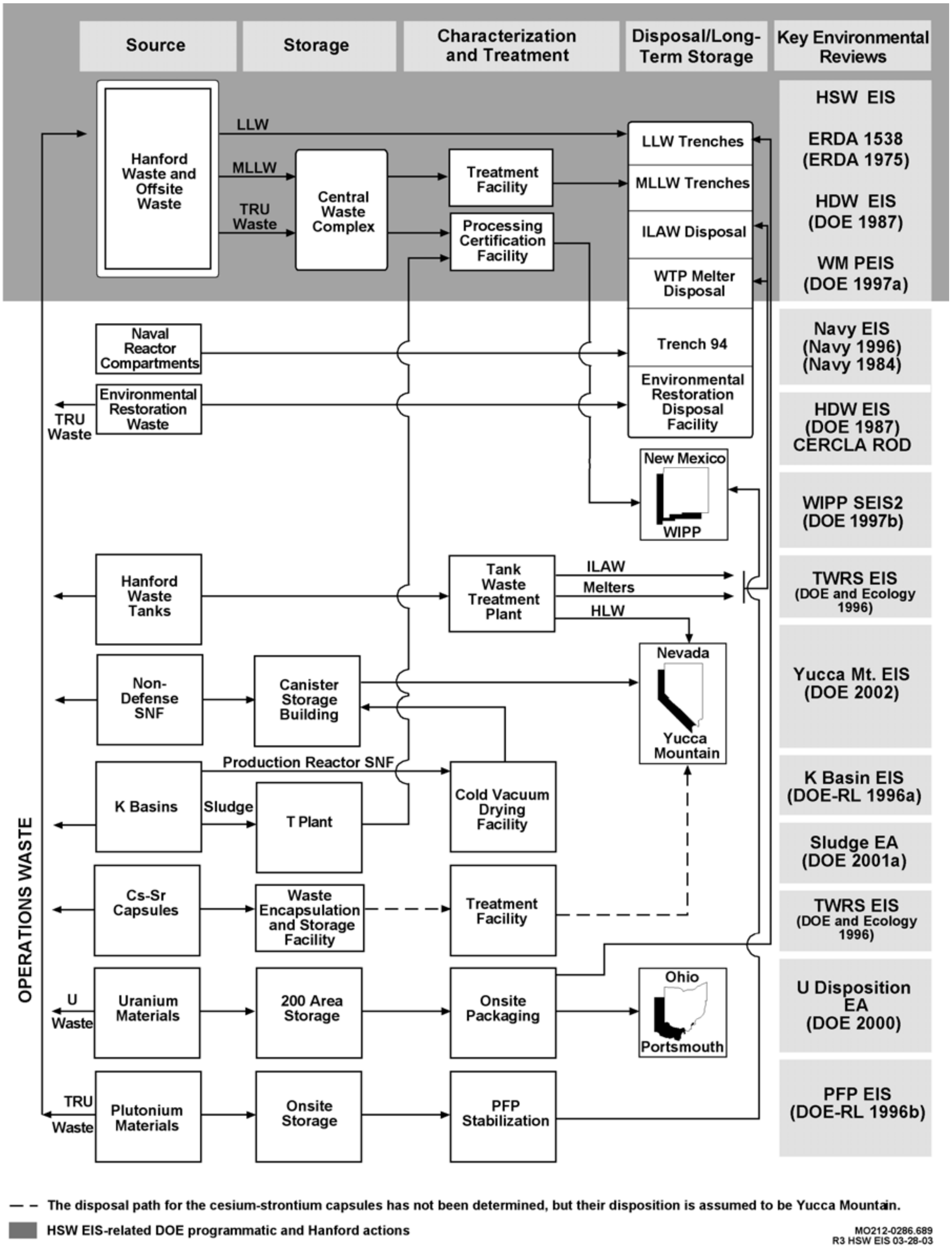

Figure S.5. Relationship of the HSW ES to Other Key Environmental Reviews

- providing information describing new DOE plans to accelerate cleanup and how they relate to the HSW EIS

- distinguishing between the Hanford waste volumes and those projected to come from offsite

- providing a fuller description of transporting waste through the states of Washington and Oregon

- providing an expanded discussion on cumulative impacts, including groundwater impacts.

S.4 Waste Volumes Analyzed

In this HSW EIS we address LLW, MLLW (including tank waste treatment plant melters), ILAW, and TRU waste. Radioactive waste may also be classified as either contact-handled or remote-handled. This HSW EIS does not reevaluate alternatives for waste types that have been or will be addressed by separate National Environmental Policy Act reviews or other appropriate documentation.

What is the difference between contact-handled and remote-handled waste?

Contact-handled waste containers produce radiation dose rates less than or equal to 200 mrem/hr at the container surface. Remote-handled waste containers produce dose rates greater than 200 mrem/hr at the container surface. Contact-handled containers can be safely handled by direct contact using appropriate health and safety measures. Remote-handled containers require special handling or shielding during waste management operations.

Because we do not know precisely how much waste Hanford will receive from offsite, we evaluated a range of waste quantities. For each waste type, we analyzed as many as three waste volumes. The "Lower Bound" waste volume is our current best case projection of the amount we could receive from offsite (based on past receipts) combined with our best projection of what we might generate during our own cleanup operations. The "Upper Bound" waste volume provides the highest waste volume we believe we could receive, again along with our best projection of what we might generate during our own cleanup operations. The "Hanford Only" waste volume is a newly analyzed waste volume developed as a result of comments we received on the first draft of this HSW EIS. The Hanford Only waste volume excludes future offsite waste volumes entirely. In other words, we added the Hanford Only waste volume so the incremental impacts of receiving offsite waste could be determined. We used a single value for the Hanford Only waste volume (versus a Lower and Upper Bound waste volumes) because of our past experience in forecasting our own waste volumes and our in-depth understanding of our cleanup plans and commitments. The three volumes by waste type are illustrated in Figure S.6. The Hanford Only waste volumes in Figure S.6 include only those volumes of wastes disposed of in the Low Level Burial Grounds, in storage at Hanford, and forecasted to be generated as part of our cleanup operations.

The Hanford Only waste volumes do not include waste disposed of in older burial grounds, environmental restoration waste disposed of in the Environmental Restoration Disposal Facility, decommissioned Naval reactor compartments, or commercial waste disposed of in the US Ecology facility. This is because

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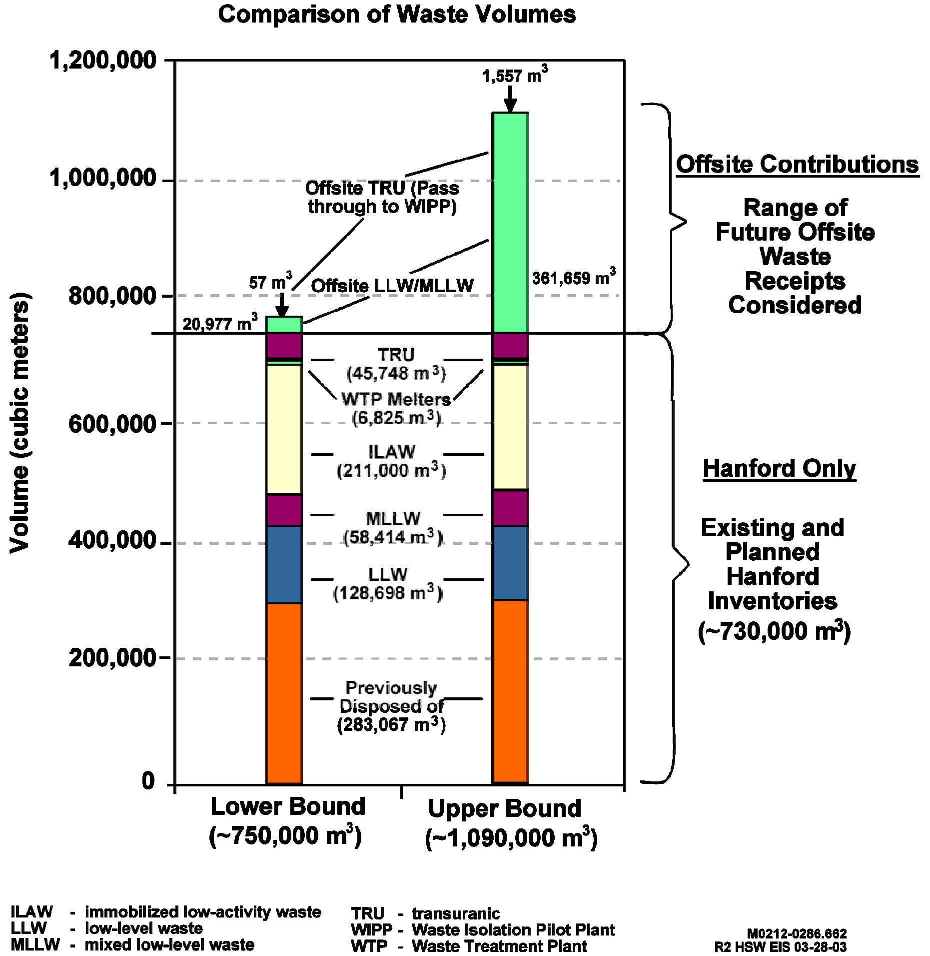
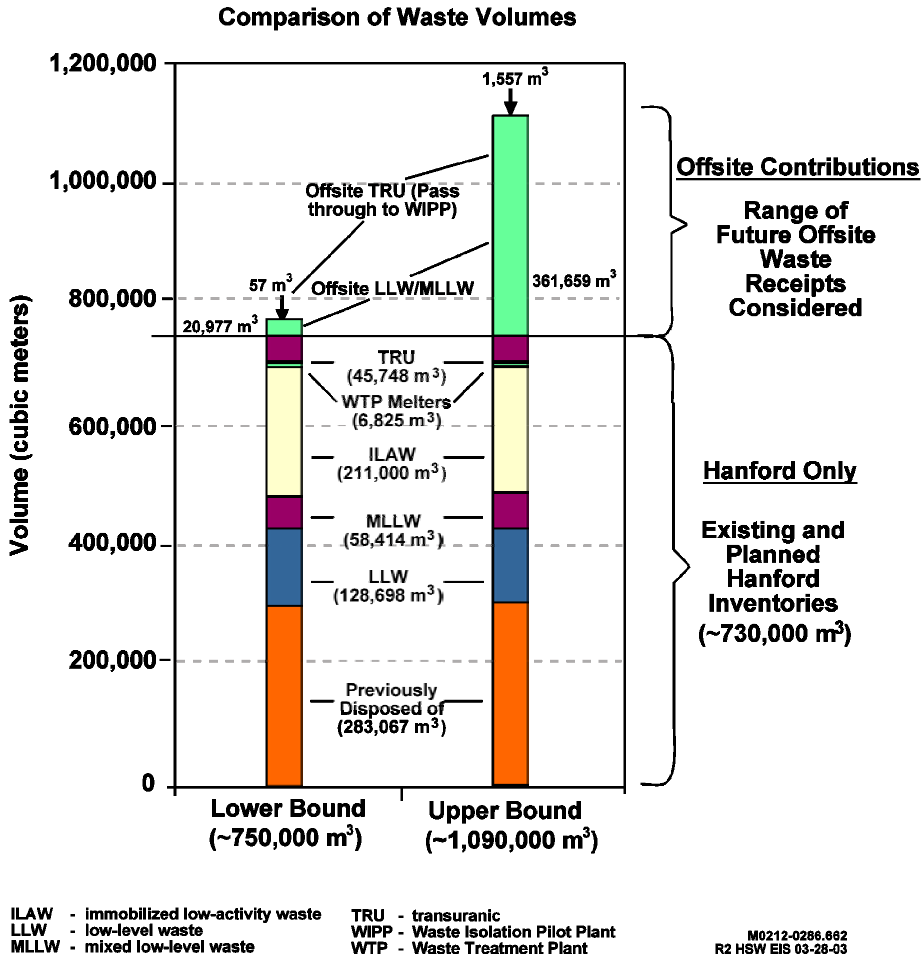


Figure S.6. Range of Waste Volumes Considered in the HSW EIS

S.5 Waste Management Activities and Facilities

In 1999, we developed a land-use plan based on the *Final Hanford Comprehensive Land-Use Plan EIS* (DOE 1999). This plan divided the site into five geographical areas: the Wahluke Slope, the Columbia River Corridor, the Central Plateau, the Fitzner/Eberhardt Arid Lands Ecology Reserve, and other areas (Figure S.7). The Comprehensive Land-Use Plan EIS Record of Decision (64 FR 61615) designates the Central Plateau as an Industrial-Exclusive zone, specifically for operating waste management and similar industrial facilities.

The Solid Waste Program activities at Hanford (located on the Central Plateau) include storage, treatment, and disposal of LLW and MLLW, as well as storage and processing of TRU waste and disposal of ILAW and melters from the tank waste treatment plant (currently under construction). To the operation, cleanup, and/or closure of these facilities and areas are the subject of other cleanup decision documents. However, these wastes are discussed in the cumulative impacts section (Section 5.14) of this HSW EIS.



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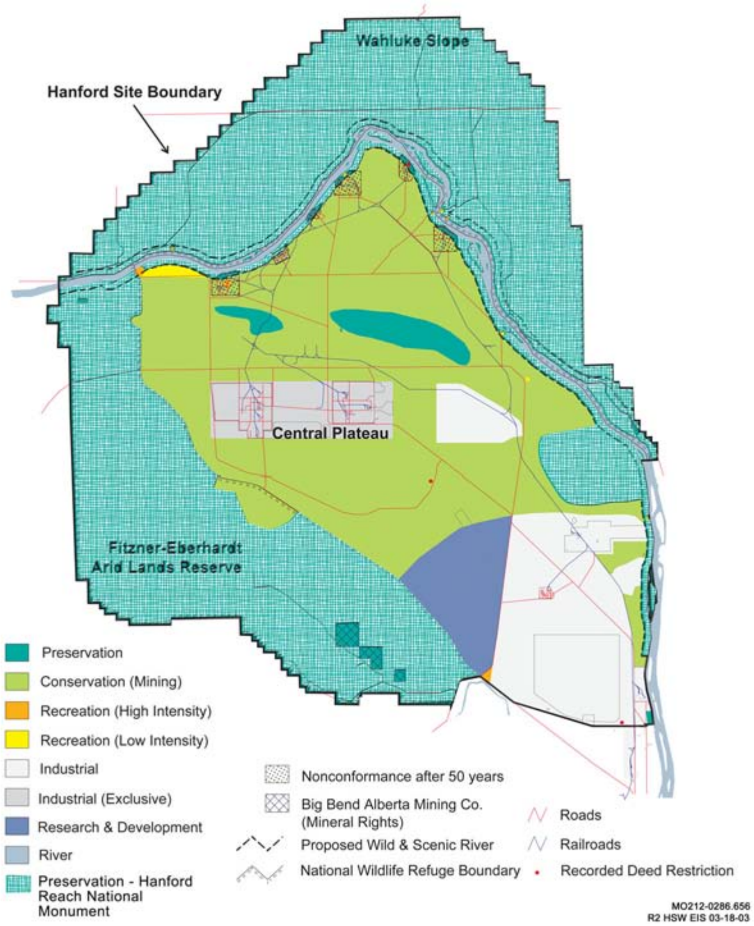

Figure S.7. Hanford's Land-Use Plan

fully understand the scope of this HSW EIS, it is important to understand the pieces of this complex program. Figure S.8 has been prepared to illustrate approximately where on Hanford's Central Plateau current and proposed treatment, storage, and disposal facilities are located.

The Hanford Solid Waste Program has three major functions: treatment, storage, and disposal of radioactive and chemically hazardous radioactive mixed waste. Solid radioactive waste from onsite and offsite generators is **stored** until it can be transferred to an appropriate treatment or disposal facility. **Treatment** of solid radioactive wastes may include size reduction, stabilization, encapsulation, and/or destruction or neutralization of non-radioactive waste. We also often use the term treatment to encompass the concepts of waste characterization, certification, and processing. Solid waste **disposal** facilities at Hanford currently accept LLW and MLLW, and, in the future would also accept ILAW and tank waste treatment plant melters. TRU waste will continue to be processed and stored until it can be disposed of at the Waste Isolation Pilot Plant in New Mexico.

Solid Radioactive Waste Storage

Waste is often stored prior to treatment or disposal. The specific storage methods we use depend on the chemical, radioactive, and physical characteristics of the waste. We store the waste in both

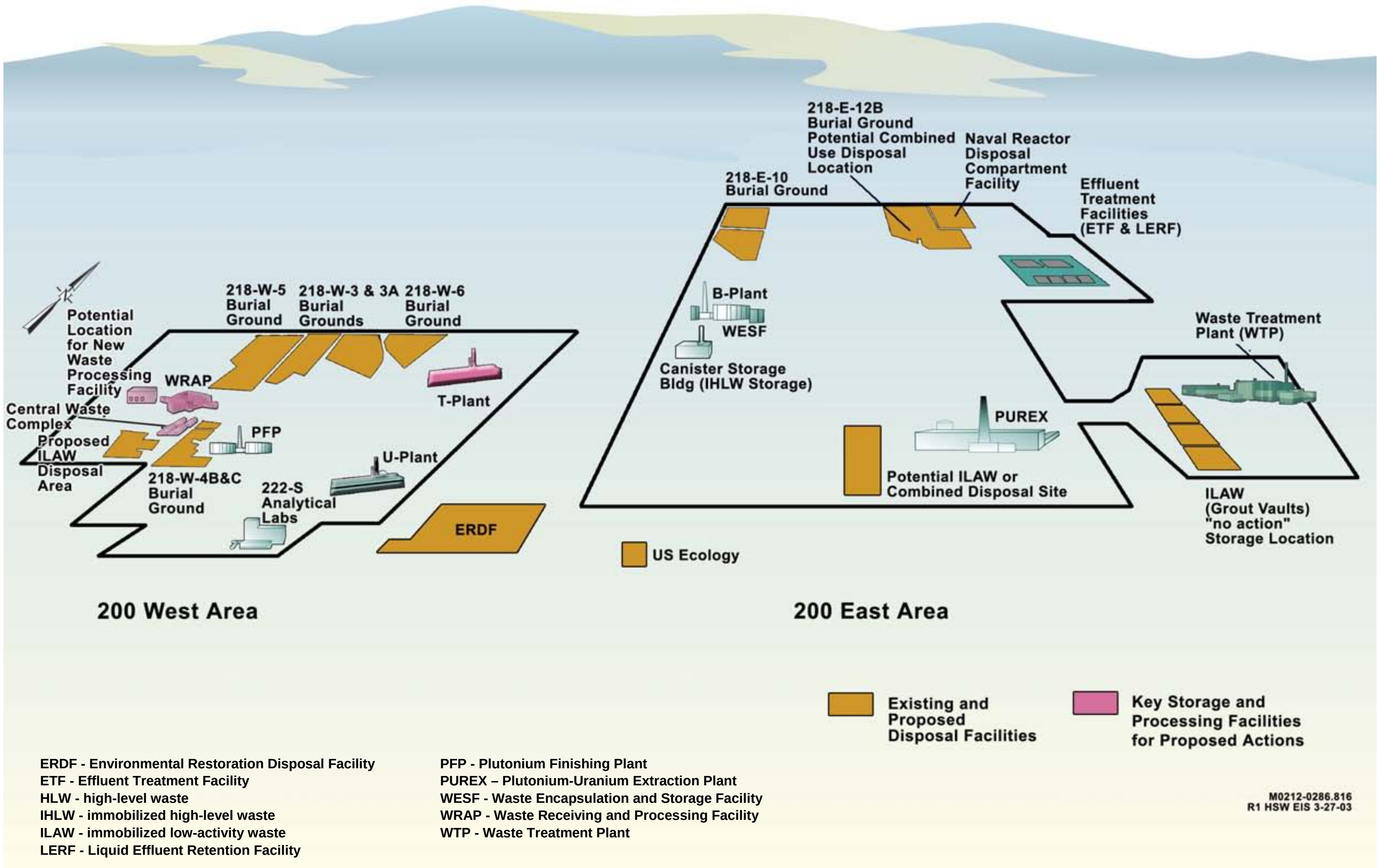

Figure S.8. Hanford's Waste Management Operations aboveground and belowground facilities. Our primary waste storage facility is the Central Waste Complex (Figure S.9), a group of enclosed metal buildings on concrete pads. Some waste is also stored outdoors in the Central Waste Complex on concrete pads if the outer containers are corrosion-resistant and suitable for such storage.

The T Plant Complex and Waste Receiving and Processing Facility also have some waste storage capabilities. The T Plant Complex will be used to store K Basin sludge and potentially other remote-handled waste. We are also considering storage of ILAW in an existing lined vault in the 200 East Area.

Hanford has limited ability to treat MLLW, so we need facilities in which to store this waste until we obtain the capability to treat it. The primary storage facility we now use is the Central Waste Complex, which is constructed to meet RCRA and State environmental regulations for MLLW interim storage.

TRU waste was not defined as a separate waste type until 1970. Beginning in 1970, Hanford waste suspected of containing TRU waste radionuclides was stored in the Low Level Burial Grounds in trenches or in caissons (underground structures intended for storage of some higher-activity waste). This waste is referred to as “suspect TRU” waste because only some of the stored waste contains TRU waste radionuclides at concentrations that meet the current definition of TRU waste. Since 1985, TRU waste has more typically been stored in surface facilities, such as the Central Waste Complex or the T Plant Complex, until it can be disposed of at the Waste Isolation Pilot Plant.

Solid Radioactive Waste Treatment and Processing

Waste treatment is often the key to safe, efficient storage and disposal of waste. We use waste treatment processes to change the physical, chemical, or biological characteristics of waste, to reduce its volume, or to make it safer for disposal.

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Figure S.9. Aerial View of the Central Waste Complex

MLLW requires treatment to specific standards defined by RCRA and State regulations before it can be disposed of. Because we have limited capability to treat MLLW at Hanford, we have contracted with offsite RCRA-permitted private commercial facilities to begin treating limited quantities of stored contact-handled MLLW. These contracts provide for the stabilization of inorganic solids, encapsulation of debris waste, and thermal treatment. One of the challenges facing all DOE sites is that commercial treatment capabilities and capacities are limited. The 200 Area Effluent Treatment Facility treats our liquid wastes, including leachate collected from the MLLW trenches.

TRU waste may require processing before it can be sent to the Waste Isolation Pilot Plant for disposal. Processing may include activities such as repackaging, characterization, and certification that the waste meets the Waste Isolation Pilot Plant waste acceptance criteria. Under current plans, we will address contact-handled and remote-handled TRU wastes differently. Contact-handled newly generated and retrievably stored TRU waste would be sent to Hanford's Waste Receiving and Processing Facility for processing and certification. Remote-handled TRU waste would be stored at Hanford until we develop processing and certification capabilities. We anticipate that the Waste Isolation Pilot Plant will have its remote-handled waste acceptance criteria and infrastructure in place to begin receiving such waste in approximately the 2005 timeframe.

Treatment is not required for most kinds of LLW. However, we treat some LLW to meet specific waste acceptance criteria. One type of LLW, called "Category 3 LLW," does require grouting waste in the trench or placing it in high-integrity containers.

Solid Radioactive Waste Disposal

The final step in the waste management process is disposal. Some types of waste can be disposed of safely in existing facilities using conventional methods, such as shallow-land burial. However, that method is objectionable to some commenters. We are considering moving exclusively to burial of LLW and MLLW in lined disposal facilities with leachate collection systems. We now dispose of LLW and treated MLLW in Hanford's Low Level Burial Grounds and are considering disposal of ILAW and tank waste treatment plant melters someplace onsite. The decision on specific location would be supported by the analyses in this EIS. We will continue to ship TRU waste offsite to the Waste Isolation Pilot Plant for disposal and plan to ship spent nuclear fuel and HLW from the underground storage tanks to Yucca Mountain for disposal.

The Low Level Burial Grounds have formed the foundation of Hanford's Solid Waste Program. Each burial ground consists of a series of trenches on the Central Plateau. There are six Low Level Burial Grounds in the 200 West Area and two in the 200 East Area. Figure S.10 illustrates disposal of LLW within Hanford's Low Level Burial Grounds.

While most Low Level Burial Grounds contain LLW, one Low Level Burial Ground in the 200 West Area contains two trenches permitted under RCRA and State regulations for disposal of MLLW. The MLLW trenches (Figure S.11) are constructed with a low-permeability liner and a system for collecting water that drains through the waste disposal area. The collected liquids, referred to as leachate, are shipped to the Effluent Treatment Facility and converted to a solid form suitable for disposal.

Figure S.10. Hanford's Low Level Burial Grounds

The Environmental Restoration Disposal Facility is located in the center of the Hanford Site between the 200 East and 200 West Areas. It is a RCRA-compliant large-scale landfill, authorized by the U.S. Environmental Protection Agency (EPA) under CERCLA. The facility is designed to receive and isolate LLW and MLLW generated from Hanford's environmental restoration activities (which primarily involve digging up and removing contaminated soil and infrastructure along the Columbia River). The Environmental Restoration Disposal Facility currently has four disposal cells and will be expanded further. The cells are lined and have a leachate collection system. This HSW EIS analyzes whether we should use the Environmental Restoration Disposal Facility location not only for environmental restoration waste, but other wastes as well (such as LLW, MLLW, and ILAW).

TRU waste is disposed of at the Waste Isolation Pilot Plant in New Mexico, the DOE underground repository for TRU waste. We began shipping TRU waste from Hanford to the Waste Isolation Pilot Plant in the summer of 2000, made several more shipments through 2002, and intend to dramatically increase Hanford TRU waste exports beginning in 2003 (Figure S.12). The disposal of TRU waste was evaluated in previous EISs and is not reconsidered in this EIS. We currently plan to dispose of both contact- and remote-handled TRU waste at the Waste Isolation Pilot Plant. Because the Waste Isolation Pilot Plant is not yet prepared to receive remote-handled TRU waste, we must temporarily store these

Figure S.11. Mixed Low-Level Waste Disposal Trench

Figure S.12. Packaging of TRU Waste for Shipment to WIPP wastes at Hanford. We anticipate that the Waste Isolation Pilot Plant will have its remote-handled waste acceptance criteria and infrastructure in place to begin receiving such waste in approximately the 2005 timeframe.

Solid Radioactive Waste Transportation and Emergency Preparedness

About 300 million hazardous material[a] shipments (DOT 1998) occur in the United States every year. About 3 million (1 percent) of these involve shipments of radioactive material.[b] Currently, less than one percent of these 3 million radioactive material shipments are DOE shipments (NEI 2003).

The annual number of DOE radioactive material shipments is expected to increase over the next several years. However, the number of DOE radioactive material shipments will continue to be small in comparison to the total number of hazardous material shipments.

Solid radioactive waste is currently transported to and from Hanford by truck. We are considering using rail as an alternative method of transporting waste. Shipment of waste by rail may require constructing a spur or developing an intermodal transfer capability. If rail shipment is proposed it will be evaluated under future National Environmental Policy Act reviews.

While the U.S. Department of Transportation regulates shipment of hazardous materials (including radioactive materials), the Nuclear Regulatory Commission and DOE have additional regulations that address transportation of radioactive materials. In addition, local, State, tribal, and federal governments and carriers all have responsibility for preparing for and responding to transportation emergencies. Local or tribal personnel typically are the first responders and incident commanders for offsite transportation accidents. Although many local jurisdictions have special hazardous material response units, most seek State or federal technical assistance during radiological incidents.

S.6 Description of Alternatives

There are both action alternatives and a No Action Alternative in this HSW EIS. Each action alternative is defined by a general waste management activity (storage, treatment, or disposal); a specific waste stream; and a specific design, location, or option for the proposed action. For example, an alternative for treatment of MLLW would be to use offsite contracts for thermal treatment of the contact-handled mixed waste stream; or an alternative for disposal of ILAW might be to use a combined-use modular facility located in the 200 East Area. We considered a number of other alternatives, but did not evaluate them in detail because DOE determined that they are not reasonable alternatives.

Under all alternatives evaluated in this HSW EIS, some waste storage operations (as opposed to waste disposal operations discussed later) would continue at the Central Waste Complex and within the Low

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(a) For the purposes of this transportation discussion, hazardous materials include items that present chemical hazards, radioactive hazards, and physical hazards (e.g., compressed gases).

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Level Burial Grounds. The action alternatives do not require additional storage beyond the current Central Waste Complex capacity. Only the No Action Alternative would require an expansion of the Central Waste Complex.

We would need additional capabilities to treat MLLW because some types, including remote-handled MLLW and non-standard items, cannot be accepted by commercial facilities. In addition, we would need a similar capability to process and certify remote-handled TRU waste and non-standard items because the Waste Receiving and Processing Facility does not have the capability to do so. The treatment action alternatives are summarized in Figure S.13.

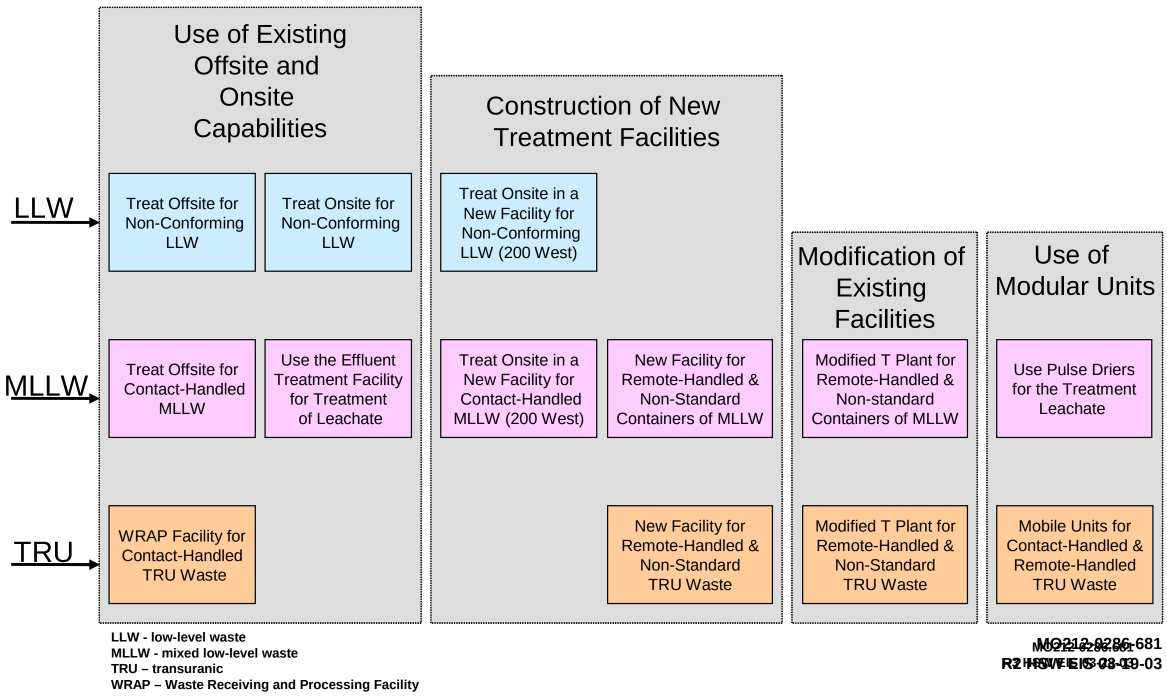


Figure S.13. Solid Waste Treatment Action Alternatives

Thus, we developed alternatives evaluating new or modified facilities in this HSW EIS to provide needed capabilities for waste treatment and processing, by asking the following specific questions:

- To treat some MLLW and TRU waste, should we modify facilities within the T Plant Complex or construct a new treatment facility?

- To treat MLLW, should we extend existing commercial treatment contracts or establish new contracts or do neither?

- To process and ship out more TRU waste, should we use mobile TRU processing facilities, also called Accelerated Process Lines (which are similar to the Waste Receiving and Processing Facility)?

- To replace the Effluent Treatment Facility capability after it ceases operating, should we use driers to process leachate from the MLLW trenches?

Facilities would use various treatment technologies. We identify the reasonable treatment technologies, their range of operations, and their alternative locations.

In some of the HSW EIS action alternatives, we consider constructing new disposal capacity for LLW and MLLW as well as using existing trench capacity. We evaluate trenches similar to those used now for disposal of LLW and MLLW at Hanford, new enhanced (deeper and wider), and expandable disposal facilities. We evaluate separate designs for each waste type and for melters and ILAW from the tank waste treatment plant. We also provide some alternatives in which we would use a lined modular disposal facility for some or all of the waste streams. In most alternatives, we would ultimately close the disposal facilities by placing over the top of the facility a cap (cover or barrier) consisting of soil, sand, gravel, and asphalt to reduce water infiltration and the potential for human, animal, or plant intrusion. Figure S.14 summarizes the various alternatives considered for the disposal of solid radioactive waste in the future.

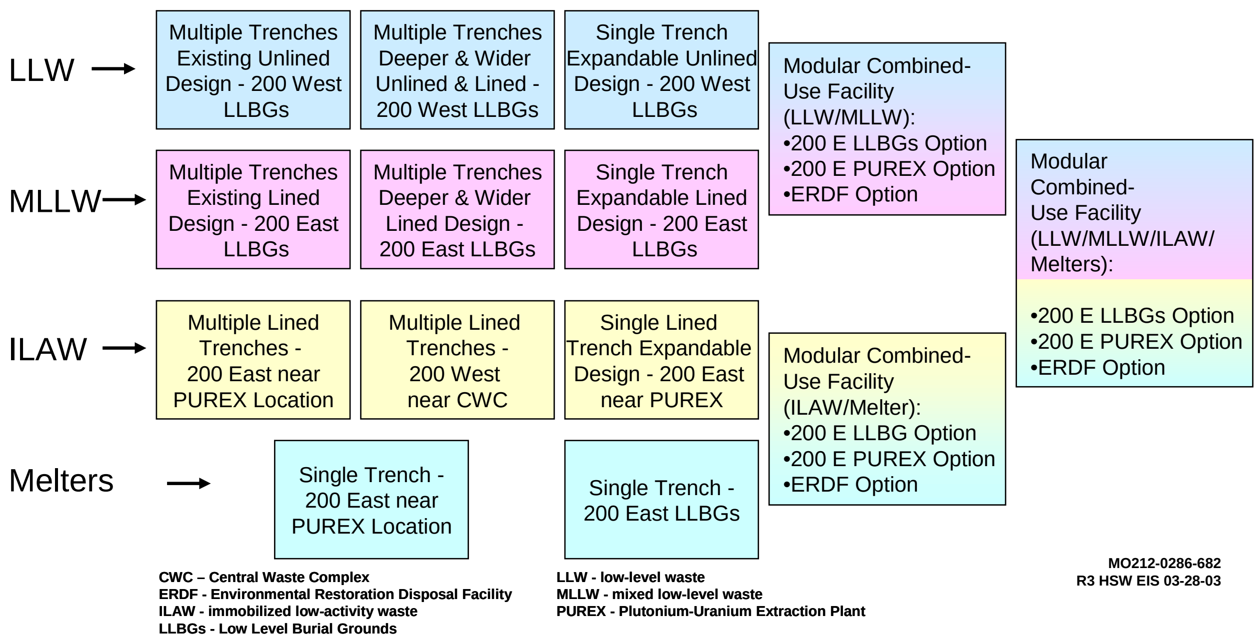


Figure S.14. Solid Waste Disposal Action Alternatives

Under most scenarios, the disposal of ILAW and melters would require new, specially designed MLLW capacity. The melters evaluated in this HSW EIS are expected to be disposed of similar to mixed waste, but because of their large size (15 to 25 feet in length, height, and width, and weighing up to 600 tons), they might be handled differently from other mixed wastes. Because the *Tank Waste Remediation System EIS* (DOE and Ecology 1996) previously evaluated the generation of these wastes, the HSW EIS is evaluating only the disposal.

Grouping of Alternatives

In developing the alternatives for this HSW EIS we quickly recognized that there are a large number of combinations of the various waste streams, their potential waste volumes, and individual options for their storage, treatment, and disposal. So, to facilitate the analysis and presentation of impacts, we have constructed six primary alternative groups. Within these alternative groups we specified alternatives for the treatment, storage, and disposal for the different waste types and analyzed for a range of potential waste volumes. The groups have been simply identified as No Action (N), A, B, C, D, and E. For Alternative Groups D and E, we considered different potential locations for the disposal facility(s) within the 200 East and 200 West Areas. With the exception of the No Action Alternative, each alternative is consistent with WM PEIS Records of Decision. Alternative Group A, Alternative Group B, and the No Action Alternative are fundamentally the same as Alternative 1, Alternative 2, and the No Action Alternative, described in the first draft of this HSW EIS. Alternative Groups C, D, and E (and their options) are new and are supported by new analysis. Figure S.15 illustrates our approach for grouping the alternatives into these alternative groups.

No Action Alternative: The No Action Alternative consists of continuing current solid waste management practices, including continued storage of radioactive wastes that cannot be processed for disposal. As part of the No Action Alternative, we would continue to implement previous Records of Decision and other NEPA decisions for existing facilities and operations and continue ongoing activities. This is the more traditional "no action" alternative, where the EIS assumes there is no change from existing operations. For example, Hanford would continue to dispose of LLW within the Low Level Burial Grounds even though doing so is certainly considered an ongoing action. However, to respond to concerns from commenters on the first draft of this HSW EIS, we also describe qualitatively a "Stop Action" scenario.

Alternative Group A – *Disposal by Waste Type in Larger Disposal Facilities – Onsite and Offsite Treatment*: New disposal facilities would be deeper and wider than those currently in use and would be lined with leachate collection systems. Different waste types would not be disposed of together. New LLW capacity would be located in the 200 West Area and new MLLW, ILAW, and melter facilities would be located in the 200 East Area. T Plant would be modified to provide treatment capabilities for remote-handled TRU waste, remote-handled MLLW, and waste in non-standard containers. Treatment of contact-handled MLLW would be provided at offsite facilities.

Alternative Group B – *Disposal by Waste Type in Existing Design Disposal Trenches – Onsite Treatment*: Disposal trenches would be of the same design as those currently in use. Different waste types would not be disposed of together. New LLW and ILAW trenches would be located in the 200 West Area and new MLLW and melter trenches would be located in the 200 East Area. A new facility would be built to provide treatment capabilities for remote-handled TRU waste, remote-handled MLLW, contact-handled TRU waste, and waste in non-standard containers.

Alternative Group C – *Disposal by Waste Type in Expandable Design Facility – Onsite and Offsite Treatment*: A single, expandable disposal facility (similar to the Environmental Restoration Disposal Facility) would be used for each waste type. Different waste types would not be disposed of

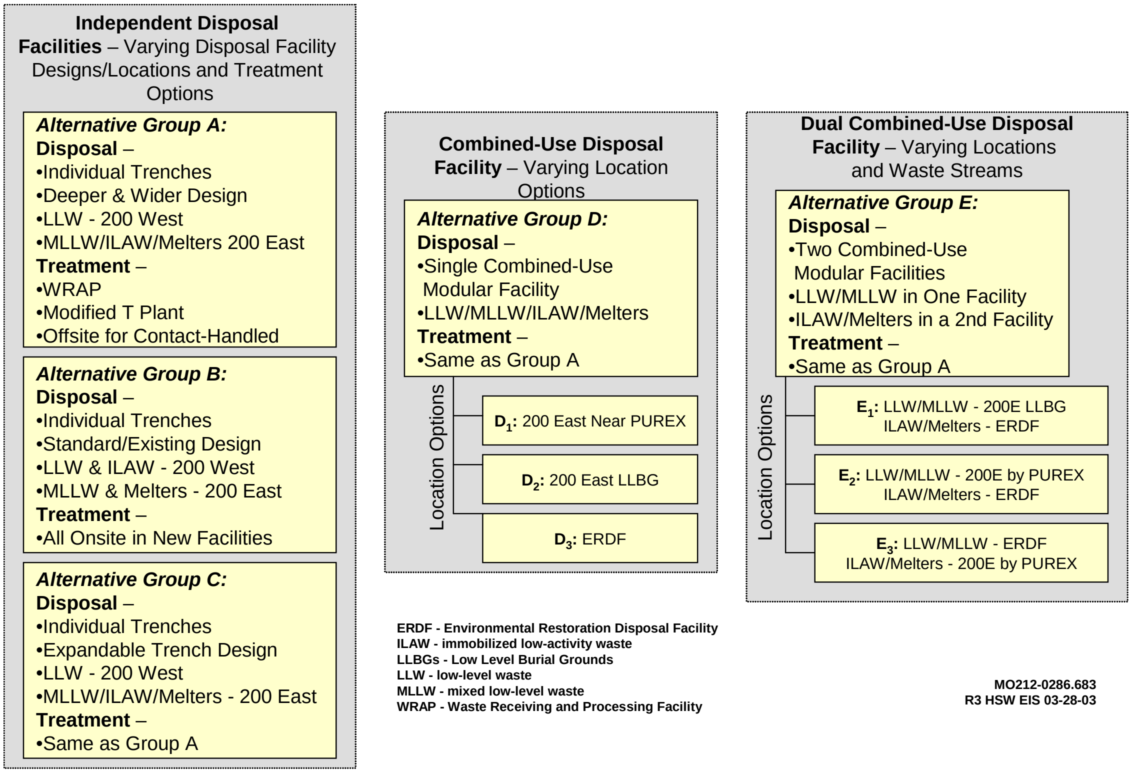


Figure S.15. Development of Alternative Action Groups

together. New LLW facilities would be located in the 200 West Area and new MLLW, ILAW, and melter facilities would be located in the 200 East Area. Treatment alternatives would be the same as those described in Alternative Group A.

Alternative Group D – *Single Combined-Use Disposal Facility – Onsite and Offsite Treatment*: LLW, MLLW, ILAW, and melters would be disposed of in a single facility. Disposal would occur either near the Plutonium-Uranium Extraction Plant (D_1), in the 200 East Area Low Level Burial Grounds (D_2), or at the Environmental Restoration Disposal Facility (D_3). Treatment alternatives would be the same as those described in Alternative Group A.

Alternative Group E – *Dual Combined-Use Disposal Facilities – Onsite and Offsite Treatment*: LLW and MLLW would be disposed of in a single facility; ILAW and melters would be disposed of in another single facility. Disposal would occur in some combination of locations as shown in Table S.1. Treatment alternatives would be the same as those described in Alternative Group A.

S.7 Comparison of Alternatives

We have prepared the following sections to summarize the results of the environmental analyses prepared in this revised draft HSW EIS. We have included a high-level summary of the environmental consequences associated with the various alternative groups. We also discuss the results of our cumulative impacts analysis, potential mitigation measures, and our long-term stewardship plans.

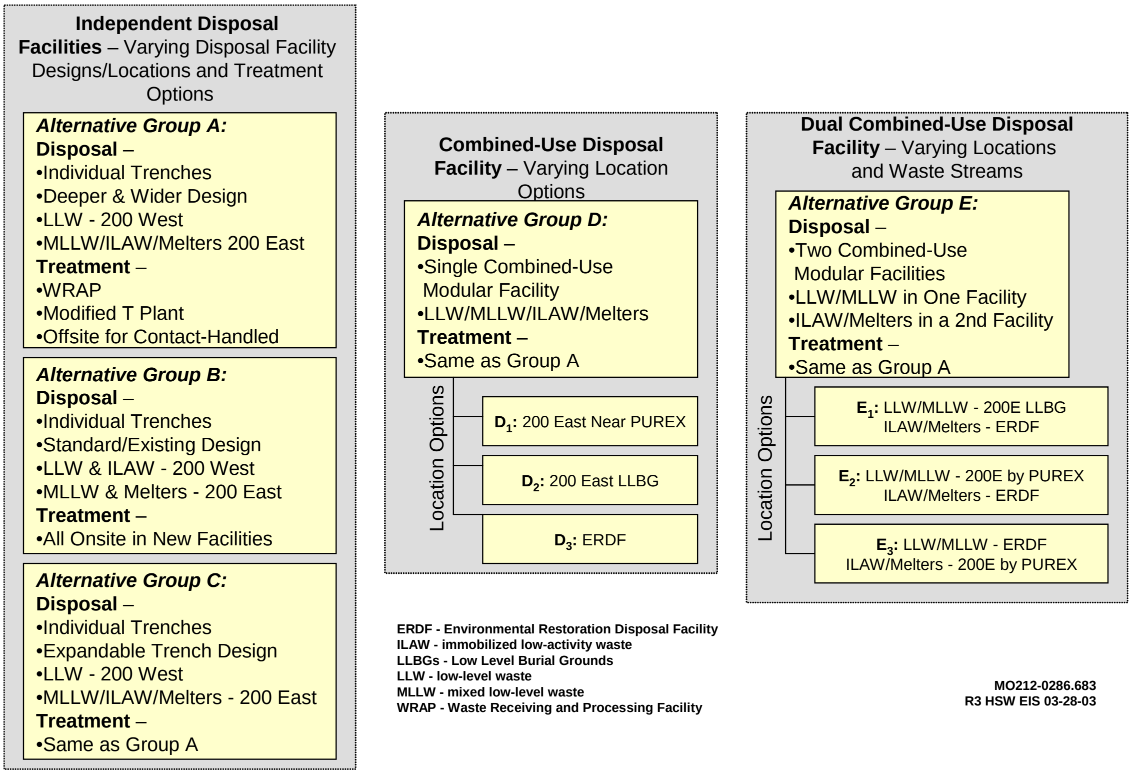


Figure S.15. Development of Alternative Action Groups

together. New LLW facilities would be located in the 200 West Area and new MLLW, ILAW, and melter facilities would be located in the 200 East Area. Treatment alternatives would be the same as those described in Alternative Group A.

Alternative Group D – ***Single Combined-Use Disposal Facility – Onsite and Offsite Treatment***: LLW, MLLW, ILAW, and melters would be disposed of in a single facility. Disposal would occur either near the Plutonium-Uranium Extraction Plant (D_1), in the 200 East Area Low Level Burial Grounds (D_2), or at the Environmental Restoration Disposal Facility (D_3). Treatment alternatives would be the same as those described in Alternative Group A.

Alternative Group E – ***Dual Combined-Use Disposal Facilities – Onsite and Offsite Treatment***: LLW and MLLW would be disposed of in a single facility; ILAW and melters would be disposed of in another single facility. Disposal would occur in some combination of locations as shown in Table S.1. Treatment alternatives would be the same as those described in Alternative Group A.

S.7 Comparison of Alternatives

We have prepared the following sections to summarize the results of the environmental analyses prepared in this revised draft HSW EIS. We have included a high-level summary of the environmental consequences associated with the various alternative groups. We also discuss the results of our cumulative impacts analysis, potential mitigation measures, and our long-term stewardship plans.

Table S.1. Alternative Group E – Dual Combined-Use Disposal Facilities Options

Options	Disposal Facility Location		
	ERDF	**200 East LLBG**	**200 East Near PUREX**
E_1	WTP Melter & ILAW	LLW & MLLW	
E_2	WTP Melter & ILAW		LLW & MLLW
E_3	LLW & MLLW		WTP Melter & ILAW

Environmental Consequences

We have examined the potential environmental impacts associated with implementing each of the alternative groups. For some consequences, such as long-term effects of waste disposal on groundwater and the Columbia River, the evaluation period extends well beyond the end of the site operations. For many of the resources, minimal impacts would be expected to occur as a result of implementing any of the alternatives and the differences between the alternative groups are also small. However, for some resources, differences in impacts among the alternative groups do exist. These differences are described below and in Section 3.4 and Section 5 of this HSW EIS.

Table S.2 provides a summary of the range of potential environmental consequences during operations of our alternatives under the projected waste volumes. Table S.3 provides our summary of the potential long-term (10,000-year) impacts associated with our alternatives. Because the differences between alternatives are often small, we have chosen to illustrate the differences by waste volumes in these two tables.

We have chosen to make a number of assumptions in our analysis that provide a conservative view of the potential impacts. These assumptions include such things as the absence of active institutional controls 100 years after site closure. Without active institutional controls the analysis further assumes that caps and covers would not be maintained and would degrade over time, maintenance and monitoring activities are not performed, and there is no long-term credit taken for the presence of liners in preventing contamination movement. Considering that many engineered structures and administrative or institutional controls have remained in place for several hundreds of years (Europe is replete with examples of both), this is considered a very, if not overly, conservative assumption.

While we have used these conservative assumptions in our analysis, the federal government fully intends to maintain institutional controls and implement long-term stewardship, mitigation, maintenance, and monitoring activities for as long as necessary. Based on comments, we may provide additional information in the final HSW EIS regarding the potential variation in the environmental impacts associated with continued active maintenance and control measures.

Land Use: We prepared an estimate of the total amount of land committed to the storage, treatment, and disposal of waste for each alternative group. Land permanently committed to waste disposal includes about 130 hectares already occupied by waste previously disposed of in the Low Level Burial Grounds.

Table S.2. Range of Incremental Impacts from Alternatives Analyzed in this EIS (Operational Period)

Consequence Category	**Measure of Impact** - where differences exist among alternative groups, a range is provided and the low and high alternative group(s) are identified by letter: Low Value (Alternative) to High Value (Alternative)	**Range of Waste Volumes**		
		Hanford Only	**Lower Bound**	**Upper Bound**
		Hanford 728,752 m^3	Offsite 20,977 m^3 + Hanford 728,752 m^3 = 749,729 m^3	Offsite 361,659 m^3 + Hanford 728,752 m^3 = 1,090,411 m^3
Routine Operations				
Land Committed to Waste Management	Additional Land Needed – Hectares	19 (D/E) to 93(N)	20 (D/E) to 95 (N)	25 (D/E) to 80 (B)
Ecological Resources	Shrub-Steppe Habitat Disturbed – Hectares	0 (N/B/D2) to 32 (A/C)	0 (N/B/D2) to 32 (A/C)	0 (B/D2) to 32 (A/C)
Geological Resources	Millions of cubic meters	1.4 (N) to 2.6 (B)	1.4 (N) to 2.6 (B)	2.3 (C/D/E) to 2.8 (B)
Consumption of Non-renewable Resources	Diesel Fuel - Thousands of cubic meters	66 (C/D/E) to 189 (N)	66 (C/D/E) to 189 (N)	67 (C/D/E) to 141 (B)
Air Quality	Maximum fraction of an air quality limit (particulate matter)	0.38 (N) to 0.47 (B)	0.38 (N) to 0.47 (B)	0.41 (C/D/E) to 0.60 (B)
Human Health and Safety – Workers and Public	Occupational Exposure - person-rem	765 (A/C) to 873 (N)	766 (A/C) to 873 (N)	774 (C) to 786 (B)
	General Population Dose - person-rem (routine atmospheric emissions)	0.08 (N) to 0.15 (B)	0.094 (N) to 0.17 (B)	0.22 (B) to 0.27 (A/C/D/E)
Cost	Cost in Billions of Dollars	\$3.2 (D) to \$3.8 (B)	\$3.2 (D) to \$3.9 (B)	\$3.5 (D) to \$4.2 (B)
Accident Analysis				
Transportation of Waste and Materials – Accidents/Fatalities	Onsite & for Offsite Treatment	2/0 (N) to 20/1 (A/C/D/E)	2/0 (N) to 20/1 (A/C/D/E)	9/0 (B) to 20/1 (A/C/D/E)
	Within the State of Oregon	0/0 (all alternatives)	2/0 (all alternatives)	4/0 (all alternatives)
	Within the State of Washington	0/0 (all alternatives)	1/0 (all alternatives)	1/0 (all alternatives)
	TRU Waste to WIPP	9/1 (N) to 18/3 (A/B/C/D/E)	9/1 (N) to 18/3 (A/B/C/D/E)	18/3 (all alternatives)
Worker Health & Safety – Industrial Accidents	Number of Recordable Cases	620 (A/C/D/E) to 770 (N)	620 (A/C/D/E) to 770 (N)	640 (A/C/D/E) to 660 (B)
	Number of Lost Workday Cases	260 (A/C/D/E) to 320 (N)	260 (A/C/D/E) to 320 (N)	260 (A/C/D/E) to 270 (B)
	Number of Lost Workdays	8900 (A/C/D/E) to 10,900 (N)	8900 (A/C/D/E) to 10,900 (N)	9200 (A/C/D/E) to 9300 (B)
Fatalities from Operational Accident Having the Largest Consequences	The Beyond-Design-Basis Earthquake at the Central Waste Complex is the accident with the largest consequences. A number of other potential accident scenarios were also evaluated.			
	Public - Number of latent cancer fatalities	34 (all alternatives)	34 (all alternatives)	34 (all alternatives)
	Non-Involved Worker - probability of a latent cancer fatality	1 (all alternatives)	1 (all alternatives)	1 (all alternatives)

Table S.3. Range of Incremental Impacts from Alternatives Analyzed in this EIS (long-term – 10,000 years)

Consequence Category	Measure of Impact - where differences exist among alternative groups, a range is provided and the low and high alternative group(s) are identified by letter: Low Value (Alternative) to High Value (Alternative)	Range of Waste Volumes		
		Hanford Only	**Lower Bound**	**Upper Bound**
		Hanford 728,752 m^3	Offsite 20,977 m^3 + Hanford 728,752 m^3 = 749,729 m^3	Offsite 361,659 m^3 + Hanford 728,752 m^3 = 1,090,411 m^3
Maximum Waste Site Intruder Risk of Fatality at 100 Years After Closure	Residential Basement Excavation	Precluded due to depth	Precluded due to depth	Precluded due to depth
	Drilling	4 in 100	4 in 100	4 in 100
	For the intruder scenarios the results are the same for all the alternatives and waste volumes, with the exception of the excavation scenario for the No Action Alternative. Because the No Action Alternative does not include protective caps over the burial ground, the excavation scenario would likely result in an acute fatality, if intrusion were to take place in the year 2150.			
Water Quality (Groundwater) – Sum of the fractions in year of greatest value	Sum-of-the-Fractions Calculation for the **Maximum** Projected combined Iodine-129 and Technetium-99 concentrations			
	200 East NW line of analysis down	58% in the year 2100 AD ($D_1/D_3/E_2/E_3$/NA) to 100% in the year 3400 AD (D_2/E_1)	58% in the year 2100 AD ($D_1/D_3/E_2/E_3$/NA) to 100% in the year 3400 AD (D_2/E_1)	58% in 2100 AD ($D_1/D_3/E_2/E_3$) to 136% in 3400 AD (B)
	ERDF line of analysis	49% in 12,050 AD (E_1/E_2) to 117% in 3790 AD (D_3)	49% in 12,050 AD (E_1/E_2) to 117% in 3790 AD (D_3)	49% in 12050 AD (E_1/E_2) to 120% in 3800 AD (D_3)
	For all other lines of analysis (200 W, 200 E SE, and along the River) the sum of the fraction never exceeds 100%.			
Exposure to Radionuclides via the Groundwater Pathway				
Maximum Annual Drinking Water Dose (2 liters per day consumption)	200 Area - Highest Results (mrem)	0.21 (E_2) to 0.51 (N)	0.21 (E_2) to 0.75 (N)	0.26 (E_2) to 2.4 (B/D_1)
	Near River – Highest Results (mrem)	0.04 (N) to 0.13 (B)	0.04 (N) to 0.13 (B)	0.09 (A/C/D/E_1/E_3) to 0.21 (B)
Fatality to Lifetime Onsite Resident Gardener	200 Area (chances in a million)	28 (E_2) to 65 (A/C)	28 (E_2) to 65 (A/C)	29 (E_2) to 130 (B)
	Near River (chances in a million)	6 (E_2) to 13 (B)	6 (E_2) to 13 (B)	7 (A/C/E_3) to 15 (B)
Fatality to Lifetime Onsite Resident Gardener with a Sauna/ Sweat Lodge	200 Area - Highest Result (chances of a fatality)	1 in 400 (A/C/D_1/E_3) to 1 in 50 (N)	1 in 400 (A/C/D_1/E_3) to 1 in 50 (N)	1 in 10 (all alternatives)
	Near River (chances of a fatality)	1 in 2000 (C/D/E) to 1 in 200 (B)	1 in 2000 (C/D/E) to 1 in 200 (B)	1 in 300 (A/C/D/E_1/E_3) to 1 in 100 (B)
Fatalities in Populations over 10,000 Years	Based on person-rem calculations, the impacts to populations downstream of Hanford were evaluated for the Tri-Cities, Washington, and for Portland, Oregon, over the 10,000-year period. Based on the population dose (person-rem), no latent cancer fatalities are predicted.			

Disposal of the Hanford Only waste volume would increase the area of land permanently committed from a low of 19 hectares of land within the 200 Area under Alternative Groups D and E, to 56 hectares for Alternative Group B, and 95 hectares for the No Action Alternative (of which 66 hectares would be for continued storage). Table S.2 provides the incremental increases in land use for the Lower and Upper Bound waste volume estimates. At most, total land use for solid waste operations, including treatment, storage, and disposal facilities, would represent about 4 percent of the 200 Area Industrial-Exclusive zone.

Transportation: We describe the impacts of shipments of solid waste from offsite generators to the Hanford Site, paying specific attention to transportation impacts with the states of Washington and Oregon, and shipments of TRU waste from Hanford to the Waste Isolation Pilot Plant. Figure S.16 shows the primary transportation routes of radioactive waste through the states of Oregon and Washington.

We also evaluated the impacts of shipments within the Hanford Site of LLW, MLLW, TRU waste, ILAW, and melters to disposal facilities, shipments of MLLW from Hanford to offsite treatment facilities, and shipments of construction and capping materials.

Figure S.16. Planned Transportation Routes of Radioactive Waste through Oregon and Washington

From the analysis, we project no radiological fatalities from any of the alternatives. Within Oregon and Washington (including the Hanford Site), we estimate the number of potential traffic accidents range from a low of 5 to a high of 25, with only one traffic fatality projected. The transport of TRU waste to the Waste Isolation Pilot Plant for Alternative Groups A through E might result in 18 accidents and 3 fatalities; and the No Action Alternative might result in 9 accidents and 1 fatality somewhere in the United States. Because the No Action Alternative leaves waste in storage or at the generator site, it results in the lowest number of accidents overall. The transportation impacts in Oregon and Washington from receiving the additional waste volumes from the Lower Bound waste volumes to the Upper Bound waste volumes is estimated at 2 additional accidents.

Air Quality and Noise: Air quality impacts are based on concentrations of particulate matter, sulfur dioxide, carbon monoxide, and nitrogen dioxide at points of public occupancy compared to State and federal air quality standards. Air quality standards are not exceeded under any of the alternatives over the entire range of waste volumes. In addition to the analysis of air quality, we also assess construction noise. Because all alternatives would involve essentially the same activities, noise levels produced by those activities at any given point in time would be essentially the same. Moreover, noise was not considered to be an important impact element because of distance to public receptors.

Ecological Resources: Potential impacts on ecological resources are small among the alternative groups and the No Action Alternative; we do not expect them to be important discriminators in the selection process. However, the loss of the shrub-steppe habitat for the alternative groups using the near PUREX disposal facility location represents a discriminating ecological resource impact. If this location were selected, mitigation measures would be expected in accordance with our biological resources mitigation strategy. Conclusions regarding potential impacts on terrestrial biota were based on appropriate seasonally adjusted surveys. Conclusions regarding potential impacts on aquatic and riparian biota near and in the Columbia River were based on an ecological risk assessment of potential future releases from waste sites through groundwater to the river. The risk of radiological impacts to aquatic and riparian biota from future contaminant releases is well below levels expected to cause any discernible impacts. The risk to threatened and endangered species is likewise negligible for all the alternative groups.

Cultural, Aesthetic, and Scenic Resources: The principal potential for impacts on cultural resources would be associated with disturbance of the surface and near-surface portions of the Area C borrow pit (Figure S.17). Although it is possible that we may find archeological sites in Area C, a recent field reconnaissance failed to reveal any sites or artifacts on the surface. Because construction would be halted in the event that an artifact of possible cultural significance were found and would remain so until a professional evaluation was made, it would be unlikely that impact to cultural resources would be important discriminators among the alternative groups. In addition, no particular distinction was made among any of the alternative groups for impacts on aesthetic and scenic resources.

Socioeconomic and Environmental Justice: Implementation of any of the alternative groups or the No Action Alternative would have minimal and barely differentiable impacts on local socioeconomic infrastructure, including housing, schools, medical support, traffic, and environmental justice impacts.

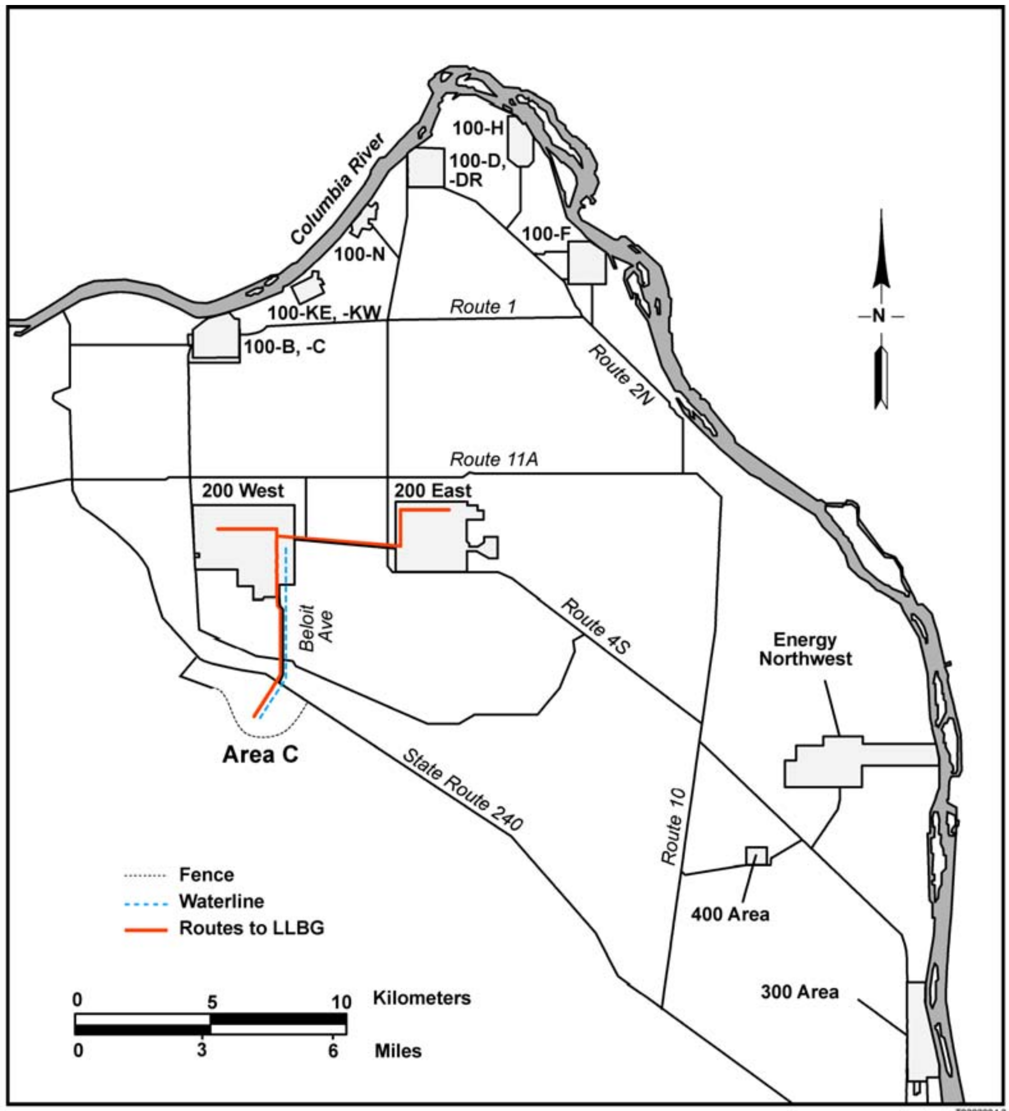


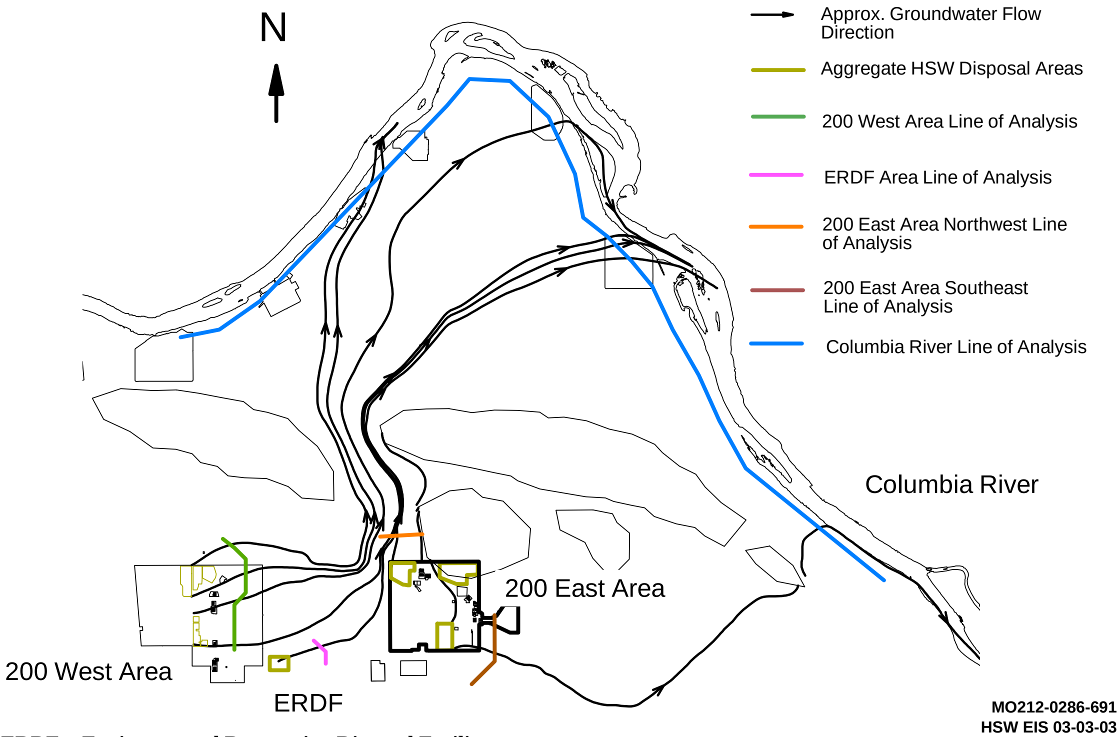
Figure S.17. Area C Location Relative to the 200 East and 200 West Burial Grounds

Geological and Non-Renewable Resources: Although large quantities of gravel, silt/ loam, and basalt would be needed in the construction of waste disposal site covers upon closure, these resources are readily available in the Area C borrow pit. The quantities of these resources range from a low of 1.4 million cubic meters for the No Action Alternative to a high of 2.8 million cubic meters for Alternative Group B. In addition to geologic resources, the consumption of fossil fuel (diesel, gasoline, and propane) has been estimated for all the alternative groups. Alternative Groups A and B have noticeably higher fossil fuel demands than the other alternative groups because of the additional construction and operation of new onsite treatment facilities.

Water Quality: One measure of water quality for purposes of comparison among the alternatives is taken as the annual dose to an individual from drinking 2 liters per day of groundwater from hypothetical wells. These hypothetical wells are assumed to contain the maximum combined concentrations of radio-nuclides in predicted plumes along several lines of analysis downgradient (toward the river) from the solid waste disposal facilities. These lines of analysis were positioned at a distance to capture maximum combined contributions from the disposal facilities and are illustrated in Figure S.18.

Maximum doses from drinking water containing combined radionuclide concentrations from the Hanford solid waste disposal facilities predicted at all lines of analysis in groundwater for any of the alternatives and waste volumes disposed of fall below 1 mrem per year for the first 1,000 years after disposal, and below 4 mrem per year for the entire 10,000-year period of analysis. The dose from drinking maximum cumulative concentrations predicted adjacent to the Columbia River is less than 0.1 mrem per year for about 9,000 years and does not exceed 1 mrem per year for the entire 10,000-year period of analysis. To put this in perspective, the average background dose to individuals in the United States is about 300 mrem per year.

Action alternatives analyzed in this EIS do not exceed the 4 mrem per year benchmark public drinking water dose (see Section 3.4.3). By the time the waste constituents from the action alternatives are predicted to reach groundwater (hundreds of years), the waste constituents would not superimpose on existing plumes and would not exceed the benchmark dose, because the existing groundwater contaminant plumes will have migrated out of the unconfined aquifer by then.



ERDF = Environmental Restoration Disposal Facility

Figure S.18. Lines of Analysis for Determining Maximum Annual Drinking Water Dose

We also use maximum concentration levels as benchmarks to compare potential contamination levels. Under all alternative groups and the No Action Alternative, the highest impacts to groundwater quality were estimated from releases of two key long-lived and mobile radionuclides, iodine-129 and technetium-99. For most of the alternative groups, predicted iodine-129 concentration levels approached but did not exceed the benchmark maximum concentration level of 1 picocurie per liter. The highest iodine-129 levels were associated with the Upper Bound waste volume considered in Alternative B. For the Upper Bound waste volume evaluated under Alternative B, maximum iodine-129 levels downgradient from the 200 East Area were at 123 percent (1.2 picocurie per liter) of the benchmark maximum concentration level.

For all the alternative groups, technetium-99 concentration levels do not exceed the benchmark maximum concentration level (900 picocurie per liter) over the 10,000-year period for all lines of analysis. Using the sum-of-fractions rule, the total concentration of technetium-99 and iodine-129 when combined ranged from 58 percent to 136 percent with the maximum occurring in the 200 Areas for Alternative Group B and the Upper Bound waste volume in about the year 3290 AD. Combined technetium-99 and iodine-129 concentration levels were well below benchmark maximum concentration levels by the time they reached the Columbia River well for all alternative groups and the No Action Alternative. At a maximum, uranium caused contamination levels of up to about 58 percent of its maximum concentration level in 200 Area wells about 10,000 years after closure. None of the alternatives resulted in concentrations of uranium exceeding 5 percent of the maximum concentration level at the river well.

Human Health – Operational Period (present to 2046): We compare radiological impacts on the public from the routine atmospheric releases of radioactive materials or chemicals during operations in various alternative groups. Airborne emissions from routine operations were determined to be very small and would not result in any additional latent cancer fatalities in the exposed population. We also compare radiological impacts to workers (both non-involved workers and occupational radiation workers). The No Action Alternative represents the highest cumulative dose, followed by Alternative Group B, with the remaining groups very closely related. At the highest collective worker dose (873 person-rems), which is associated with the No Action Alternative, 1 latent cancer fatality might be inferred (0.52). No latent cancer fatalities would be expected among workers for the other alternative groups.

We do not expect either occupational radiation exposure or occupational injuries as a result of accidents to result in radiation-related fatalities among workers involved in the waste management operations, although some reportable and lost workday accidents of an industrial nature would be expected based on Hanford Site labor statistics (see Table S.2). The radiological impacts of accidents vary greatly depending on the circumstances of the events analyzed, and are described in detail in Appendix F.

Human Health – Post Closure Period: As stated previously, we have chosen to make a number of assumptions in our analysis that provide a conservative view of the potential long-term impacts. These assumptions include such things as the absence of active institutional controls 100 years after site closure. While we have used these conservative assumptions in our analysis, the federal government fully intends to maintain institutional controls and implement long-term stewardship and maintenance and monitoring activities for as long as necessary. In the case of intruder scenarios (e.g., unauthorized use of or entry into an area), the consequences are essentially the same for all alternative groups, and while not discriminators among alternatives, they do present potential impacts. Because of these impacts, we will employ mitigation techniques such as the use of institutional controls and long-term stewardship actions.

Impacts on the public in the long term are expressed in terms of the annual dose a hypothetical gardener might receive, if the individual were to intrude on the Hanford Site, drill a well into a contaminated aquifer, spread the drilling mud about the garden plot, and use the well water for both domestic and irrigation purposes. Plots of the annual doses to the hypothetical resident gardener are provided in Section 3.4. There are differences in the annual doses over time as a function of the alternative under consideration; however, the maximum values are all less than 25 mrem per year, which is the limit for all pathways (DOE 2001b).

To account for the possibility that the hypothetical gardener had a sauna, or in the case of a Native American, a sweat lodge, the annual dose to such an individual as a function of time was also determined. Plots of the annual doses to the resident gardener are again compared among the alternatives in Section 3.4. The much higher doses associated with the sauna/sweat lodge scenario are attributable to inhalation of radionuclides released as a result of elevated water temperatures used in saunas or sweat lodges. For all alternatives, the annual dose is at or less than 4 mrem for the first 1,000 years. Late in the 10,000-year period there is considerable difference among the alternatives with the risk of a latent cancer fatality ranging up to about 1 in 10 for well locations on the Central Plateau. This rise is due primarily to the arrival of uranium in groundwater at some sites. In terms of this analysis, Alternative Group B tends to be the least preferred action alternative with others closely grouped together.

Under all of the alternatives, radioactive or hazardous chemical exposures to populations using Columbia River water downstream from the Hanford Site would be far below those from which we would expect any health effects.

Cumulative Impacts

Here, we summarize potential cumulative impacts associated with implementing the various alternative groups and waste volumes considered. The cumulative impacts analysis focused on past, present, and reasonably foreseeable future actions. Current and future actions at Hanford include preparation for and disposal of tank waste, CERCLA remediation projects, decontamination and decommissioning of the Hanford reactors, operation of a commercial LLW disposal site by US Ecology, and operation of the Columbia Generating Station by Energy Northwest. We evaluate cumulative impacts regarding worker health and safety; public health (for atmospheric, surface water, and groundwater pathways); land use; air quality; and ecological, cultural, and socioeconomic resources. For most resource and potential impact areas, the combined effects from the HSW EIS proposed actions added to these activities are small.

Because of public interest in cumulative impacts associated with contamination of groundwater and the Columbia River, these impacts are summarized here in more detail. Cumulative impacts on groundwater and the Columbia River are examined in the context of existing sources of contamination in the soil, vadose zone, and groundwater. Groundwater beneath the operational areas and in plumes from the Central Plateau moving towards the Columbia River is currently contaminated with hazardous chemicals and radionuclides from past liquid and other disposal practices and unplanned releases. Mobile radionuclides leached from wastes in the environment could eventually be transported through the vadose zone to groundwater.

Although not used as a source of drinking water today nor expected to be in the foreseeable future, groundwater was analyzed as a scenario in which an individual in the future drills a well through the vadose zone to groundwater and uses the groundwater as a source of drinking water. To understand cumulative Hanford groundwater impacts, we analyzed the annual dose to an individual drinking 2 liters of that water per day. The annual dose was also calculated for an individual drinking 2 liters per day of water taken from the Columbia River at the Richland pumphouse. We took into account all wastes intentionally or unintentionally disposed of on the Hanford Site since the beginning of operations and waste forecasted to be disposed of through cleanup completion. The long-lived mobile radionuclides selected with which to make these estimates were technetium-99 and uranium isotopes using the System Assessment Capability (SAC) (Kincaid et al. 2000) software and data. Other long-lived radionuclides occur in sufficient quantity in various Hanford sources to also be of interest (such as iodine-129). However, the SAC program had not completed the inventory and classification of waste forms in time to integrate these other radionuclides into the present analysis.

This analysis does not include the contribution to cumulative impacts of all radionuclides because of the uncertainties in the inventory and modeling approach. In particular, for one contaminant of interest, iodine-129, such source information has only been partially developed and validated. However, if all sources of iodine-129 were to be considered, it is felt that the cumulative impacts to groundwater could be greater than the impacts presented here by a factor of up to about 3 (see Section 5.14). This is due to the fact that over one-third of the available inventory of iodine-129 is included in the solid waste and ILAW streams. Although it is likely that the actual factor would be less than 3, DOE is continuing to refine computer models to provide more precise estimates. If further analysis shows the potential for adverse cumulative groundwater impacts, then DOE would implement appropriate mitigation measures to prevent such cumulative impacts from occurring. Potential mitigation measures include treating waste by such methods as macroencapsulation, grouting, or placing it in robust containers.

The approach taken by the SAC is consistent with the methods, characteristics, and controls associated with a composite analysis as described by the Columbia River Comprehensive Impact Assessment team (DOE-RL 1998). The SAC is being applied in this HSW EIS to examine the cumulative dose from technetium-99 and uranium associated with all wastes to remain at Hanford after closure of the site, and to provide an overall perspective regarding the contribution of solid waste from implementing any of the HSW EIS alternatives to cumulative impacts from other potential sources. Results of these analyses are provided in Section 5.14 and Appendix L.

Using SAC, we can conclude that the potential dose from groundwater contamination by technetium-99 is dominated by the existing groundwater plumes and releases from liquid waste disposal sites (e.g., cribs, ponds, ditches) over the next 2,000 years. Releases of contaminants from solid waste begin to have noticeable contributions between the years 3000 and 5000 and decline thereafter, with contributions from tank residuals causing a later secondary peak, and with long-term releases from solid wastes, including ILAW, appearing during the last several thousand years of the 10,000-year post-closure analysis. Figure S.19 illustrates these results.

SAC was also employed to evaluate the relative role in overall release of different waste types, including solid waste, past liquid discharges, past tank leaks, future tank losses, tank residuals, unplanned releases, and facilities including canyon buildings. The variability in the results is due to variability in the inventory, release, and transport of the contaminants. In the simulation, the contribution to technetium-99 from solid waste releases to groundwater would amount to approximately 20 percent of the cumulative release from all Hanford sources. For uranium, releases from solid waste to groundwater are much lower. The majority of the technetium-99 and uranium releases from wastes (other than ILAW) were predicted to occur from liquid discharge sites (e.g., cribs, ponds, ditches) used in the past and from unplanned releases on the Central Plateau and from off-plateau waste sites.

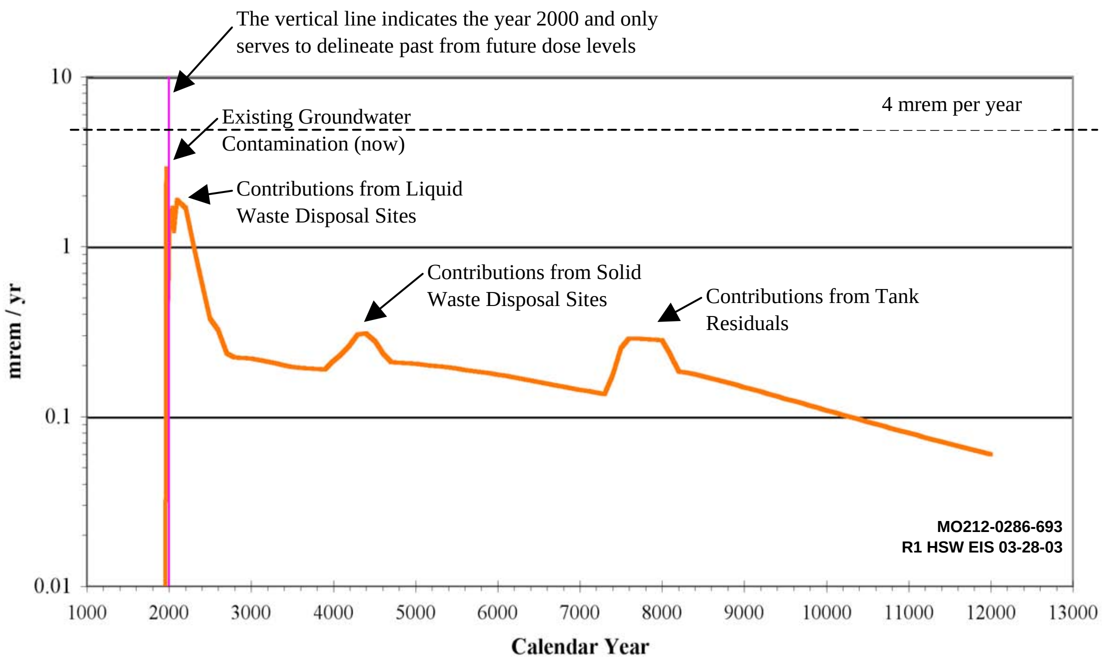


Figure S.19. Annual Drinking Water Dose from Technetium-99 in Groundwater Southeast of the 200 East Area from All Hanford Sources Including ILAW

Uncertainties

Even with the knowledge gained over the past decade in addressing our environmental cleanup challenges, there still are a great many unknowns. Waste site inventories, both in terms of chemical and radioactive contaminants, are not precisely known for many of the solid and liquid wastes sites present on the Central Plateau. Although the overall quantities of radionuclides generated at the Hanford Site are relatively well known, the actual amount in specific waste sites is uncertain. In addition, the long-term performance of our in-place waste site remedies and closure techniques is largely unproven. The analysis conducted within the HSW EIS employed a range of models and techniques, each with its own set of assumptions and associated uncertainties. In general, the approach we took was to use best-estimate or conservative assumptions, so that the estimated impacts would appear to be greater than we would actually experience.

Overall, the largest uncertainties for the HSW EIS surround the actual volumes of waste we must treat, store, and dispose of and their associated levels of activity. To deal with this uncertainty we took the approach of using a range of potential waste volumes, with the Upper Bound waste volume being a very conservative (larger than expected) estimate of the maximum expected volume of waste to be managed.

Another set of uncertainties occurs in our use of the various models and modeling techniques. For example, the science of modeling waste movement in the vadose zone and groundwater is still very young. Our SAC is an example of a good, but still emerging, tool. Because we are still uncertain about the nature and extent of some of the sources and types of contaminants, the SAC modeling input has built-in uncertainties. In particular, the inventory of iodine-129 in the solid waste, vadose zone and groundwater is uncertain by up to a factor two, and thus, so are the associated cumulative effects. However, when the performance measure is human dose, variability with regard to individual behavior and exposure affects uncertainty in the estimated dose even more than variability in inventory, release, or environmental transport of the contaminant.

Mitigation

We have identified measures we could take to avoid or reduce environmental impacts that might occur as a result of the Hanford Solid Waste Program. The text box on the following page provides a brief list of potential mitigation measures that could be pursued. For example, to avoid loss of cultural resources, we will conduct cultural resource surveys before constructing solid waste management facilities. If we discovered cultural resources, we would confer with Tribal governments in evaluating the find and determine appropriate management actions. In addition, if mature sage-steppe habitat needs to be removed to construct a solid waste management facility, we could mitigate the habitat loss by revegetating or protecting other parcels of land.

In addition, we will continue to evaluate additional measures to improve the long-term performance of the disposal facilities and to reduce performance uncertainties. These measures include barriers or waste form technologies (e.g., macroencapsulation) to limit releases and transport of radionuclides, actions to restrict public access, and more protective designs during operations.

Besides identifying specific mitigation actions, the alternatives evaluated in this HSW EIS incorporate various mitigation features as part of the alternatives, such as use of a multi-use lined modular disposal facility, which would be considered an action to minimize the amount of land used.

Any mitigation plan(s), if necessary, would be prepared after the Record(s) of Decision is published because the specific actions needed to reduce or avoid potential environmental impacts would be dependent on the specific decisions and associated mitigation commitments documented in that Record(s) of Decision.

What are some of our potential mitigation measures?

- Continue implementing DOE's pollution prevention/waste minimization program.
- Perform cultural surveys prior to construction.
- Implement guidelines (such as the replacement of sage-steppe community disturbed by construction or capping activities) consistent with the *Hanford Site Biological Resources Management Plan* and the *Hanford Site Biological Resources Mitigation Strategy*.
- Continue implementing As-Low-As-Reasonably-Achievable principles during operations and construction.
- Continue training and practices to prepare for possible emergencies and accidents.
- Perform large movements of construction and capping materials during low traffic times.
- Prepare and implement resource management plans and mitigation plans associated with the *Hanford Comprehensive Land-Use Plan.*
- Construct new facilities and trenches in areas that have already been disturbed. This would minimize the chances of encountering items of cultural significance or disturbing items of cultural significance that have not been disturbed. It would also minimize the impacts to animal, plants, and ecosystems.
- Construct new trenches in uncontaminated areas within the Low Level Burial Grounds to minimize potential health impacts to workers.
- Construct final closure caps that would allow the growth or re-growth of sage-steppe habitat on them.
- Plan construction activities to avoid nesting seasons.
- Reuse soils removed during construction of disposal trenches for construction of final closure caps to the extent possible.
- Install and use rain curtains in operating trenches. This would prevent some of the rainwater and snow melt from coming into contact with waste already in place. This, in turn, would reduce the amount of waste that could leach into the rainwater, reduce the amount of contaminated rainwater (leachate) that would have to be treated, and reduce the amount of leachate that could possibly reach the vadose zone or groundwater.
- Use soil fixants to minimize dust generated during construction activities, waste disposal, and final closure activities.
- Treat and dispose of MLLW in storage as quickly as possible to minimize accidents and exposure to workers from aboveground storage.
- Certify and ship transuranic waste in storage as quickly as possible to minimize accidents and exposure to workers from aboveground storage.
- Keep areas around facilities and trenches clear of flammable material to limit impacts from wildfires.
- Keep trenches clear of tumbleweeds, other deep-rooted plants, and burrowing animals to minimize the potential for spreading contamination.

Long-Term Stewardship and Post Closure

The Hanford Site is being cleaned up to meet certain land-use and regulatory requirements. These requirements are based, in part, on limitations of the level of cleanup that can be practically achieved. Limitations that prevent unrestricted use of all land and groundwater at the Hanford Site include the following:

- ***technical and economic limitations*** – technically and economically practicable technologies may not exist to perform cleanup activities. For example, no technology known or anticipated can remove 100 percent of the contents of Hanford's HLW tanks.

- ***worker safety and health issues*** – impacts to workers from cleaning up may be greater than the impacts to the general public from not cleaning up. For example, the impacts to workers from digging up and treating waste from old burial grounds might be greater than the impacts to the general public from capping the waste in place.

- ***environmental issues*** – cleanup may result in greater impacts to the environment than already exist. For example, the risk of accidental releases to the environment during retrieval of waste from old burial grounds might be larger than the risk to the environment of capping the waste in place.

These limitations result in some hazards remaining after cleanup activities are complete. Because some hazards will remain, we need a program to monitor them and deal with any problems that occur. These post-cleanup activities are referred to as long-term stewardship. Specific long-term stewardship activities are dependent on rules and regulations under which the specific cleanup and post-cleanup activities are performed and the specific hazards that remain. Long-term stewardship activities are intended to continue isolating hazards from people and the environment.

What are typical long-term stewardship activities?

- monitoring to verify the integrity of caps placed over disposal sites
- maintaining caps to ensure their continued integrity
- monitoring groundwater and the vadose zone to determine whether systems to contain hazards are working
- monitoring for surface contamination
- monitoring animals, plants, and the ecosystem
- performing groundwater pump-and-treatment operations
- installing and maintaining fences and other barriers
- posting warning signs
- establishing easements and deed restrictions
- establishing zoning and land-use restrictions
- maintaining records on cleanup activities, remaining hazards, and locations of the hazards
- maintaining necessary infrastructure (e.g., utilities, roads, communication systems).

S.8 Major Conclusions

Our analysis demonstrates that implementing the proposed action (to operate existing and new facilities for the safe treatment, storage, and disposal of solid radioactive wastes and to close those facilities) would not be expected to have adverse physical effects on populations using the Columbia River downstream of the Hanford Site. In addition, the disposal of solid waste would add only a small contribution to projected doses for people in the highly unlikely event that they were to drink from groundwater from various locations on the Hanford Site. However, while also highly unlikely, intruder and resident gardener scenarios incorporating the use of saunas or sweat lodges would result in doses at about 8,000 years hence that might be of concern. Mitigation plans, particularly those related to our long-term stewardship actions, including land-use covenants and active and passive institutional controls, would be used to prevent post-closure intrusion into the waste zones or groundwater resource for as long as needed into the future.

In general, the Proposed Action would potentially result in small, short-term public health and worker safety impacts due primarily to the transportation of waste, industrial accidents, and occupational exposure to radiation, regardless of alternative group chosen for implementation. Transportation impacts would be associated largely with non-radiological traffic accidents and vehicle emissions. Industrial accidents would depend for the most part on the volumes of waste to be handled. Occupational exposure to radiation would be well below permissible limits and would not result in any additional latent cancer fatalities. Impacts at the Hanford Site for the operational period are summarized in Table S.2. Impacts are compared in more detail among the alternatives in Section 3.4 and discussed in further detail in Section 5 and supporting appendixes.

Major Impact Differences Among the Alternatives

The No Action Alternative does not solve the issue of final disposition for many of the waste types, leaving large volumes in storage for the foreseeable future. Therefore, the obligation to dispose of these wastes would become the responsibility of some future generation. Moreover, the No Action Alternative results in the largest impacts for a number of the environmental resource categories. It uses the most land, the largest amount of non-renewable and geologic resources, and results in the largest occupational exposures and number of industrial accidents. In addition, by implementing the No Action Alternative we would be eventually precluded from meeting our compliance obligations.

Following the No Action Alternative, Alternative Group B generally has the next highest potential impacts among the alternative groups. As configured, Alternative Group B would be the action alternative with the largest land-use impacts. This is because this alternative group involves building new treatment facilities and using the existing (and less efficient) designs for disposal cells. Based on these considerations, Alternative Group B results in the highest impacts among the alternative groups in the non-renewable and geologic resources, air quality, worker dose, groundwater quality, and occupational exposure categories. One off-setting benefit of Alternative Group B is a reduction in transportation impacts, because some MLLW would be sent only to a nearby treatment plant.

Alternative Groups A and C have more efficient designs for the individual disposal cells (for both LLW and MLLW) and both would use a combination of existing onsite facilities (including a modified

T Plant) and offsite capabilities for the treatment of waste. These alternative groups have noticeably reduced impacts in a number of the environmental consequences categories over Alternative Group B. Thus, the use of existing onsite and offsite treatment capabilities appears to be preferred over the construction of new facilities, as is the use of improved design disposal cells.

Alternative Groups D and E were configured to evaluate the potential impacts and benefits associated with multi-use disposal facilities. In Alternative Group D, we looked at a single, multi-use disposal facility for all Hanford solid waste types (LLW, MLLW, ILAW, and melters). In Alternative Group E, we considered two multi-use disposal facilities, one for LLW and MLLW and another for ILAW and melters. The waste treatment approach for these alternative groups would be the same as in Alternative Groups A and C. In general, these alternative groups have noticeably reduced impacts, in a number of the environmental consequences categories, over Alternative Groups A, B, and C. Within these two alternative groups we also examine the effect of different locations of the multi-use disposal facility(s). The differences in impacts among Alternative Groups D and E and their subgroups would be minor. Thus, the use of multi-use facilities also appears to be preferred over those designed for individual waste streams.

DOE Preferred Alternative

Based on the results of the environmental consequences analyses, cost, and other considerations, we have identified a preferred alternative for the HSW EIS. The preferred alternative consists of those actions identified in Alternative Group D for waste quantities up to the Upper Bound waste volumes, in addition to the use of modular facilities for the processing and certification of TRU waste, as follows:

Storage: The Central Waste Complex would continue as our primary storage facility for LLW, MLLW, and TRU waste. The storage of retrievably stored TRU waste in the Low Level Burial Grounds would continue until retrieval operations are complete.

Treatment: LLW and MLLW would be treated using a combination of existing capabilities and processes, offsite commercial capabilities, and a modified T Plant. TRU waste would be processed and certified using a combination of the Waste Receiving and Processing Facility, a modified T Plant, and the modular facilities.

Disposal: LLW, MLLW, ILAW, and melters would be disposed of in a new modular facility. This new disposal facility would include a RCRA-compliant liner and a leachate collection system and upon closure would be capped with the modified RCRA Subtitle C cover. Existing Low Level Burial Grounds would be similarly capped. These existing Low Level Burial Grounds would continue to be used pending start of the new disposal facility.

In general, alternatives outlined in Alternative Groups D and E would be the most environmentally preferable, operationally efficient, and marginally cost-effective. The differences in impacts between Alternative Groups D and E and their respective subgroups would be minor. However, Alternative Group D appears to offer a combination of low environmental impacts and low cost. Waste disposal operations would be combined in a single location that could provide a more efficient regulatory pathway to construction and operation.

Areas of Controversy

We acknowledge that areas of controversy exist regarding the Proposed Action and the analyses in the HSW EIS. Areas of controversy were identified during the public interaction processes. We are not able to resolve many of these issues because they reflect either differing points of view or uncertainties in predicting the future. However, we have considered these areas in the development of this revised draft of the HSW EIS. Issues raised by the public are addressed in the Comment Response Document, Volume III.

Receipt of Offsite Waste: There are differing points of view about the importation of waste to Hanford from offsite locations and the impact that waste would have on the environment. In order to clearly communicate the incremental impacts of receiving offsite waste, we analyzed three different waste volumes, Hanford Only, Lower Bound, and Upper Bound.

Modeling Uncertainties and Evaluation of Long-Term Performance: There are differing points of view regarding the ability to predict groundwater impacts and long-term performance for performance behaviors and the use of computer models for accurately predicting groundwater and human health impacts raise questions about our ability to accurately predict impacts far into the future. We present long-term impacts using the best available methodologies and conservative assumptions, and we identify the uncertainties associated with our models. Some disagreement also exists with our use of conservative assumptions, which could lead to higher modeled groundwater concentrations than would actually occur, potentially masking differences among the alternatives. DOE believes that the analyses in this EIS are reasonable for purposes of evaluating potential impacts from alternatives.

Transportation: There are differing points of view regarding previous transportation analyses conducted as part of the Waste Management Programmatic EIS and the desire by members of the public to have the transportation impacts reanalyzed as part of the HSW EIS. Although an analysis of nation-wide transportation of wastes to Hanford from other DOE sites was not performed, the transportation impacts associated with those wastes in the states of Oregon and Washington were added to the revised draft.

Cumulative Impacts: There are differing points of view regarding how best to assess cumulative impacts on the Hanford Site. Because the Hanford Site cleanup is a technically complex and long-term program, with associated uncertainties both in terms of final cleanup end states and modeling techniques, cumulative impact analyses will necessarily contain those same uncertainties.

Technetium-99 Inventory in ILAW: There are differing points of view regarding the amount of technetium-99 to be included in the low-activity waste stream. The analysis performed in this revised HSW EIS assumed a maximum quantity of technetium-99 in the ILAW waste stream to provide a bounding level of analysis. Details of the analysis can be found in Section 5.3 and Appendix G. In addition, as indicated in Section 1.5.2, DOE is currently preparing a separate EIS that will evaluate alternative treatment processes for some tank waste and disposal of low-activity waste forms other than those considered in this HSW EIS.

Lines of Analysis: There are differing points of view about where groundwater impacts should be calculated. It has been suggested that analysis at the disposal facility boundaries is needed. The points of analyses used in the HSW EIS comparative assessment were located along lines approximately 1 kilometer downgradient from aggregate Hanford solid waste disposal facilities within the 200 East, 200 West, and the ERDF areas and near the Columbia River located downgradient from all disposal facilities. These points of analysis downgradient from the overall waste disposal facilities in each area are not meant to represent points of compliance but rather common locations to facilitate a more complete comparison of long-term impacts from various waste management configurations and locations defined for each alternative.

Land Use: There are differing points of view about actions on the Hanford Site that use additional land for waste management actions, particularly those actions not directly associated with Hanford cleanup operations.

Use of Area C Borrow Pit: There are differing points of view over the use of the Area C borrow pit for obtaining geological materials for construction of disposal facilities covers.

S.9 Public Interaction Process

This section provides a brief summary of our public interaction process that has led to the development of this revised draft of the HSW EIS.

Scoping Process

Initial Scoping for the HSW EIS: To determine the scope of the issues to be addressed in the HSW EIS, we issued a Notice of Intent to prepare an EIS in 1997. We requested comments and recommendations from interested parties on the range of actions, alternatives, and impacts we should consider and we held public scoping meetings. We received both oral and written comments. In response to these comments, along with DOE-wide decisions reflected in the WM PEIS Records of Decision, we restructured and revised some of our alternatives and projected waste volumes from those originally presented in the 1997 Notice of Intent for the HSW EIS. This scoping process and the other key events that have led to the preparation of the revised draft of this EIS are illustrated in Figure S.20.

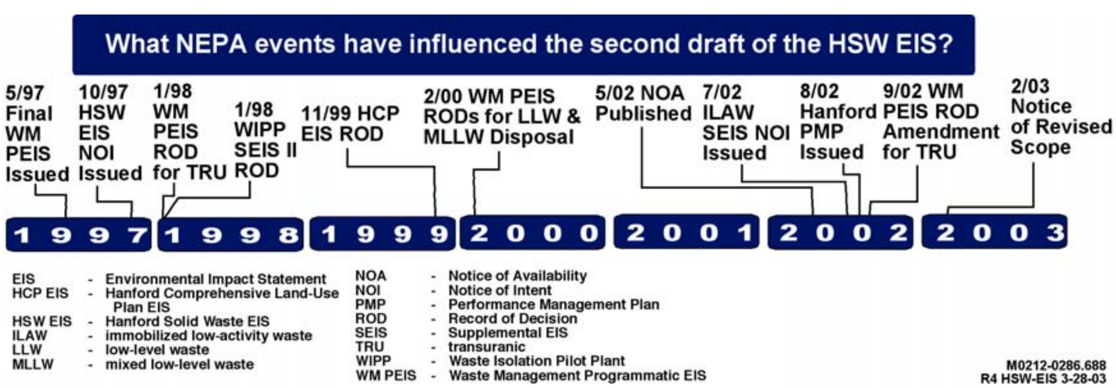


Figure S.20. HSW EIS Development Timeline

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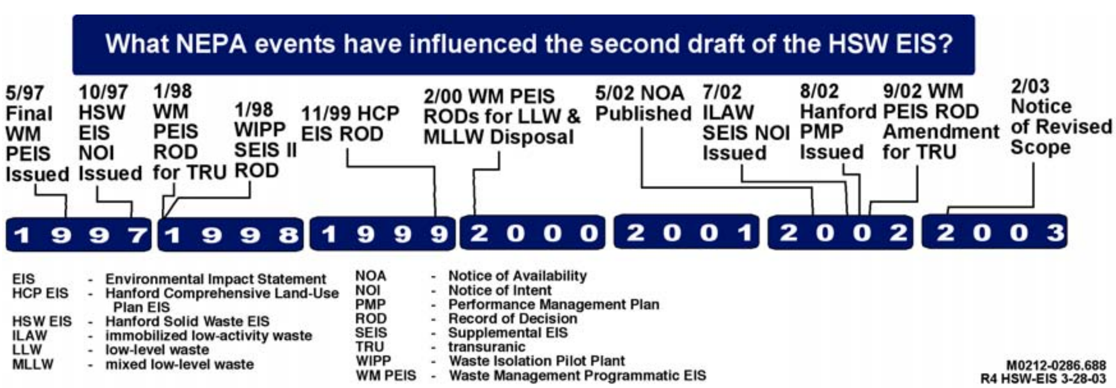

Figure S.20. HSW EIS Development Timeline

Scoping for ILAW Disposal Alternatives: On July 8, 2002, DOE published a Notice of Intent in the *Federal Register* announcing our plan to prepare the Tank Waste Remediation System (TWRS) Supplemental EIS for the disposal of ILAW. During the scoping period, we invited all interested parties to submit comments or suggestions concerning the scope of the issues, alternatives, and environmental impacts to be analyzed in a TWRS Supplemental EIS and we held a public scoping meeting in Richland, Washington. For those who commented, one of the concerns was that disposal of ILAW at Hanford should be considered with disposal of other similar radioactive wastes, such as LLW and MLLW, and should be included in the HSW EIS. In response to this concern we decided to include the ILAW analysis in the HSW EIS. Consequently, all topics that were originally identified in the Notice of Intent for consideration in a TWRS Supplemental EIS are now addressed in this revised draft of the HSW EIS, and all comments on ILAW generated during the scoping phase of the TWRS Supplemental EIS are now included in Appendix A of the HSW EIS. DOE published a Notice of Revised Scope in the *Federal Register* on February 12, 2003 (68 FR 7110).

Comments on the First Draft of the HSW EIS

As a result of our public involvement activities on the first draft of the HSW EIS, we received approximately 3,800 comments. We reviewed these comments and considered them both individually and collectively. In Section S.3 of this summary, we briefly listed the key concerns we heard as a result of the public review, and we have described how those comments have influenced the development of the revised draft of the HSW EIS. The revised draft of the HSW EIS is an extensive rewrite, which is intended to address these concerns.

We have also prepared a Comment Response Document (Volume III) to provide responses to the public comments on the first draft of the HSW EIS. The Comment Response Document provides responses to comments received. In addition, in the Comment Response Document we also provide summary responses to a number of common issues and questions. We describe our role in managing Hanford's cleanup and waste management operations and our intentions for accelerating the cleanup at Hanford. We also provide additional details on the relationship between this HSW EIS and other NEPA documents, including the Waste Management Programmatic EIS, our approach to the development of alternatives, analysis of the impacts of offsite waste (including transportation issues), and our approach to understanding cumulative impacts. We also respond to the concerns over the technical content and scope of the HSW EIS, including depth of analysis, disposal facility design details and alternatives, and long-term performance.

Public Comment Process for the Revised Draft of the HSW EIS

We encourage public comments on this revised draft of the HSW EIS. Information on the availability of this draft and the schedule for public meetings was sent to anyone who requested it, attended a past public meeting, or submitted comments on the first draft. Comments may be submitted verbally at public meetings or in writing by mail, fax, or email. We will consider all comments received during the designated comment period. The final HSW EIS will include responses to the comments received on this revised draft of the HSW EIS.

No sooner than 30 days after the EPA Notice of Availability of the Final HSW EIS, DOE will issue one or more Record(s) of Decision. We will describe the substance of the decision, the alternatives considered in reaching our decision, and the environmentally preferred alternative. We will also identify and discuss any additional factors we used to make our decision and any mitigating actions we propose to avoid or minimize adverse environmental consequences from the actions we decide to implement. If such a document is required, we will prepare a Mitigation Action Plan to establish our specific mitigation commitments.

Comments on this revised draft HSW EIS may be submitted in person at the public meetings or:

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