THE HANFORD SITE

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

## Offsite Secondary Waste Treatment and Disposal

DOE/EIS-0391-SA-3

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# ACRONYMS AND ABBREVIATIONS

| | |
|---|---|
| BOF | Balance of facilities |
| CEQ | Council on Environmental Quality |
| CFR | *Code of Federal Regulations* |
| CH | Contact handled |
| CO | Carbon monoxide |
| $CO_{2eq}$ | Carbon dioxide equivalent |
| DFLAW | Direct-feed low-activity waste |
| DOE | U.S. Department of Energy |
| DST | Double-shell waste storage tank |
| Ecology | Washington State Department of Ecology |
| EMF | Effluent Management Facility |
| EPA | Environmental Protection Agency |
| ETF | Effluent Treatment Facility |
| EIS | Environmental impact statement |
| FMCSA | Federal Motor Carrier Safety Administration |
| FWF | WCS Federal Waste Facility |
| FR | *Federal Register* |
| GHG | Greenhouse gases |
| HC | Hydrocarbon |
| HEPA | High-efficiency particulate air |
| HLW | High-level radioactive waste |
| IDF | Integrated Disposal Facility |
| IHLW | Immobilized high-level radioactive waste |
| IP | Industrial package |
| IX | Ion exchange |
| LAB | Analytical laboratory |
| LAW | Low-activity waste |
| LAWPS | Low-Activity Waste Pretreatment System |
| LCF | Latent cancer fatality |
| LERF | Liquid Effluent Retention Facility |
| LLW | Low-level radioactive waste |
| LSA | Low specific activity |
| MLLW | Mixed low-level radioactive waste |
| MREM | Millirem |
| NEPA | National Environmental Policy Act of 1969 |
| NNSS | Nevada National Security Site |
| NRC | Nuclear Regulatory Commission |
| Perma-Fix DSSI | Perma-Fix Diversified Scientific Services, Inc |
| PFNW | Perma-Fix Northwest |
| PM*x* | Particulate matter (of x diameter) |
| RCRA | *Resource Conservation and Recovery Act* |
| RH | Remote handled |
| RPPDF | River Protection Project Disposal Facility |
| ROD | Record of Decision |
| ROI | Region of influence |

| | |
|---|---|
| SA | Supplement analysis |
| SALDS | State-Approved Land Disposal Site |
| SEPA | State Environmental Policy Act |
| SEIS | Supplemental environmental impact statement |
| SST | Single-shell waste storage tank |
| TC&WM EIS | *Tank Closure and Waste Management Environmental Impact Statement for the Hanford Site, Richland, Washington* |
| TRU | Transuranic |
| TSCR | Tank-Side Cesium Removal |
| TWRS EIS | *Tank Waste Remediation System, Hanford Site, Richland, Washington, Final Environmental Impact Statement* |
| USDOT | U.S. Department of Transportation |
| VLAW | Vitrified low-activity waste |
| WCS | Waste Control Specialists LLC |
| WDOH | Washington State Department of Health |
| WIPP | Waste Isolation Pilot Plant |
| WIR | Waste incidental to reprocessing |
| WM PEIS | *Waste Management Programmatic Environmental Impact Statement* |
| WRPS | Washington River Protection Solutions LLC |
| WTP | Waste Treatment and Immobilization Plant |

# 1 INTRODUCTION

## 1.1 Background

In December 2012, the U.S. Department of Energy (DOE) issued the *Tank Closure and Waste Management Environmental Impact Statement for the Hanford Site, Richland, Washington* (DOE/EIS-0391; DOE 2012) (hereinafter, TC&WM EIS). In the TC&WM EIS, DOE analyzed 17 alternatives,[1] 11 of which involved retrieval, treatment, storage, and disposal of tank wastes, followed by the closure of the single-shell waste storage tanks (SST) at the Hanford Site. DOE issued the first in a series of Records of Decision (RODs) for the Final TC&WM EIS on December 13, 2013 (Volume 78 of the *Federal Register*, page 75913 [78 FR 75913]).[22] For the tank closure portion of the alternatives, which encompasses operations of the tank farm and Waste Treatment and Immobilization Plant (WTP), DOE announced that it would select Tank Closure Alternative 2B,[3] which would, among other things: (1) retrieve 99 percent of the waste from the SSTs; (2) treat tank waste, including pretreatment of tank waste with separation into low-activity waste (LAW) and high-level radioactive waste (HLW); and (3) dispose of the vitrified LAW and secondary waste[4] and construct immobilized HLW (IHLW) interim storage modules to store the IHLW prior to disposal.[5] The 2013 ROD also stated, "Tank waste treatment includes pretreatment of all tank waste, with separation into LAW and HLW. New evaporation capacity, upgrades to the Effluent Treatment Facility (ETF), new transfer lines, and processing of both vitrified LAW and secondary waste for disposal are part of tank waste treatment." For waste management, the ROD further stated: "DOE has decided to implement Waste Management Alternative 2, which includes disposal of LLW [low-level radioactive waste] and MLLW [mixed low-level radioactive waste] at IDF [Integrated Disposal Facility]-East from tank treatment operations."

The WTP, as analyzed in the TC&WM EIS, would start processing tank waste by sending it to the Pretreatment Facility, where it would be separated into HLW and LAW. The process would then send each of these waste streams to the HLW Vitrification Facility and the LAW Vitrification Facility, respectively, for further treatment. The WTP, as analyzed in the TC&WM EIS, also contained an analytical laboratory (LAB) and 22 other support facilities referred to

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[1] The TC&WM EIS analyzed 11 tank closures alternatives, 3 waste management alternatives, and 3 Fast Flux Test Facility decommissioning alternatives.

[2] DOE issued an amended ROD related to the management of cesium and strontium capsules on May 18, 2018 (83 FR 23270). DOE also issued an amended ROD related to the Direct-Feed Low-Activity Waste approach on January 28, 2019 (84 FR 424).

[3] The decision in the ROD to implement Alternative 2B stated, "DOE has decided to implement Tank Closure Alternative 2B, 'Expanded WTP Vitrification and Landfill Closure,' without supplemental treatment at WTP and without technetium-99 removal in the WTP Pretreatment facility." This caveat is included in the selected Alternative 2B and not further repeated in this supplement analysis.

[4] Secondary waste, as described in the TC&WM EIS, is generated as a result of other activities, e.g., waste retrieval or waste treatment, that is not further treated by the WTP or supplemental treatment facilities and includes liquid and solid wastes. Liquid-waste sources could include process condensates, scrubber wastes, spent reagents from resins, offgas and vessel vent wastes, vessel washes, floor drain and sump wastes, and decontamination solutions. Solid-waste sources could include worn filter membranes, spent ion exchange resins, failed or worn equipment, debris, LAB waste, high-efficiency particulate air filters, spent carbon adsorbent, and other process-related wastes. Secondary waste can be characterized as low-level radioactive waste, mixed low-level radioactive waste, transuranic waste, or hazardous waste. Not all of the secondary wastes described in the TC&WM EIS are addressed by this supplement analysis.

[5] For the complete list of activities covered in the ROD, see 78 FR 75918.

collectively as the "balance of facilities" (BOF). When DOE issued the ROD in 2013, its plan was to start operation of all the WTP facilities at the same time.

Due to technical issues with the WTP Pretreatment Facility and HLW Vitrification Facility, only the LAW Vitrification Facility, LAB, and BOF have been completed and are preparing for operations. To begin treating waste as soon as practicable, DOE decided to use the Direct-Feed Low-Activity Waste (DFLAW) approach, which is a sequenced approach, that will treat a portion of the tank waste first.[6]

**Direct Feed Low-Activity Waste (DFLAW)**

The DFLAW approach will separate and pretreat some of the tank waste (approximately 23.5 million gallons) from certain underground tanks at the Hanford Site and immobilize (vitrify in a glass matrix) the pretreated LAW at the LAW Vitrification Facility.

The DFLAW approach is a two-phased approach that will separate and pretreat supernate (essentially the upper-most layer of tank waste that contains low concentrations of long-lived radionuclides) from some of the Hanford tanks, to generate a LAW stream. Phase 1 of the DFLAW approach will entail the following: in-tank settling; separation (removal by decanting) of the supernate (including dissolved saltcake and interstitial liquids); filtration; and then cesium removal using ion exchange columns in a tank-side cesium removal (TSCR) unit. For Phase 2, DOE plans to treat additional supernate (including dissolved saltcake and interstitial liquids) using the same processes and will deploy either an additional TSCR unit or construct a filtration and cesium removal facility.

Facilities and equipment necessary to implement the DFLAW approach include: the Effluent Management Facility; a TSCR unit and either an additional TSCR unit or a filtration and cesium removal facility; additional transfer lines; and a storage pad for cesium ion exchange columns (IX Column Storage Pad). DOE prepared a supplement analysis of the TC&WM EIS (EIS-0391-SA-02; DOE 2019), which evaluated the DFLAW approach. DOE published an amended ROD (84 FR 424; January 28, 2019) to include construction and operation of the IX Column Storage Pad to support implementation of the DFLAW approach.

The DFLAW approach and other, non-DFLAW activities that are planned or ongoing at the Hanford Site (e.g., tank farm and 222-S laboratory operations) will generate an increased volume of liquid and non-liquid secondary waste over normal tank farm operations.[7] These wastes (described in Appendix A) include secondary waste generated by, or derived from, the vitrification of LAW using the DFLAW approach, as well as other secondary waste. The TC&WM EIS evaluated the management of secondary wastes from WTP and other tank farm operations. Details related to the TC&WM EIS evaluation are presented in Section 2.1 of this supplement analysis (SA).

[6] Information related to the amended Consent Decree and milestone dates is presented in Section 1.3 of this supplement analysis.

[7] Secondary wastes generated by, or derived from, vitrification of LAW using the DFLAW approach is being addressed in the *Final Waste Incidental to Reprocessing Evaluation for Vitrified Low-Activity Waste and Secondary Waste at the Hanford Site* (Final WIR Evaluation). The secondary wastes addressed in the Final WIR Evaluation are a subset of the secondary waste addressed in this SA; this SA includes secondary wastes generated by or derived from vitrification of LAW using the DFLAW approach (and addressed in the Final WIR Evaluation) plus other non-DFLAW wastes as described in Appendix A (e.g., from tank farm and 222-S laboratory operations).

## 1.2 Proposed Action

As a result of projected increases in the volumes of secondary waste and the lack of sufficient onsite secondary waste treatment capability and capacity once LAW Vitrification Facility operations begin using the DFLAW approach, DOE proposes to transport and treat certain solid and liquid secondary wastes, as described herein (see Appendix A), at licensed and permitted commercial treatment facilities off the Hanford Site. The lack of sufficient onsite treatment capability is discussed in Section 2.1 of this SA.

Section 4.1.14 of the TC&WM EIS acknowledged that secondary waste (namely MLLW) would be treated to meet *Resource Conservation and Recovery Act* (RCRA) land-disposal-restriction treatment standards prior to disposal through a combination of on- and offsite capabilities. Additionally, Section 4.3.14 of the TC&WM EIS stated, "if DOE determines that use of Hanford's or another DOE site's waste management facilities is not practical or cost-effective, DOE may approve the use of non-DOE (commercial) facilities to store, treat, and dispose of such waste." Over the past 7 years (2015–2021), DOE has shipped dangerous waste and MLLW offsite to licensed and permitted commercial treatment facilities (approximately 87 tons [dangerous waste] and 72 tons [MLLW] annually) (DOE 2022; Table 5-4).[8] With the increased need for offsite treatment and disposal (as presented in Section 2.2 and Appendix A), DOE needs to prepare this Supplement analysis (SA) to evaluate whether the current Proposed Action is adequately addressed in the TC&WM EIS (see Section 1.5).

In the TC&WM EIS, DOE described the possibility of constructing and operating enhancements to the ETF that could include a solidification capability (DOE 2012; Section E1.2.3.3.4). This capability would provide the ability for ETF to solidify and stabilize radioactive secondary wastes to allow for the safe disposal of immobilized secondary waste at the integrated disposal facility (IDF). The ETF solidification capability would be a capital project and is not anticipated to be implemented at the Hanford Site for approximately 10 years but is expected to be implemented.

The TC&WM EIS assumed that the majority of the secondary waste would be treated onsite and would be disposed of onsite at the IDF. DOE still proposes to dispose of treated secondary waste onsite at the IDF. However, DOE proposes to treat certain secondary waste, as described herein (see Appendix A), at offsite, licensed and permitted commercial facilities and to potentially dispose of some of these secondary wastes (after treatment) offsite at licensed and permitted commercial disposal facilities. This action would be implemented on an interim basis until such time as an enhanced onsite treatment capability is available for DFLAW operations (estimated to be approximately 10 years).[9]

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[8] Applying the range of density factors for untreated solid and liquid secondary wastes from Section A.3 in Appendix A provides a range of volumes of the dangerous waste (40–80 cubic meters per year) and MLLW (33–65 cubic meters per year).

[9] After DFLAW operations are complete and full WTP operations have begun, DOE may have a need to continue offsite treatment and disposal for certain waste streams, consistent with historical activities and the acknowledgement in the TC&WM EIS (Section 4.1.14).

## 1.3 Purpose and Need for the Proposed Action

The purpose and need discussed in the TC&WM EIS relative to tank closure and waste management has not substantively changed:

- Safely retrieve and treat radioactive, hazardous, and mixed tank waste; close the SST system; and store and/or dispose of the waste generated from these activities at Hanford. Further, DOE needs to treat the waste and close the SST system in a manner that complies with federal and applicable Washington State laws and DOE directives to protect human health and the environment. Long-term actions are required to permanently reduce the risk to human health and the environment posed by waste in the 149 SSTs and 28 double-shell waste storage tank (DST).

- Expand or upgrade existing waste treatment, storage, and disposal capacity at Hanford to support ongoing and planned waste management activities for onsite waste.

The Proposed Action evaluated in this SA would effectively manage secondary waste through use of offsite commercial treatment and disposal facilities, including use of such facilities for certain secondary waste generated by, or derived from, vitrification of LAW in the LAW Vitrification Facility using the DFLAW approach. The amended Consent Decree includes a milestone for completion of hot commissioning of the LAW Vitrification Facility (see text box).

**LITIGATION RELATING TO THE TREATMENT OF LAW IN HANFORD'S TANKS**

The Washington State Department of Ecology filed a lawsuit against DOE in 2008, State of Washington v. Chu, No. 2:08-cv-05085-FVS (E.D. Wa.), in which the State of Oregon later intervened. In order to settle this litigation, the parties entered into a Consent Decree in 2010. The 2010 Consent Decree established milestones for the retrieval of waste from certain SSTs, and for construction and initial operation of the facilities that constitute the WTP: the HLW, LAW, and Pretreatment facilities; the LAB; and the BOF. However, technical and funding issues regarding the retrieval of tank waste and startup of WTP facilities arose. Beginning in November 2011, DOE notified Washington and Oregon that a serious risk had arisen that DOE may be unable to meet one or more of the milestones, as required by the 2010 Consent Decree. These notifications resulted in informal attempts to negotiate modifications to the decree, as well as formal dispute resolution under the decree, both of which were unsuccessful. Both parties filed motions to amend the decree. Because DFLAW was not part of the 2010 Consent Decree, the court concluded it was beyond the scope of that decree and could not be included in an amended Consent Decree. Nevertheless, the court included in its 2016 Amended Consent Decree a milestone for completion of hot commissioning of the WTP LAW Vitrification Facility by December 31, 2023, based on the belief that the DFLAW approach would allow the LAW Vitrification Facility to begin hot operations by that date.

In July 2022, the court extended the milestone for LAW hot commissioning to August 2025 due to impacts from COVID-19. The court determined that DOE had established good cause and was entitled to the extension due to "force majeure" events.

## 1.4 Regulatory Documents and Actions Related to the Proposed Action

### 1.4.1 National Environmental Policy Act Documents

**Tank Closure and Waste Management Environmental Impact Statement for the Hanford Site, Richland, Washington (TC&WM EIS)** (DOE/EIS-0391; DOE 2012). The construction of the WTP was originally analyzed in the 1996 *Tank Waste Remediation System, Hanford Site, Richland, Washington, Final Environmental Impact Statement* (DOE/EIS-0189; DOE 1996) (hereinafter, TWRS EIS). The TC&WM EIS (DOE 2012) revised and updated the analyses of the TWRS EIS, which addressed retrieval, treatment, and disposal of the tank waste, by also evaluating the impacts of different scenarios for final closure of the SST system. The TC&WM EIS provides the current baseline against which the potential impacts from the Proposed Action in this SA can be compared and evaluated. The Final TC&WM EIS analyzed 17 alternatives, 11 of which involved retrieval, treatment, storage, and disposal of tank wastes and closure of the SSTs. In the TC&WM EIS 2013 ROD (78 FR 75913), DOE stated the following regarding the construction and operation of the WTP's Pretreatment Facility, HLW Vitrification Facility, LAW Vitrification Facility, and LAB:

> "This TC&WM EIS ROD amends the 1997 TWRS EIS ROD concerning the decision to construct the WTP. Under this TC&WM EIS ROD, DOE will not construct the Phase II plant described in the 1997 TWRS ROD due to technical and financial impracticability as analyzed in the 2001 TWRS Supplement Analysis. …Tank waste treatment includes pretreatment of all tank waste, with separation into LAW and HLW. New evaporation capacity, upgrades to the ETF [emphasis added], new transfer lines and processing of both vitrified LAW and secondary waste for disposal are included in this decision."

The TC&WM EIS 2013 ROD (78 FR 75913) also announced that DOE intended to pursue Tank Closure Alternative 2B; it stated the following as to tank waste:

> "This ROD includes decisions involving the following major activities from Tank Closure Alternative 2B: Retrieval of 99 percent of the tank waste by volume; use of liquid-based retrieval systems; leak detection monitoring and routine maintenance; new waste receiver facilities, as needed; additional storage facilities, as needed; additional storage facilities for canisters; operations and necessary maintenance, waste transfers and associated operations such as use of the 'hose in hose' transfer lines or installation of new transfer lines, where needed; and upgrades to existing DST and SST systems which includes piping and other ancillary equipment as needs are identified. Tank waste treatment includes pretreatment of all tank waste, with separation into LAW and HLW. New evaporation capacity, upgrades to the ETF, new transfer lines and processing of both vitrified LAW and secondary waste for disposal are included in this decision. Disposal activities include disposal of LAW onsite and construction of enough IHLW Interim Storage Modules to store all the IHLW generated by WTP treatment prior to disposal."

On May 18, 2018, DOE issued an amended ROD for the TC&WM EIS for the management of cesium and strontium capsules at Hanford (83 FR 23270). From 1974 to 1985, cesium and strontium were recovered from HLW stored in underground tanks at the Hanford Site, packed in corrosion-resistant capsules, and placed in storage under water at Hanford's Waste Encapsulation and Storage Facility. The TC&WM EIS evaluated storage, treatment, and final disposition of these capsules and their contents. The 2018 amended ROD announced DOE's decision to move the capsules from wet storage to a new dry-storage facility. DOE did not make any decisions in the 2018 amended ROD on treatment or final disposition of the cesium and strontium capsules; however, moving the capsules to dry storage will reduce the potential risk of onsite radiological exposures and airborne releases from a failure of the Waste Encapsulation and Storage Facility.

On January 28, 2019, DOE issued another amended ROD related to the DFLAW approach (84 FR 424). This 2019 amended ROD was supported by an SA that evaluated implementation of the DFLAW approach (DOE/EIS-0391-SA-02; January 17, 2019). Per the 2019 amended ROD:

> "DOE/EIS-0391-SA-02 concluded that the DFLAW facilities and functions, except for the IX Column Storage Pad, were addressed in the TC&WM 2013 ROD. The SA also concluded that the IX Column Storage Pad does not represent a substantial change to DOE's proposal or significant new circumstances or information relevant to environmental concerns. There are no additional mitigation measures required beyond those commitments in the 2013 TC&WM EIS ROD. The 2013 TC&WM EIS ROD addressed the functions necessary to implement DFLAW, with the exception of those related to the IX Column Storage Pad. DOE's decision is to amend the TC&WM EIS ROD to include construction and operation of the IX Column Storage Pad to support implementation of DFLAW."

In 2019, DOE determined that proposed upgrades and modifications to the Liquid Effluent Retention Facility (LERF) and ETF to support DFLAW were adequately addressed in the TC&WM EIS. The modification included installation of a new steam stripper and addition of a new brine load-out system to handle the acetonitrile distillate. The acetonitrile distillate is further described in Section A.1 of Appendix A as a waste that is proposed for offsite treatment.

**Waste Management Programmatic Environmental Impact Statement for Managing Treatment, Storage, and Disposal of Radioactive and Hazardous Waste (WM PEIS)** (DOE/EIS-0200; DOE 1997a). During the 1990s, DOE anticipated a need for managing wastes at locations other than where the waste was generated. In order to address this need, DOE conducted analyses for management of radioactive and hazardous wastes, including LLW and MLLW. The WM PEIS analyzed the transportation of large volumes of LLW across the country for treatment and disposal. Some of the alternatives evaluated in the WM PEIS included centralized alternatives that evaluated transporting all of the LLW and MLLW to the Hanford Site for disposal and for treatment and disposal, respectively. In the ROD for the WM PEIS (65 FR 10061, February 25, 2000), DOE decided to establish regional LLW disposal at two DOE sites: the Hanford Site and the Nevada Test Site, now referred to as the Nevada National Security Site (NNSS). Specifically, the ROD noted that the Hanford Site would dispose of its own LLW onsite and would receive and dispose of LLW that is generated and shipped (by either truck or rail) by other sites that meets its waste acceptance criteria. In the TC&WM EIS 2013 ROD, DOE decided to defer the importation of offsite waste at Hanford, at least until WTP is operational.

**Waste Isolation Pilot Plant Disposal Phase Final Supplemental Environmental Impact Statement** (DOE/EIS-0026-S-2, September 1997) (DOE 1997b). The Waste Isolation Pilot Plant (WIPP) Supplemental Environmental Impact Statement (SEIS)-II established the disposal and transportation pathway for transuranic (TRU) waste. In its ROD (63 FR 3624, January 23, 1998), DOE decided on geologic disposal at the WIPP facility for the TRU component of radioactive waste. TRU waste from Hanford, including that stored in certain SSTs, is designated for this disposal pathway. The WIPP SEIS-II is relevant because TRU waste is a component of the waste identified in the TC&WM EIS for the Hanford tank farms.

### 1.4.2 Permitting Actions Related to the Proposed Action

Waste management operations at the Site are permitted by the Washington State Department of Ecology (Ecology) under Hanford Dangerous Waste Permit WA7890008967, "Hanford Facility Resource Conservation and Recovery Act (RCRA) Permit," Revision 8C, which describes the treatment, storage, and disposal of dangerous and mixed wastes at Hanford. There are ongoing permit modifications proceeding concurrently with the preparation of this SA as necessary for compliance with state and federal regulations. There have also been dozens of permit changes or modifications that have been processed for WTP and the Hanford Dangerous Waste permit over the past 5 years related to DFLAW. Each of the proceedings for permit changes or modifications includes an opportunity for public comment. Table 1-1 provides a listing of permit modifications within the past 5 years related to DFLAW operations at various permitted facilities, including LERF/ETF.

**Table 1-1 Dangerous Waste Permit Modifications Related to DFLAW and LERF/ETF**

| Modification Title | Description | Public Comment Period |
|---|---|---|
| Class 3 Permit Modification for the IDF Operating Permit | Incorporated new and modified information for the IDF facility. | July 25, 2022 – September 9, 2022 |
| Class 2 Permit Modification for the LERF and 200 Area ETF Section | Allowed for the addition of the Acetonitrile Distillate Load-out Facility, acetonitrile distillate tote storage, acetonitrile distillate storage tanks, and brine storage tanks to the 200 Area ETF. | April 6, 2022 – June 4, 2022 |
| Class 2 Permit Modification for the LERF and 200 Area ETF Carbon Dioxide Removal Skid | Allowed for the installation and operation of a carbon dioxide removal skid in the 200 Area ETF. The removal skid is a filtering system that will remove excess carbon dioxide generated during the treatment process. This additional capability is necessary to treat the WTP effluent management facility (EMF) waste. | March 31, 2022 – May 29, 2022 |
| Class 3 IDF Permit Modification | Modified the permit for the existing IDF Operating Unit Group 11, incorporated new and modified information that included the addition of three dangerous waste management units:<br>Operation of an additional disposal cell | September 13, 2021 – October 28, 2021. |

| Modification Title | Description | Public Comment Period |
|---|---|---|
| | Storage area Treatment area. | |
| LAWPS Operating Unit Group 1 | Addressed operations of the TSCR to remove the cesium from the tanks prior to feeding waste to the LAW Vitrification Facility. | June 28, 2021 – August 12, 2021 |
| Class 2 Permit Modification for the LERF and 200 Area ETF Section | Allowed for the installation of a supplemental organic-waste treatment system at ETF, including the addition of the steam stripper. | June 23, 2021 – August 22, 2021 |
| 200 Area ETF Delisting | Targeted technical changes to the existing delisting to support startup of the LAW Vitrification Facility using the DFLAW approach.<br>Included the addition of a new waste treatment process (steam stripping) to the 200 Area ETF to accommodate the expected level of certain constituents in liquid effluent from the WTP Effluent Management System. | June 7, 2021 – July 7, 2021 |
| Class 3 Permit Modification for the IDF Leachate Collection System | Supported operation of Hanford's IDF leachate collection system to allow for disposal of MLLW in the engineered landfill. Wastes include tank farm waste and waste from DFLAW operations. | May 24, 2021 – July 23, 2021 |
| Class 2 and 3 Permit modification LERF and 200 Area ETF Permit section, construction of Basin 41 | Allowed for the addition of a liquid retention basin to LERF. The improvements included construction of a fourth LERF basin, Basin 41, and added a connection from the primary transfer line from WTP EMF to LERF Basin 41. Modifications to the permit addenda included: Increased storage and treatment capacity for LERF from the added Basin; Updated topographic map, showing Basin 41; Added references to Basin 41 for waste acceptance and process information related to the LERF Basins; and Inspection, preparedness, prevention, and emergency response requirements for the additional basin. | July 10, 2020 – September 8, 2020, and February 22, 2021 – April 8, 2021 |
| Class 3 Permit Modification, LAWPS, Operating Unit Group 1 Permit Modification | Allowed for the addition of a new operating unit group to the permit. DOE issued a SEPA Determination of Significance and Notice of Adoption to support the LAWPS. The proposed draft permit modification added the LAWPS Operating Unit Group 1 to the Dangerous Waste Permit. It provided design and construction details for Phase 1 of the LAWPS Operating Unit Group and the associated SEPA documentation. | June 22, 2020 – August 7, 2020, and September 28, 2020 – November 12, 2020 |
| WTP Risk Assessment permit modification | Incorporated the draft preliminary risk assessment and the risk assessment work plan for the DFLAW configuration. | February 24, 2020 – April 9, 2020 |

| Modification Title | Description | Public Comment Period |
|---|---|---|
| | Updated and added new documents to the WTP portion of the permit to support the risk assessment for the DFLAW configuration. | |
| WTP Permit Modification | Added a description of operations to the WTP Dangerous Waste permit for the LAW Vitrification Facility and EMF. The modification described operations, provided clarification between the baseline and DFLAW configurations, and added details to ensure the operating permit is compliant with all dangerous waste regulations. | February 10, 2020 – March 26, 2020 |
| LERF and ETF Permit Modification | Made the following modifications: Revising the LERF and 200 Area ETF Operating Unit Group boundary to include the WTP to LERF Basin 42 primary transfer line; Making facility improvements to accommodate increased wastewater volume in support of the DFLAW project; and Adding leak detection, closure, and inspection requirements for the new equipment. Facility improvements included: Adding a primary transfer line from the WTP to LERF Basin 42; Installing a brine waste load-out system inside the 200 Area ETF; and Permitting and installing filter drain sump tanks in the 200 Area ETF load-in station. An electronic leak detection system will be installed on the primary transfer line from WTP to the LERF Basin 42. A sight glass will also be installed at the LERF Basin 42 catch basin. The brine load-out system will be located within Building 2025E. Brine waste from the brine load-out system will be transferred into containers called totes. The existing filter drain sump tank is located in the Building 2025ED load-in station, which is also where the new filter drain sump tank will be installed. Filter drain sump tank 59A-TK-2 is located in the east bay of 2025ED, and a similar 45-gallon sump tank, 59A-TK-3, will be installed in the west bay. | February 3, 2020 – March 19, 2020 |
| Permit Modification to Allow for Disposal of MLLW at the IDF | Supported operations and allowed for disposal of MLLW in both disposal cells of the IDF, added receipt of MLLW from Hanford Site operations, and allowed for the construction of a treatment pad and a storage pad. | December 16, 2019 – February 14, 2020 |

| Modification Title | Description | Public Comment Period |
|---|---|---|
| Class 2 Permit Modification for the LERF and 200 Area ETF | Allowed for a waste transfer line connection from WTP EMF to the LERF and to make improvements to the 200 Area ETF to support tank waste treatment. The improvements allowed a secondary waste load-out system inside ETF and a filter sump tank to the existing load-in station. This required modification to the permit conditions and applicable addenda. Modifications to the addenda included revised information on the LERF and the 200 Area ETF boundary, the waste analysis plan, facility improvements, container management, leak detection, closure, and inspection requirements. | September 16, 2019 – November 15, 2019 |
| WTP LAW and EMF | Made Class 3 permit modifications to the WTP Dangerous Waste permit to add WTP LAW Vitrification Facility and EMF operating information and proposed operating conditions to the existing permit. | July 1, 2019 – August 30, 2019 |
| LAWPS Permit Modification | Requested approval to add a new operating unit for the LAWPS, which will pretreat (remove cesium and filter out solid particles) DST waste for subsequent vitrification in the LAW Vitrification Facility. The planned cesium removal system would be deployed in phases. Phase One would employ a TSCR unit. Phase Two would either use a filtration and cesium removal facility or an additional TSCR unit. | May 1, 2019 – June 30, 2019 |
| Dangerous Waste Permit Modification | Allowed for installation of a new permitted waste container storage area and a new transporter staging area to support WTP operations. | April 1, 2019 – May 30, 2019 |
| WTP Permit Modification for EMF Equipment | Allowed for the installation of vessels, preheaters, exhausters, high-efficiency particulate air filters, and critical piping associated with the EMF. | June 4, 2018 – July 18, 2018 |
| Environmental Performance Demonstration Test – WTP Permit Modification | Incorporated the draft Environmental Performance Demonstration Test plan for the LAW Vitrification Facility into the WTP permit. This proposal was one of many changes to the original WTP permit. | April 23, 2018 – June 22, 2018 |
| WTP Effluent Management Ancillary Equipment | Addressed a proposed change affecting the WTP Dangerous Waste permit. | March 5, 2018 – April 18, 2018 |
| WTP Analytical Laboratory | Addressed proposed modifications to the operations of the LAB and provided the operating details for the LAB under the DFLAW approach for the WTP Dangerous Waste permit. | December 4, 2017 – January 19, 2018 |

| Modification Title | Description | Public Comment Period |
|---|---|---|
| WTP Dangerous Waste Permit Modification | Allowed for the installation of new Dangerous Waste permit-regulated, noncritical ancillary equipment, such as pipelines, valves, and inline components at the WTP EMF. This ancillary equipment was identical to equipment that has been installed in WTP facilities to date. | November 6, 2017 – January 5, 2018 |
| WTP Interim Compliance Schedule | Addressed second portion of a Class 3 permit modification and focused on proposed modifications to the interim compliance schedule for the WTP Dangerous Waste permit. The proposed interim compliance schedule was revised to align the dates with the final Consent Decree filed in U.S. District Court, Eastern District of Washington (Case 2:08-CV-5085 – RMP, Document 222) on March 11, 2016. | September 28 – November 13, 2017 |
| WTP Dangerous Waste Permit Modification | Incorporated design information for the secondary containment within EMF at the WTP. | July 3, 2017 – September 1, 2017 |
| Class 2 Modification to WTP EMF Permit | Allowed for the installation of new underground waste transfer pipelines needed to support the DFLAW approach for LAW Vitrification Facility operations. | April 10, 2017 – June 9, 2017 |
| WTP Dangerous Waste Permit Modification | Updated the WTP Dangerous Waste permit interim compliance schedule to reflect the compliance dates outlined in the amended Consent Decree. | March 6, 2017 – May 5, 2017 |

DFLAW= Direct-Feed Low-Activity Waste; DST= double-shell waste storage tank; EMF= Effluent Management Facility; ETF= Effluent Treatment Facility; IDF= Integrated Disposal Facility; LAB=analytical laboratory; LAW=low-activity waste; LAWPS= Low-Activity Waste Pretreatment System; LERF= Liquid Effluent Retention Facility; MLLW=mixed low-level radioactive waste; SEPA=State Environmental Policy Act; TSCR= Tank-Side Cesium Removal; VLAW=vitrified low-activity waste; WTP=waste treatment plant

## 1.5 Scope and Organization

The Council on Environmental Quality (CEQ) regulations that implement the National Environmental Policy Act (NEPA) direct agencies to prepare a supplement to either a draft or final EIS when a major federal action remains to occur and either the "agency makes substantial changes to the proposed action that are relevant to environmental concerns" or there are "significant new circumstances or information relevant to environmental concerns and bearing on the proposed action or its impacts". (Title 40 *Code of Federal Regulations* [CFR] 1502.9(d)(1)(i)–(ii)). DOE's NEPA regulations state that when it "is unclear whether or not an EIS supplement is required, DOE shall prepare a Supplement Analysis." (10 CFR 1021.314(c)). This SA provides sufficient information for DOE to determine whether (1) to supplement an existing EIS, (2) to prepare a new EIS, or (3) no further NEPA documentation is required (10 CFR 1021.314(c)(2)(i)–(iii)).

This SA analyzes whether transporting an increased volume of secondary waste to offsite licensed and permitted commercial treatment facilities and, depending on the waste stream, disposing of some of those wastes at offsite licensed and permitted commercial disposal facilities, constitutes a substantial change to the original proposed action evaluated in the TC&WM EIS or significant new circumstances or information relevant to environmental concerns compared to those presented in the TC&WM EIS. Chapter 2 and Appendix A of this SA present a description of the Proposed Action, while Chapter 3 presents a comparative analysis of the potential environmental impacts of the Proposed Action and those presented in the TC&WM EIS. Chapter 4 presents potential cumulative impacts of the Proposed Action. Chapter 5 provides DOE's conclusion and determination. Lastly, Chapter 6 presents a bibliographic listing of the references cited in this SA. Appendix A has its own reference list.

# 2 PROPOSED ACTION

## 2.1 Secondary Waste Overview

The TC&WM EIS defines secondary waste as follows (DOE 2012; Section 2.2.2.2.1):

> "Waste generated as a result of other activities, e.g., waste retrieval or waste treatment, that is not further treated by the Waste Treatment Plant or supplemental treatment facilities and includes liquid and solid wastes. Liquid-waste sources could include process condensates, scrubber wastes, spent reagents from resins, offgas and vessel vent wastes, vessel washes, floor drain and sump wastes, and decontamination solutions. Solid-waste sources could include worn filter membranes, spent ion exchange resins, failed or worn equipment, debris, LAB waste, high-efficiency particulate air filters, spent carbon adsorbent, and other process-related wastes. Secondary waste can be characterized as low-level radioactive waste, mixed low-level radioactive waste, TRU waste, or hazardous waste."

As described in Section 4.1.14 of the TC&WM EIS, secondary waste is produced under all of the analyzed tank closure alternatives, including the preferred alternative, Alternative 2B. The secondary waste types produced from these tank closure alternatives include:

- LLW
- MLLW
- Mixed TRU waste
- Hazardous waste
- Nonhazardous waste
- Liquid Process waste

Table 4-86 of the TC&WM EIS presents the estimated secondary waste generation volumes for each type of secondary waste for each project phase of Alternative 2B.

Not all of the secondary wastes, volumes, or waste types described in the TC&WM EIS are encompassed by the Proposed Action evaluated in this SA. The secondary wastes addressed by this SA are the wastes described in Appendix A and consist of MLLW and LLW.

The Proposed Action and this SA concern only a portion of the operations phase described under the preferred alternative, Alternative 2B, in the TC&WM EIS; more particularly, the Proposed Action and this SA concern the specific secondary wastes, described in Appendix A, including secondary wastes generated by, or derived from, vitrification of LAW using the DFLAW approach and other non-DFLAW secondary wastes (e.g., tanks farm and laboratory operations) (see Appendix A). DOE is proposing offsite treatment and potential offsite disposal of these secondary wastes on an interim basis, until such time as an enhanced onsite treatment capability is available for DFLAW operations (estimated to be approximately 10 years) in accordance with the 2013 TC&WM EIS ROD, as amended. From Table 4-86 of the TC&WM EIS, the estimated secondary waste generation volumes during all operations include the following:

- 27,500 cubic meters of solid LLW
- 27,500 cubic meters of MLLW
- 206 cubic meters of mixed TRU waste
- 63,300 cubic meters of hazardous waste
- 254 cubic meters of nonradioactive nonhazardous waste
- 0 liters of liquid LLW[10]

As described in Section 2.2.3 of the TC&WM EIS, many waste disposal aspects of the proposed actions in the TC&WM EIS were addressed in previous EISs. For instance, DOE evaluated the programmatic aspects of waste management, including transportation, across the DOE complex in the WM PEIS (DOE 1997a). The WIPP SEIS-II (DOE 1997b) addressed transportation and disposal of TRU waste quantities at the WIPP facility in New Mexico. The TC&WM EIS, Section 2.8.1.14, identifies the following specific types of secondary wastes and the assumed plans for their management:

- Secondary LLW (e.g., personal protective equipment, tools, filters, empty containers) would be generated during routine operations. LLW is typically not treated or only minimally treated (e.g., compacted) before disposal. The LLW would be sent to the IDF for disposal.

- Secondary MLLW (e.g., personal protective equipment, tools, job waste, soil from closure activities) would be generated during operations. *Using a combination of on-* ***and offsite capabilities****, secondary MLLW would be treated* to meet RCRA land-disposal-restriction treatment standards prior to disposal (emphasis added).

- Under the TC&WM EIS 2013 ROD, Tank Closure Alternative 2B, Waste Management Alternative 2, Disposal Group 1, IDF-East would be constructed and operated for the disposal of tank waste and all other LLW and MLLW. The River Protection Project Disposal Facility (RPPDF) would be constructed and operated for disposal of lightly contaminated equipment and soils resulting from closure activities. IDF-East and the RPPDF operations would cover an approximately 40- year operations timeframe, with

[10] The TC&WM EIS (Section E.1.2.3.3.1) assumed that all liquid secondary wastes were processed through the thin-film dryer at ETF and only the concentrated powder would be disposed. In the DFLAW process, all the liquid waste cannot be processed through the thin-film dryer (either because of the volume increase or the concentration of some constituents as a result of the DFLAW process). For example, the liquids from the steam stripper cannot be discharged to SALDs, as is currently done for the liquid waste from the thin-film dryer. (See Appendix A for more information about the secondary waste streams proposed for offsite treatment.)

IDF-East capacity at 1.2 million cubic meters and RPPDF capacity at 1.08 million cubic meters.

- For analysis purposes, the TC&WM EIS assumed that all of the TRU waste would be disposed of at the WIPP facility. The WIPP SEIS-II evaluated the receipt and disposal of 57,000 cubic meters (74,600 cubic yards) of contact handled (CH)- and 29,000 cubic meters (37,900 cubic yards) of remote handled (RH)-mixed TRU waste from the Hanford Site (DOE 1997b). The Proposed Action addressed by this SA would not generate TRU waste and does not affect TRU waste generation, treatment, shipment, or disposal as described in the TC&WM EIS or WIPP SEIS-II. Thus, TRU waste is not analyzed further in this document.

- Hazardous waste generated during construction and operations would be packaged in U.S. Department of Transportation (USDOT)-approved containers and shipped offsite to permitted commercial recycling, treatment, and disposal facilities. Management of the hazardous waste would require planning, coordination, and establishment of satellite accumulation areas, but because the waste would be treated and disposed of at offsite commercial facilities, the hazardous waste would have a minor impact on the Hanford Site.

- Any nonhazardous solid waste generated during facility construction and operations would be packaged and transported in conformance with standard industrial practice. Solid waste such as office paper, metal cans, and plastic and glass bottles that can be recycled would be sent offsite for that purpose. The remaining nonhazardous solid waste would be sent for offsite disposal in a local landfill. This additional waste load would have only a minor impact on the handling and accumulation of nonhazardous solid waste on the Hanford Site.

- Process waste, including solid and liquid secondary LLW, would be generated by the activities performed to retrieve, separate, and treat tank waste. Process waste and dilute process waste, such as cooling waters or steam condensates, would be routed to the Hanford liquid-waste processing facilities, the mission of which it is to manage such wastes, as applicable. The TC&WM EIS assumed that the liquid-waste processing facilities, Effluent Management Facility (EMF), ETF, and the Treated Effluent Disposal Facility, or their equivalents, would continue to be available to manage process liquids generated under the Tank Closure alternatives.

The TC&WM EIS evaluated the onsite treatment of solid secondary waste (primarily MLLW) at three onsite locations (Central Waste Complex, Waste Receiving and Processing, and T-plant) and onsite treatment of liquid secondary waste from the retrieval (tank farm operations) and WTP operations. Liquid MLLW was assumed to be grouted onsite at each of these three facilities because it was uncertain which facility would ultimately house the grouting capability.[11] As identified in Table M-2 of Appendix M of the TC&WM EIS, solid and liquid secondary wastes would be grouted. As described in the description of Waste Management Alternative 2 in Section M.4.3.2, the waste was assumed to be disposed of onsite at the IDF. In the TC&WM EIS,

[11] Per the glossary in the TC&WM EIS, "grout" is defined as, "A fluid mixture of cement-like materials and liquid waste that sets up as a solid mass and is used for waste fixation, immobilization, and stabilization."

Appendix E, Section E.1.2.3.3.4, DOE discussed the potential ETF enhancements, which could include a solidification (or grouting) facility.

As identified in Part A of the DOE permit application to Ecology for the LERF/ETF, DOE anticipated consolidating all grouting capability from the three onsite locations analyzed in the TC&WM EIS to one for liquid and solid waste at a single location (i.e., ETF).

The LERF/ETF permit application included initial information on modular grout capability with the capacity to expand for full WTP operations; however, as identified in Section 1.2 of this SA,

the ETF solidification capability was determined to be a capital project and is not anticipated to be implemented at the Hanford Site for approximately 10 years.

The ETF comprises an aqueous waste treatment system that provides storage and treatment for a variety of aqueous mixed waste. This aqueous waste includes process condensate from the 242-A Evaporator (242-A Evaporator overheads are sent to ETF for treatment and, as such, are not a waste stream being proposed for offsite treatment/solidification), WTP aqueous waste, and other aqueous wastes generated from onsite remediation and waste management activities. Aqueous waste is pumped to the ETF for treatment in a series of process units, or systems, that remove or destroy essentially all of the dangerous waste constituents. The ETF treatment of liquid waste also includes a thin-film dryer. The powder derived from the thin-film dryer is grouted and disposed of at the IDF. The treated liquid effluent is discharged to a State-Approved Land Disposal Site (SALDS) north of the 200 West Area, under the authority of Washington State Waste Discharge Permit ST0004500, the U.S. Environmental Protection Agency (EPA), Final Delisting, 200 Area ETF (40 CFR Part 261, Appendix IX, Table 2) and the Washington State delisting approval under Washington Administrative Code, Chapter 173-303, *Dangerous Waste Regulations*.

Regarding liquid secondary waste, the thin-film dryer at the ETF is not capable of handling the expected volume of liquid secondary waste for treatment once DFLAW operations begin. As stated in the 2013 ROD, DOE decided to make the upgrades to ETF. To date, changes have been made to the ETF Dangerous Waste permit and the facility to address the required upgrades. However, ETF solidification capability upgrades have not yet been implemented. Without the capacity upgrades, the existing ETF is not capable of managing all of the nonrecycled, liquid secondary waste expected to be generated by, or derived from, vitrification of the LAW using the DFLAW approach in combination with other non-DFLAW waste (such as wastes from the 222-S laboratory, tank farms operation facilities, and onsite remediation and waste management activities as described in Appendix A). As a result, DOE needs to establish the ability to transport larger volumes of secondary waste offsite for treatment.

## 2.2 Proposed Offsite Treatment and Potential Offsite Disposal

As identified in Section 1.2 of this SA, DOE proposes to transport and treat certain secondary waste, described below and in Appendix A, at licensed and permitted commercial treatment facilities that are located off the Hanford Site. In addition, DOE proposes to potentially dispose of some of these treated secondary wastes (see Appendix A) at licensed and permitted commercial disposal facilities.[12] Other wastes described in Appendix A would be disposed of as LLW and MLLW onsite at the IDF, as assumed in the TC&WM EIS. This Proposed Action (both offsite treatment and potential offsite disposal) would be implemented on an interim basis until such time as an enhanced onsite treatment capability is available for DFLAW operations (estimated to be approximately 10 years).

The potential changes to information included in the TC&WM EIS analyses include the following:

- Updated estimate of secondary waste generation,
- Transportation of secondary waste (LLW and MLLW) to a licensed and permitted treatment facility,
- Offsite treatment of LLW and MLLW,
- Transportation of treated secondary waste from an offsite commercial treatment facility back to the Hanford Site for onsite disposal at the IDF (if treated at Perma-Fix Northwest [PFNW]), and
- Disposal of a portion of the treated secondary waste (LLW and MLLW) at a licensed, commercial, offsite, disposal facility.

### 2.2.1 Updated Secondary Waste Inventory

The current Management and Operating contractor for the Hanford tank farms is Washington River Protection Solutions LLC (WRPS). WRPS prepared a data package to provide updated generation, treatment, characterization, and disposal information for secondary waste streams that would be generated by the tank farms and WTP during the next approximately 10 years (WRPS 2022a). The waste streams would originate from WTP facilities (LAW Vitrification Facility, LAB, EMF, and BOF), tank farm facilities (LAWPS/TSCR, SST, DST, process condensate from the 242-A Evaporator, LERF/ETF), and the 222-S Laboratory. Appendix A of this SA contains a summary of the data package and the specific data used for this SA.

The expected secondary waste inventories of LLW and MLLW are grouped into the following three groups based on their proposed treatment and disposal locations.[1313] More detail on the projected secondary waste inventory and the basis for the groupings is contained in Appendix A.

[12] Any waste shipped offsite for treatment and disposal would be appropriately classified as LLW or MLLW, not exceed Class C concentration limits per 10 CFR 61.55. and meet the licensing and waste acceptance criteria of the receiving facility prior to transport.

[13] Secondary wastes generated by, or derived from, vitrification of LAW using the DFLAW approach are addressed in the Final WIR Evaluation. The secondary wastes addressed in the Final WIR Evaluation are a subset of the secondary waste addressed in this SA; this SA includes secondary wastes generated by or derived from vitrification of LAW using the DFLAW approach (and addressed in the Final WIR Evaluation) plus other non-DFLAW, non-reprocessing, and non-vitrification wastes described in Appendix A (e.g., tank farm and laboratory operations).

**Group 1:** Wastes to be treated at PFNW in Richland, Washington, and returned to the Hanford IDF for disposal. Examples of wastes in this group include LLW and MLLW debris, LLW and MLLW liquids, MLLW brine, and steam stripper concentrate. Wastes included in this group are expected to be stabilized or microencapsulated as appropriate at PFNW and are also expected to meet the waste acceptance criteria for onsite disposal at IDF.

**Group 2:** Wastes to be treated offsite at Perma-Fix Diversified Scientific Services, Inc (Perma-Fix DSSI) in Kingston, Tennessee, and disposed of offsite at Waste Control Specialists (WCS) in Andrews County, Texas, in its Federal Waste Facility (FWF). Examples of wastes in this group include carbon adsorber beds and MLLW liquids from the 222-S laboratory that require specialized treatment such as thermal stabilization.

**Group 3:** Wastes to be treated offsite (at either PFNW or WCS) and disposed of at the Hanford IDF (if treated at PFNW) or at the WCS FWF (if treated at WCS). Examples of wastes in this group include certain high-efficiency particulate air (HEPA) filters from the LAW Vitrification Facility and the EMF evaporator concentrate (bottoms). The LAW melter offgas HEPA filters would be expected to be treated at PFNW and returned to IDF for disposal or treated and disposed of at WCS. The EMF evaporator concentrate would be expected to be treated and disposed of at WCS.

The data package also identifies LLW and MLLW secondary waste streams that will undergo onsite treatment and disposal at IDF (WRPS 2022a). These specific waste streams include items like MLLW debris and MLLW powders from the ETF treatment process.[14] These wastes are not proposed to be shipped offsite for treatment or disposal, will be managed in a manner consistent with that presented in the TC&WM EIS and ROD, and are not evaluated further in this SA.

The projected volumes of as-generated, secondary waste for each of the three groups proposed for offsite treatment were obtained from WRPS (2022a) and are listed in Table 2-1. Appendix A also includes additional details on these secondary waste inventories including volumes of specific waste types (solid and liquid LLW and MLLW), and estimated numbers of annual shipments.

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The secondary waste addressed in the Final WIR Evaluation that fall into Group 1 are ETF brine, melter discharge chamber thermowells, melter glass pool level detectors and consumables, melter bubblers, melter pour spout assemblies, and glass debris (shards). The secondary waste addressed in the Final WIR Evaluation that fall into Group 2 are the carbon adsorber beds. The secondary waste addressed in the Final WIR Evaluation that fall into Group 3 are LAW melter offgas HEPA filters and EMF evaporator concentrate (bottoms). The LAW melter offgas HEPA filters are anticipated to be treated at PFNW and returned to IDF for disposal or treated and disposed of at WCS. The EMF evaporator concentrate is anticipated to be treated and disposed of at WCS.

[14] Other wastes that will be disposed of at the IDF include vitrified low-activity waste (VLAW) canisters and VLAW spent melters.

**Table 2-1 Projected Annual Average Volumes of Secondary Waste under the Proposed Action**

| Waste Stream Group[a] | Treatment Location | Disposal Location | Annual Average (cubic meters)[b] |
|---|---|---|---|
| 1 | PFNW | IDF | 8,300 |
| 2 | DSSI | WCS FWF | 18 |
| 3a | PFNW | IDF | 332[c] |
| 3b | WCS | WCS FWF | 332[c] |

PFNW=Perma-Fix Northwest; DSSI=Perma-Fix Diversified Scientific Services, Inc.; IDF=Integrated Disposal Facility; FWF=Federal Waste Facility; WCS=Waste Control Specialists

a Waste stream groups are analytical constructs. They are defined in Appendix A of this SA and represent groups of waste that have common proposed treatment and disposal locations.

b WRPS (2022) provides secondary waste volume projections on an annual basis for 10 years. This SA normalizes these values to use an annual average. Values are estimated pretreatment volumes and are presented with two significant digits.

c The estimates for Group 3 are not meant to be additive. If DOE shipped the waste to PFNW for treatment, the treated waste would be returned to the Hanford IDF for disposal. If DOE shipped the waste to DSSI or WCS for treatment, the treated waste would be disposed of at the WCS FWF.

### 2.2.2 Transportation of Secondary Waste to a Treatment Facility

The secondary waste (solid waste and liquid waste to be shipped in separate containers) generated at Hanford and shipped offsite for treatment would be transported in USDOT-certified containers and would meet all applicable USDOT requirements under 49 CFR Subchapter C for transportation to an offsite permitted treatment facility. The containers would be USDOT 7A industrial packages (IP-1 or IP-2) or Type A packages (49 CFR 178.350) depending on the radionuclide inventory of each package. The transportation of the packages would include a Hazardous Waste Manifest (49 CFR 172.205) and would follow USDOT regulations and standard best management practices for transportation of hazardous materials.

While IP is suitable for the shipment of radioactive materials with low specific activity (LSA), higher activity levels require the use of Type A packages. The maximum activity of special form radioactive material permitted in a Type A package is identified as "$A_1$" in 10 CFR Part 71. Appendix A to 10 CFR Part 71 includes a method for calculating the combined maximum activity for mixtures of radionuclides. Prior to shipment of any package containing secondary waste, DOE would demonstrate that the inventory in each package is less than the LSA quantity (for IP-1 and IP-2) or that the sum of fractions for the expected radionuclides in each container would be less than 1.0 for Type A packages.[15]

As identified in Section 2.2.1 and Appendix A of this SA, the inventory of secondary wastes includes multiple types of suitable transportation packages for solid and liquid waste. The solid wastes could be shipped in drums or boxes, and the liquid wastes could be shipped in either 300-gallon totes or 350-gallon "supertainers." It is possible, however, that other suitable IP or Type

[15] Transportation packages must contain Type A quantities (or less) of normal form Class 7 solid or liquid radioactive material in accordance with 10 CFR Part 71 and demonstrate that the sum of fractions of the activity limits for each radionuclide is less than 1.0.

A containers, including 55- and 85-gallon drums, could theoretically be used for transporting liquid wastes in certain cases.

As shown in Table 2-1, the largest volume of the secondary waste would be treated at PFNW. PFNW is licensed and permitted by the State of Washington. DOE proposes to potentially treat approximately 18 cubic meters per year of secondary waste at DSSI. These treated wastes would then be disposed of at the WCS FWF. DSSI is a licensed and permitted treatment facility. Wastes are not disposed of at DSSI.

DOE could elect to treat and dispose of the Group 3 wastes (consisting primarily of HEPA filters from the LAW Vitrification Facility and EMF-concentrate) at WCS, a licensed and permitted disposal facility.[16] WCS is permitted and licensed to accept solid and liquid LLW and MLLW, treat and stabilize it, and dispose of the solidified Class A, Class B, or Class C LLW and MLLW at its onsite FWF (TCEQ 2022). Prior to shipment of the secondary waste to the permitted treatment facility, DOE would determine whether its radiological and hazardous constituents are within regulatory limits and meet the waste acceptance criteria for the treatment facility.

The treatment facility at PFNW is approximately 26 miles from the 200 Area tank farms; 1.2 miles of which are off the Hanford Site. The treatment facility at Perma-Fix DSSI is approximately 2,370 miles (driving distance) from the Hanford Site. The WCS treatment facility and FWF are approximately 1,580 miles (driving distance) from the Hanford Site.

**Table 2-2 Projected Annual Average Number of Shipments of Secondary Waste by Destination and Form**

| Waste Stream Group[a] and Type | Originating Location | Destination Location | Driving Distance (miles) | Annual Average Number of Shipments |
|---|---|---|---|---|
| **Group 1** | | | | |
| 1 (solids) | Hanford | PFNW (treatment) | 26[b] | 1,005 |
| 1 (liquids) | Hanford | PFNW (treatment) | 26[b] | 39 |
| 1 (solids & solidified liquids) | PFNW | IDF (disposal)[c] | 26[b] | 1,082 |
| **Group 2** | | | | |
| 2 (solids) | Hanford | DSSI (treatment) | 2,370 | 2 |
| 2 (liquids) | Hanford | DSSI (treatment) | 2,370 | 1 |
| 2 (solids & solidified liquids) | DSSI | WCS FWF (disposal) | 1,200 | 3 |
| **Group 3** | | | | |
| 3a (liquids) | Hanford | PFNW (treatment) | 26[b] | 24 |
| 3a (solidified liquids) | PFNW | IDF (disposal)[c] | 26[b] | 44 |
| 3b (liquids)[d] | Hanford | WCS (treatment & disposal)[c] | 1,580 | 24 |

DSSI=Perma-Fix Diversified Scientific Services, Inc.; FWF=Federal Waste Facility; IDF=Integrated Disposal Facility; PFNW=Perma-Fix Northwest; WCS=Waste Control Specialists

a Waste stream groups are analytical constructs. They are defined in Appendix A of this SA and represent groups of waste that have common proposed treatment and disposal locations. The entries for each waste group include shipments of waste to a treatment facility and then shipment of the treated waste to a disposal location.

[16] As explained previously, the LAW melter offgas HEPA filters would be expected to be treated at PFNW and returned to IDF for disposal or treated and disposed of at WCS. The EMF evaporator concentrate would be expected to be treated and disposed of at WCS.

b Virtually all Hanford onsite transport, as only 1.2 miles of the route is along offsite roads.

c Transport of the solidified liquids would require additional shipments to account for the increased volume associated with the grout. See Section A.3 in Appendix A for details. This increase would not apply to Group 2 wastes since the expected thermal treatment would not increase the volume for disposal.

d Maximum transportation impact case to both public and crews for waste stream Group 3. In Group 3, the LAW melter offgas HEPA filters would be expected to be treated at PFNW and disposed of at IDF or treated and disposed of at WCS. The EMF evaporator concentrate, also in Group 3, would be expected to be treated and disposed of at WCS. However, the maximum transportation impacts would occur if the full inventory in Group 3 was transported to WCS for treatment/disposal.

Note: PFNW is located in Richland, WA; DSSI is located in Kingston, TN; WCS is located in Andrews County, TX.

### 2.2.3 Offsite Treatment of Secondary Waste

Operations at PFNW are governed by radioactive material licenses issued by the Washington State Department of Health (WDOH 2019, 2020) and a permit for treatment and storage of dangerous waste issued by Ecology (Permit Number WAR 000010355).[17] The radioactive material licenses and permit authorize PFNW to possess and process radioactive material, including treatment and stabilization. The license also limits the quantity of radioactive material at the facility and describes operating requirements related to radiation monitoring, inventory control, waste receipt and shipment, recordkeeping, reporting, and environmental monitoring, among other things.

As identified in Appendix A of this SA, DOE proposes to send solid and liquid secondary wastes to PFNW for treatment (Group 1 and 3a waste streams). The projected volume of solid LLW and MLLW proposed to be treated at PFNW annually is approximately 7,700 cubic meters (from Tables A-1 and A-3). The projected volume of liquid (mostly MLLW) proposed to be treated annually at PFNW is approximately 916 cubic meters (from Tables A-1 and A-3). See also Table 2-1 above.

Operations at Perma-Fix DSSI are conducted in accordance with the radioactive material license and the hazardous waste management permit issued by the State of Tennessee Department of Environment and Conservation (TDEC 2020, 2021). The license authorizes Perma-Fix DSSI to possess and process radioactive material, including treatment and stabilization. After treatment, Perma-Fix DSSI disposes of the treated wastes in accordance with the DOE contract. As discussed earlier, wastes are not disposed of at DSSI, and this SA expects that the Hanford secondary waste treated at DSSI (as Group 2) would be sent to the WCS FWF for disposal.

As identified in Appendix A, DOE proposes to send certain MLLW (Group 2 waste streams) to Perma-Fix DSSI for treatment. The projected volume of solid MLLW to be treated annually at Perma-Fix DSSI is 15 cubic meters, while the projected volume of liquid MLLW to be treated annually at Perma-Fix DSSI is 3 cubic meters (see Table A-2). See also Table 2-1 above.

WCS is permitted, licensed, and authorized to receive, treat, and dispose of Class A, Class B, and Class C LLW and MLLW. The WCS waste acceptance criteria document, *FWF Federal Generator Handbook* (WCS 2015), addresses operations and regulatory parameters, pre-shipment requirements, documentation, and transportation, and provides various forms including a waste profile sheet. The *WCS Waste Acceptance Plan* (WCS 2014) provides additional

[17] PFNW is currently in discussions with Ecology to renew PFNW's Dangerous Waste permit. Prior to sending secondary waste to PFNW, DOE would verify that the waste could be treated and stabilized within the terms and conditions of the PFNW permit.

information related to the waste acceptance process, including waste form requirements and a description of the generator and waste approval processes.

As identified in Section 2.2.1, certain secondary wastes (the LAW melter offgas HEPA filters) in Group 3 could be treated either at PFNW or at WCS, and other waste in Group 3 (the EMF evaporator concentrate) would be expected to be treated and disposed of at WCS. If the LAW melter offgas HEPA filters were transported to WCS for treatment, the treated waste form would be disposed of at the WCS FWF. The projected volume of solid MLLW from Group 3 is approximately 6 cubic meters (see Table A-3). The projected volume of liquid MLLW from Group 3 is approximately 326 cubic meters. For normalization purposes within the analysis, the minimal quantity of 6 cubic meters of solid MLLW was included in the much greater total anticipated liquid MLLW volume to be shipped, yielding an equivalent total shipping volume estimate of 332 cubic meters for the Group 3 MLLW (see Table A-2).

Section 2.8.1.14 of the TC&WM EIS states the following:

> "Secondary MLLW (e.g., personal protective equipment, tools, job waste, soil from closure activities) would be generated during operations, deactivation, and closure. *Using a combination of on-* ***and offsite capabilities***, secondary MLLW would be treated to meet RCRA land-disposal-restriction treatment standards prior to disposal." (emphasis added)

While the analysis in the TC&WM EIS assumed that most of the LLW and MLLW would be treated onsite prior to disposal at the IDF, it acknowledged the potential for offsite treatment.

### 2.2.4 Transportation of Treated Secondary Waste for Disposal

After treatment of the secondary waste (Groups 1 and 3a) at PFNW, the treated secondary waste would be returned to the Hanford Site and disposed of at the IDF, pending a determination that the final waste form meets Hanford's waste acceptance criteria for the IDF. For the Group 3b waste stream option, the secondary waste would have been shipped to WCS for treatment and would be disposed of at the WCS FWF. Therefore, no additional offsite transportation would be necessary for this case. For Group 2, the treated secondary waste would be sent from DSSI to the WCS for disposal, pending a determination that the final waste form meets WCS's waste acceptance criteria.

### 2.2.5 Disposal of Treated Secondary Waste

As identified in Table 2-1 above, the secondary waste in Groups 1 and potentially 3a is planned for disposal on the Hanford Site at the IDF, consistent with the analysis in the TC&WM EIS.

The largest waste stream proposed for potential offsite disposal would be the Group 3b waste stream, which would consist primarily of treated EMF-concentrate. This waste stream would be treated at the WCS and disposed of at the WCS FWF, a licensed and permitted commercial disposal facility. The treated EMF-concentrate would result in approximately 2,660 55-gallon drums per year of a grouted waste form, or 26,600 drums (approximately 5,640 cubic meters) over the 10-year Proposed Action period.[18] When including other secondary wastes that could be disposed of at WCS (e.g., carbon adsorber beds, HEPA filters), the total estimated volume for disposal would consist of approximately 5,800 cubic meters of disposal containers over the 10-year period.

The estimated radioactivity contained in the Group 2 and Group 3 waste streams would be approximately 5,700 curies of all isotopes over the 10-year period (WRPS 2022a).[19]

The WCS FWF in Andrews County, Texas, is located on a 600-foot-thick nearly impermeable red-bed clay formation, a natural barrier that contributes to safe and permanent disposal of radioactive waste. WCS is permitted and licensed by the State of Texas for near-surface disposal of Class A, Class B, and Class C LLW from Texas Compact waste generators and certain noncompact generators, as well as federal Class A, Class B, and Class C LLW and MLLW. Waste generated by federal entities, which includes DOE-owned or -generated LLW and MLLW, is currently disposed of in the WCS FWF. All hazardous and radioactive waste in the WCS FWF is encapsulated in a 7-foot-thick liner system that includes a 1-foot-thick layer of reinforced concrete and a RCRA-compliant geosynthetic layer. The license for the WCS FWF[20] contains an initial total volume limit of 300,000 cubic yards (229,365 cubic meters) and total activity limit (total decay corrected radioactivity) of 5,500,000 curies for containerized Class A, Class B, and Class C

LLW and MLLW, collectively, at the FWF.[21] The proposed disposal of these secondary wastes would contribute only a fraction of the initial volume limit (2.5 percent) and activity limit (0.10 percent) of the WCS FWF.

[18] RPP-RPT-55960, *Supplemental Immobilization of Hanford Low-Activity Waste: Cast Stone Screening Tests* (WRPS 2013), covers a range of waste loadings expressed as water to dry mix (w/dm) ratio ranging from 0.4 to 0.6 by weight. For this analysis, the middle of the range at 0.5 was applied, which is estimated to yield about 1.7 cubic meters of grout for each cubic meter of liquid waste treated. Note, the above-referenced solidified waste volume may be slightly different than the waste volume generated by the commercial treatment facility. This increase in volume is not applicable to thermally treated liquid wastes (i.e., Group 2).

[19] The estimated total disposal volume and curies over the 10-year period are provided with two significant figures.

[20] Radioactive Material License No. R04100 CN600616890 (TCEQ 2022) issued by the Texas Commission on Environmental Quality.

[21] Decay correction is a method of estimating the amount of radioactive decay at some set time before it was actually measured. The curies from secondary waste are not decay corrected.

# 3 ENVIRONMENTAL CONSEQUENCES

## 3.1 Introduction

DOE conducted an initial screening review to identify the differences between the proposed approach for treatment and disposal of secondary waste from that evaluated in the TC&WM EIS. Resource areas that would be unaffected or any impacts that would be minimal and clearly bounded by the TC&WM EIS analyses were eliminated from detailed analysis in this SA. Section 3.2 describes the results of that initial screening review. For those resource areas that warranted additional evaluation, Section 3.3 provides the analysis of the potential environmental impacts associated with the differences identified in Section 3.2.

## 3.2 Initial Screening Review

- The TC&WM EIS waste management analysis indicated that the majority of secondary waste would be treated, as necessary, onsite and disposed of at the Hanford IDF. The analysis in this SA considers offsite treatment of secondary waste and potential offsite disposal of some of the secondary waste over an approximate 10-year period. The SA analysis assumes the following: A grouting facility would not be constructed onsite for approximately 10 years and therefore could not treat secondary waste generated by, or derived from, vitrification of LAW using the DFLAW approach or other non-DFLAW waste (e.g., tank farm and laboratory operations);

- Approximately 8,650 cubic meters per year of LLW and MLLW would be transported offsite for treatment instead of being treated onsite; and

- Approximately 350 cubic meters per year of MLLW could be disposed of at a licensed and permitted commercial treatment and disposal facility.

Table 3-1 provides a comparative evaluation of the potential impacts for each of the environmental resource areas analyzed in the TC&WM EIS. The center column presents the summary of potential impacts from the TC&WM EIS for Alternative 2B, which was selected in the 2013 ROD (78 FR 75913). The right-hand column provides an assessment of the potential impacts from the Proposed Action for that resource.

**Table 3-1 Comparative Resource Screening Analysis of Environmental Impacts**

| Resource Area | Impacts in 2012 TC&WM EIS for Alternative 2B | Assessment of Impacts for the Proposed Action |
|---|---|---|
| Land Use | Presented as percent of total land commitment within either the Industrial-Exclusive Zone[a] or Borrow Area C,[b] as appropriate.<br><br>101 hectares (2 percent) committed to tank closure within the Industrial-Exclusive Zone; 95.1 hectares (10 percent) affected within Borrow Area C. (TC&WM EIS, Section 2.8.1.1) | The proposed loading of secondary waste onto trucks is within the Industrial-Exclusive Zone,[a] which includes the tank farms and WTP complex. The Proposed Action would require no Borrow Area C[b] materials or new construction beyond that evaluated under Alternative 2B in the TC&WM EIS. There would be no increases in the potential land use impacts beyond those evaluated for Alternative 2B. Because the use of the commercial treatment and disposal facilities would not involve any new land disturbance or changes in their operations, there would not be any offsite land use impacts. |
| Visual Resources | Little change in the overall visual character of the 200 Area. (TC&WM EIS, Section 2.8.1.1) | The proposed loading of secondary waste onto trucks would not introduce any uniquely different operations that would change the potential impacts to visual resources presented in the TC&WM EIS for Alternative 2B. Additional trucks on the highway or entering or departing from the commercial treatment or disposal facilities would not cause notable visual impacts. |
| Noise and Vibration | Negligible offsite impact of onsite activities. Minor traffic noise impacts. (TC&WM EIS, Section 2.8.1.3) | The offsite shipments of secondary waste would result in a slight increase in traffic between the Hanford Site and PFNW. With approximately 2,200 additional shipments annually (mostly between Hanford and PFNW, with a small subset exiting the Benton County area for WCS or DSSI), the daily truck loads could increase by approximately six to eight per day. While this increased truck traffic would increase the potential noise in the area immediately south of the Hanford Site, there would not be large numbers of trucks transporting waste at the same time. Each incremental truck shipment would contribute small increases in noise, which would dissipate quickly. It would not be discernible from the existing truck and vehicle traffic noise. |

| Resource Area | Impacts in 2012 TC&WM EIS for Alternative 2B | Assessment of Impacts for the Proposed Action |
|---|---|---|
| Air Quality | *Peak year incremental criteria pollutant* (most stringent guideline/standard [micrograms per cubic meter])<br>CO (1-hour) standard=40,000/40,500<br>Nitrogen oxides (1-hour) standard=188/35,200<br>$PM_{10}$ (24-hour) standard=150/4,910<br>$PM_{2.5}$ (24-hour) standard=35/4,910<br>Sulfur oxides (1-hour) standard=197/105<br><br>*Peak year incremental toxic chemical concentrations* (micrograms per cubic meter)<br>Ammonia (24-hour) ASIL=70.8/12.0<br>Benzene (annual) ASIL=0.0345/0.00459<br>Mercury (24-hour) ASIL=0.09/0.117<br>Toluene (24-hour) ASIL=5,000/3.62<br>Xylene (24-hour) ASIL=NL/1.1<br>(TC&WM EIS, Table 2.9) | The proposed transportation of secondary wastes for offsite treatment eliminates the potential releases of criteria pollutants from onsite treatment, which was assumed in the TC&WM EIS. There would be emissions from the transport vehicles, which is evaluated in Section 3.3 of this SA. |
| Geology and Soils | Small impact from construction, including potential for short-term soil erosion. Excavation depths limited to 12 meters.<br>New permanent land disturbance, 112 hectares<br>(TC&WM EIS, Section 2.8.1.5) | The proposed loading of secondary waste onto trucks is within the Industrial-Exclusive Zone,[a] which includes the tank farms and WTP complex. There would be no construction associated with the proposal beyond that evaluated under Alternative 2B. Treated secondary waste would still be disposed of at the Hanford IDF, as was analyzed in the TC&WM EIS. |
| Water Resources | Surface Water – Short-term increase in stormwater runoff during construction, but no direct disturbance to surface-water features. No direct, routine discharge of effluents during operations to surface waters or to the subsurface. Water use would not exceed site capacity.<br><br>Vadose Zone and Groundwater – Potential for SST retrieval leaks in the short term without any recovery once in the subsurface. Groundwater mounds could begin to re-expand due to increased discharge of sanitary wastewater, nonhazardous process wastewater, and treated radioactive liquid effluents to onsite treatment and disposal facilities during waste treatment.<br>(TC&WM EIS, Section 2.8.1.6) | Surface Water – The proposal would not introduce new potential surface-water releases or water uses beyond those potential impacts evaluated for Alternative 2B. Operations would adhere to Hanford's spill prevention and emergency response plans and procedures as identified in Section 4.1.6 of the TC&WM EIS.<br><br>Vadose Zone and Groundwater – The proposal would not introduce new potential impacts to the vadose zone or groundwater beyond those potential impacts evaluated for Alternative 2B. Operations would adhere to Hanford's spill prevention and emergency response plans and procedures as identified in Section 4.1.6 of the TC&WM EIS. |

| Resource Area | Impacts in 2012 TC&WM EIS for Alternative 2B | Assessment of Impacts for the Proposed Action |
|---|---|---|
| Ecological Resources | Terrestrial Resources – 1.2 hectares of sagebrush habitat affected in the 200 Area.<br><br>Wetlands – No impact on wetlands within the 200 Area.<br><br>Aquatic Resources – No impact on aquatic resources within the 200 Area.<br><br>Threatened and Endangered Species – No impact on any federally listed threatened or endangered species. Potential impacts on two State-listed species.<br>(TC&WM EIS, Section 2.8.1.7) | The Proposed Action would not affect any ecological resources since no land would be disturbed beyond that evaluated under Alternative 2B. Any potential impacts resulting from a transportation accident are addressed in Section 3.3 of this SA. |
| Cultural and Paleontological Resources | Prehistoric, historic, and paleontological resources – No impacts.<br><br>American Indian Interests – The 200 Area's containment structures and closure barriers would be visible from higher elevations.<br>(TC&WM EIS, Section 2.8.1.8) | The proposed loading of secondary waste onto trucks is within the Industrial-Exclusive Zone,[a] which includes the tank farms and WTP complex. There would be no construction associated with the proposal beyond that evaluated under Alternative 2B. |
| Socioeconomics | Peak annual workforce (full-time equivalent) – 6,860<br>Peak daily commuter traffic (vehicles per day) – 5,500<br>Peak daily truck loads, offsite – 48<br>Impact on the region of influence (ROI) – Potential for change in the socioeconomic ROI, including increases in population, demand and cost for housing and community services, and level-of-service impacts on local transportation.<br>(TC&WM EIS, Section 2.8.1.9) | The Proposed Action would not measurably affect the workforce or socioeconomic conditions. The secondary waste would not be treated onsite; therefore, the workers associated with this effort would not be employed by DOE and whether the commercial treatment facilities would require additional workers is uncertain. There could be additional workers employed to drive the trucks for secondary waste transportation; however, the number of drivers hired would be unlikely to have a notable effect on the local economy.<br><br>The offsite shipments of secondary waste would result in a slight increase in traffic between the Hanford Site and PFNW. With approximately 2,200 additional shipments annually between Hanford and PFNW, the daily truck loads could increase by approximately six to eight per day. |

| Resource Area | Impacts in 2012 TC&WM EIS for Alternative 2B | Assessment of Impacts for the Proposed Action |
|---|---|---|
| Public and Occupational Health and Safety (Normal Operations) | Normal Operations<br>*Offsite population impact – life of project*<br>Dose (person-rem)/latent cancer fatality (LCF) – 1,600/1<br>*Peak year maximally exposed individual impact*<br>Dose (millirem (mrem)/yr)/increased risk of an LCF – $10/6\times10^{-6}$<br>*Peak year onsite maximally exposed individual impact*<br>Dose (mrem/yr)/increased risk of an LCF – $1.7/1\times10^{-6}$<br>*Radiation worker population impact – life of project*<br>Dose (person-rem)/LCF – 11,000/7<br>*Average annual impact per radiation worker*<br>Dose (mrem/yr)/increased risk of an LCF – $160/1\times10^{-4}$<br>*Peak year noninvolved worker impact*<br>Dose (mrem/yr)/increased risk of an LCF – $3.4/2\times10^{-6}$<br>(TC&WM EIS, Section 2.8.1.10) | Increasing the amount of offsite treatment and disposal of secondary waste would transfer the potential worker health impacts from onsite DOE contractors to those working at the commercial treatment and disposal facilities; however, these impacts are expected to be similar to those presented in the TC&WM EIS for this activity. These elements of the Proposed Action are evaluated in more detail in Section 3.3.2 of this SA. |
| Public and Occupational Health and Safety (Facility Accidents) | Facility Accidents<br>*Offsite population consequences*<br>Dose (person-rem)/latent cancer fatalities (LCFs) – 75,000/50<br>*Maximally exposed offsite individual consequences*<br>Dose (rem)/increased risk of LCF – $4.3/3\times10^{-3}$<br>*Noninvolved worker consequences*<br>Dose (rem)/increased risk of LCF – 13,000/1<br>*Offsite population risk*<br><br>Annual number of LCFs/number of LCFs over the life of the project – 0/1<br>*Maximally exposed offsite individual risk*<br>Annual increased risk of an LCF/increased risk of an LCF over life of the project – $1\times10^{-6}/3\times10^{-5}$<br>*Noninvolved worker risk*<br>Annual increased risk of an LCF/increased risk of an LCF over life of the project - $8\times10^{-3}/2\times10^{-1}$<br>(TC&WM EIS, Section 2.8.1.11) | Because there would be minimal onsite treatment for the secondary waste, there would be a slight decrease in onsite facility accident potential; however, this accident risk would be transferred to the commercial facilities responsible for the waste treatment. These elements of the Proposed Action are evaluated in detail in Section 3.3.3 of this SA. |
| Public and Occupational Health and Safety (Transportation) | Transportation<br>*Traffic accidents* (nonradiological fatalities) – 1<br>*Offsite population*<br>Dose (person-rem)/LCFs – $73/4.4\times10^{-2}$<br>*Worker*<br>Dose (person-rem)/LCFs – $260/1.6\times10^{-1}$<br>(TC&WM EIS, Section 2.8.1.12) | There would be an increase in health risks to transportation crews for the secondary waste shipments and a small increase in health risks to the population along transportation routes. Furthermore, there would be an increased accident risk associated with the offsite transportation of the secondary waste. These elements of the Proposed Action are evaluated in further detail in Section 3.3.4 and Appendix A of this SA. |

| Resource Area | Impacts in 2012 TC&WM EIS for Alternative 2B | Assessment of Impacts for the Proposed Action |
|---|---|---|
| Industrial Safety | Worker Population Impact – Total Project<br>Total recordable cases (fatalities) – 3,880 (0.50)<br>(TC&WM EIS, Section 2.8.1.15) | Transportation of secondary waste offsite for treatment, as opposed to onsite treatment, would transfer the potential industrial safety impacts to treatment workers from DOE contractors to those working at the commercial treatment facilities; however, these impacts are expected to be similar to those presented in the TC&WM EIS for this activity. The proposal would not introduce any new industrial hazards that were not included in the evaluation of Alternative 2B. |
| Environmental Justice - Human Health Impacts | No disproportionately high and adverse human health impacts on minority or low-income populations due to normal facility operations or postulated facility accidents.<br>(TC&WM EIS, Section 2.8.1.13) | The proposal would not contribute substantially to offsite consequences, including from any subsequent transportation (as demonstrated in Section 3.3.4). There would be no disproportionately high or adverse offsite impacts to minority or low-income populations from the transportation and offsite treatment or disposal of secondary waste at licensed and permitted facilities within their existing permitted authority or capacity. |
| Waste Management | <u>Secondary waste generated during operations</u> (cubic meters)<br>LLW - 27,500 (disposed onsite)<br>MLLW - 27,500 (disposed onsite)<br>Mixed TRU - 206 (shipped to WIPP for disposal)<br>Hazardous waste - 63,300 (shipped offsite for management and disposal)<br>Nonradioactive, nonhazardous waste - 254 (disposed offsite in a local landfill) | The proposal includes offsite treatment of secondary waste. The largest volume of secondary waste would be returned to the Hanford IDF for disposal (consistent with the analysis in the TC&WM EIS). Approximately 18 cubic meters annually of MLLW would be sent to DSSI for treatment and the WCS FWF for disposal. DOE could treat and dispose of an additional approximately 3,320 cubic meters of MLLW at WCS, a licensed and permitted commercial disposal facility. These elements of the Proposed Action are evaluated in more detail in Section 3.3.5 of this SA. |

ASIL=Acceptable Source Impact Level; IDF=Integrated Disposal Facility; FWF=Federal Waste Facility; LCF=latent cancer fatality; LLW=low-level radioactive waste; MLLW=mixed low-level radioactive waste; mrem/yr=millirem per year; NL=not listed; PM*x*=particulate matter with an aerodynamic diameter less than or equal to *x* micrometers; PFNW=Perma-Fix Northwest; RCRA=Resource Conservation and Recovery Act; ROI=region of influence; SST=single-shell waste storage tank; TRU=transuranic; WCS=Waste Control Specialists LLC; WTP=Waste Treatment and Immobilization Plant

a Industrial-Exclusive Zone: Land within the 200 Area.

b Borrow Area C: Located south of the Hanford 200 West Area along State Route 240. It is a proposed supply site for the sand, soil, and gravel needed to support the RCRA Subtitle C closure cap portion of the alternatives discussed in the TC&WM EIS.

## 3.3 Additional Evaluations

The environmental resource area screening process described in Section 3.2 (Table 3-1) identified five resource areas related to the proposed implementation of the Proposed Action for further evaluation: (1) air quality, (2) public and occupational health and safety (normal operations), (3) public and occupational health and safety (facility accidents), (4) public and occupational health and safety (transportation), and (5) waste management.

### 3.3.1 Air Quality

The Proposed Action would not involve the construction or operation of any facilities that have not been evaluated previously under NEPA or existing facilities that have not been licensed and permitted for air emissions by the applicable state regulatory agency. Therefore, the Proposed Action would not involve any new sources of facility air emissions at the Hanford Site, the offsite commercial treatment facilities, or any commercial disposal facilities. As identified in Section 2.1 of this SA, the TC&WM EIS assumed (under all alternatives) that the three onsite waste management locations (Central Waste Complex, Waste Receiving and Processing, and T-plant) were all expanded to provide a conservative evaluation of potential impacts since it was uncertain which facility would ultimately house the capability to treat and store all secondary waste. The potential emissions of criteria and toxic air pollutants associated with the construction, operation, and deactivation of these possible expansions are presented in Tables G-47 and G-48 in Appendix G of the TC&WM EIS. Greenhouse gases (GHG) are discussed in Section G.5 of the TC&WM EIS. The estimated emissions of carbon dioxide for Waste Management Alternative 2, which includes the expansion of these facilities, is presented in Table G-167 of the TC&WM EIS.

The transportation of secondary waste by truck to offsite treatment facilities and from the treatment facilities to a disposal site would generate vehicle emission pollutants, including GHG. Potential air quality emissions were evaluated in the TC&WM EIS (Appendix G) for each alternative for the construction, operation, deactivation, and closure project phases.[22] These evaluations did not include offsite transportation of waste for treatment and disposal. To estimate the relative contribution of air emissions that include offsite transportation of secondary waste for treatment and disposal, DOE compared the transportation emissions of CO, nitrogen oxides, and GHGs to similar emissions for Tank Closure Alternative 2B during operations.

The large majority of the secondary waste shipments would be for a distance of 26 miles (i.e., Hanford Site to PFNW and back), (see Table 2-2). To estimate vehicle emissions of total hydrocarbons (HC), CO, nitrogen oxides, particulate matter 2.5 micron or smaller ($PM_{2.5}$), and total GHGs (expressed as carbon dioxide equivalent [$CO_2e$]), total truck transportation miles were multiplied by emission rates for each pollutant (Table 3-2). Truck miles were calculated from the estimated number of truck shipments and the miles of each trip (see Table 2-2). GHG emission rates vary by driving conditions, with slower speeds yielding higher GHG emissions per mile and higher speeds producing lower emissions per mile (Quiros et al. 2017). The GHG emission rate for regional highway driving conditions was selected because it best characterized the transportation routes for the shipments to PFNW (26 miles) and return shipments to the IDF.

[22] Table G-167 provides estimated annual average emissions of carbon dioxide by alternative as opposed to by project phase

The longer routes to Perma-Fix DSSI and WCS are characterized by varying amounts of higher-speed Interstate highway and slower speed hill-climb driving conditions. However, the GHG emission rate for regional highway driving is approximately equal to the average of the GHG emission rates for Interstate and hill-climb driving conditions. Therefore, the regional highway driving GHG emission rate was used for all transportation routes.

**Table 3-2 Emission Rates for Heavy-Duty Diesel Vehicles Used to Estimate Emissions for Transportation of Secondary Waste**

| Emission Pollutant | Emission Rate (grams/mile)[a] |
|---|---|
| Total HCs[b] | 0.269 |
| Exhaust CO[b] | 2.000 |
| Exhaust nitrogen oxides[b] | 4.169 |
| Total particulate matter less than 2.5 microns[b] | 0.119 |
| Total GHG ($CO_2e$)[c] | 1,755 |

$CO_2e$=carbon dioxide equivalent; GHG=greenhouse gas; PM2.5=particulate matter less than 2.5 microns

a Emission rate for GHG is dependent on driving conditions. Emission rates are based on grams per mile.

b Source: EPA 2021.

c Source: Quiros et al. 2017, Table 2.

Under the Proposed Action, the waste streams identified in Tables 2-1 and 2-2 as Group 1 or 2 would be transported as listed in Table 2-2. There are two options for the transportation of secondary waste for treatment and disposal of Group 3 waste streams. The approximately 332 cubic meters of Group 3 waste would either be shipped to PFNW for treatment and be disposed of at the IDF (Option 1) or shipped to a licensed and permitted commercial disposal facility (WCS) for treatment and disposal (Option 2). For the air quality evaluation, Option 1 includes all the shipments for Group 1 and 2 waste streams in Table 2-2 and Group 3 shipments to PFNW and disposal at the IDF. Option 2 is the same as Option 1 except the Group 3 waste stream is shipped to WCS instead of PFNW.

Estimated annual truck emissions from transportation would be small for both Option 1 and Option 2 with no pollutant emission exceeding 0.3 ton per year except for nitrogen oxides (0.51 ton per year) under Option 2 (Table 3-3). Emissions were higher under Option 2 because of the additional miles for shipping secondary waste to WCS. Adding offsite transportation of secondary waste would increase Alternative 2B estimated emissions by about 0.01 to 0.014 percent for CO, 0.017 to 0.026 percent for nitrogen oxides, and less than 0.0006 percent for $PM_{2.5}$.[23] Option 2 increases would be slightly higher, but neither offsite transportation option would substantially increase the annual estimated emissions of either CO, nitrogen oxide, or $PM_{2.5}$. The TC&WM EIS did not estimate emissions of total HCs, so there is no direct

[23] Appendix G, Section G.2.1 of the TC&WM EIS states, "For the purpose of this analysis, emissions of $PM_{10}$ and $PM_{2.5}$ from activities were assumed to be the same. Therefore, the concentrations estimated would also be the same, and $PM_{2.5}$ concentrations are not shown separately." As such, only $PM_{10}$ emissions are reflected in the TC&WM EIS tables; however, $PM_{2.5}$ is discussed in the analysis in this SA.

comparison. The Proposed Action would add such a small amount of hydrocarbons (0.02–0.03 tons per year) to the environment, air quality impacts would not be expected.

GHG emissions were estimated as 145 and 215 tons per year for Options 1 and 2, respectively. To put this into perspective, the estimated GHG emissions for Alternative 2B were 145,000 metric tons per year (159,835 tons per year) (DOE 2012, Appendix G, Table G-167). The incremental increase in annual GHG emissions from adding offsite transportation of secondary waste for treatment and disposal would be approximately 0.09 and 0.13 percent per year, respectively, for Options 1 and 2. Although there would be an increase in GHG emissions, the increase would be relatively small compared to the annual estimate of GHGs emissions for Alternative 2B.

**Table 3-3 Estimates of Truck Emissions (tons per year) for Transportation of Secondary Waste**

| Shipment Option[a] | Truck Miles/Year | Emission Pollutant (tons per year) | | | | |
|---|---|---|---|---|---|---|
| | | Total HC | Exhaust CO | Exhaust NOx | Total $PM_{2.5}$ | Total GHG ($CO_2e$) |
| Option 1 | 74,908 | 0.02 | 0.17 | 0.34 | 0.01 | 145 |
| Option 2 | 111,086 | 0.03 | 0.24 | 0.51 | 0.01 | 215 |

CO=carbon monoxide; $CO_2e$=carbon dioxide equivalent; HC=hydrocarbon; $NO_x$=nitrogen oxides; $PM_{2.5}$=particulate matter less than 2.5 microns

a Option 1 assumes the Group 3 waste streams in Table 2-1 are shipped to PFNW and disposed of at the IDF; Option 2 assumes that the Group 3 waste streams are shipped to WCS for treatment and disposal.

### 3.3.2 Public and Occupational Health and Safety (Normal Operations)

The TC&WM EIS evaluated the potential health and safety impacts associated with the management, treatment, and disposal of numerous forms of secondary waste that would result from the operations of facilities/processes needed to support treatment of tank waste and associated closure activities.

Transportation of secondary waste offsite for treatment (and potential subsequent disposal), as opposed to the onsite treatment options evaluated in the TC&WM EIS, would essentially transfer the potential normal operational health impacts from the Hanford workforce to workers at commercial treatment and disposal facilities, given that the scopes of work would be similar in nature regardless of location. Accordingly, radiological impacts resulting from this work would be comparable to those presented in the TC&WM EIS for treatment/disposal activities originally proposed for the Hanford Site.

For all workers at offsite treatment/disposal locations, under the requirements of 10 CFR Part 20 and 29 CFR Part 1910, as well as applicable state regulatory guidance, it is expected that radiation protection programs would maintain doses as low as reasonably achievable and stay within compliance limits set by their respective governing authorities (e.g., Nuclear Regulatory Commission [NRC], Occupational Safety and Health Administration, WDOH, Texas Commission on Environmental Quality, or governing state equivalent).

Operations at the commercial treatment and disposal facilities would be conducted in accordance with licenses and permits issued by their respective states (i.e., Washington, Tennessee, and/or Texas). Because the secondary waste volumes and constituents would be treated and disposed of in accordance with the existing licenses and permits of these facilities, impacts to facility workers are expected to fall within the range of potential health impacts considered during the licensing and permitting processes. Further, because there would be no new or additional radiological emissions or effluents at these commercial facilities beyond those evaluated as part of their permitting and licensing processes, there would be no additional doses to the public that have not previously been considered. As discussed earlier in this SA, the licensed operational throughput and disposal capacities of all analyzed offsite facilities would be expected to definitively accommodate the entire projected quantity of secondary waste being sent from the Hanford Site over the analyzed period.

Based on the above considerations regarding both workers and the public, there would be no substantive difference in normal operational dose impacts to workers or the public from those originally estimated in the TC&WM EIS associated with the treatment and disposal of secondary waste. Potential health impacts associated with transportation activities are addressed in Section 3.3.4.

### 3.3.3 Public and Occupational Health and Safety (Facility Accidents)

The TC&WM EIS analyzed a spectrum of accidents for operations associated with Alternative 2B and Waste Management Alternative 2 (DOE 2012, Tables 4-50 and 4-149). The accidents analyzed included leaks, fires, and design-basis seismic events. The accident with the highest consequence and risk was a seismic-induced collapse and failure of the WTP. Under that bounding scenario, DOE estimated that the hypothetical maximally exposed individual at the nearest offsite location could receive a dose of 4.3 rem, and the population surrounding the Hanford Site within a 50-mile radius could receive a collective dose of 75,000 person-rem. That accident was estimated to have a probability of occurrence of $5 \times 10^{-4}$ per year, or once in 2,000 years.

As discussed in Section 2.2.1 of this SA, proposed treatment and stabilization of secondary LLW and MLLW at the PFNW facility (Groups 1 and 3a) could account for as much as approximately 8,630 cubic meters per year of material being handled there annually (approximately 7,700 cubic meters per year solid and approximately 930 cubic meters per year liquid). This would reduce the potential for accidents on the Hanford Site since the treatment would occur offsite. Although this proposed volume would be a significant percentage of the PFNW facility's allowable annual treatment capacity, it would not be outside of its approved operating envelope. Treatment and stabilization of secondary LLW and MLLW at PFNW would not change the types of accidents that could occur at the facility or the potential impacts from accidents compared to operations that were evaluated as part of the licensing or permitting processes with the State of Washington.

Proposed treatment and stabilization of secondary MLLW at the Perma-Fix DSSI facility could account for as much as approximately 18 cubic meters per year of material being handled there annually (approximately 15 cubic meters per year solid and approximately 3 cubic meters per year liquid). This relatively small volume of MLLW would account for less than 1 percent of the annual treatment capacity at the DSSI facility. Treatment and stabilization of secondary MLLW at DSSI would not change the types of accidents that could occur at the facility or the potential impacts from accidents compared to operations that were evaluated as part of the licensing or permitting processes with the State of Tennessee.

Proposed treatment and disposal of approximately 332 cubic meters of secondary MLLW (primarily EMF-concentrate) at WCS would not change the types of accidents that could occur at those facilities or the potential impacts that could occur from presently ongoing MLLW treatment and disposal operations at such locations because the secondary waste would meet the existing waste acceptance criteria and would be within the volumes stipulated in the facilities' state permit(s) or license(s).

As part of the TC&WM EIS accident analysis, DOE estimated potential impacts from intentional destructive acts (DOE 2012, Sections 4.1.11.12 and 4.3.11.4). For that analysis, DOE evaluated a range of potential scenarios on the Hanford Site, including: (1) an explosive device in an underground waste tank, (2) an aircraft or ground vehicle impact on the WTP, (3) an intentional breach of the WTP ammonia tank, and (4) a large aircraft crash at the Solid Waste Operations Complex Storage Building. These scenarios are identified in Appendix K, Section K.3.11 of the TC&WM EIS and were selected based on a number of factors, including quantities, location, and the dispersibility of radiological material. Because the Proposed Action in this SA would not introduce new onsite impacts or risks from intentional destructive acts, the potential onsite impacts associated with the Proposed Action in this SA are bounded by the subject analysis in the TC&WM EIS.

It should be noted that because there would now be minimal Hanford onsite treatment activities for secondary waste streams due to the proposed offsite treatment alternatives, there would be a slight reduction in Hanford onsite facility accident potential compared to what was originally evaluated in the TC&WM EIS. This small "reduction-delta" in accident risk, however, would essentially be transferred to the commercial facilities that would now be responsible for the waste treatment. As detailed above, however, such additional risk quantities at the offsite facilities would be expected to be minimal in comparison to the overall inherent risk baselines that are already expected and analyzed as part of the licensing and permitting processes for those facilities.

Based on the above, there would be no substantive difference in facility accident dose impacts from those originally estimated in the TC&WM EIS associated with the offsite treatment and disposal of secondary waste.

### 3.3.4 Public and Occupational Health and Safety (Transportation)

There would be a separate (i.e., new) set of incident-free and accident risks associated with the transportation of secondary waste to offsite treatment and disposal facilities that were not considered in the TC&WM EIS. The TC&WM EIS evaluated the potential transportation health risk impacts from the management, treatment, and disposal of numerous packages of radioactive waste (e.g., HLW, LLW, MLLW, and TRU waste) that would result from Hanford Site operations of all facilities supporting the treatment of tank waste and secondary waste streams. This included both CH and RH TRU waste canisters and packages over a wide array of radiological concentrations and intensities. For Tank Closure Alternative 2B, the TC&WM EIS did not include any offsite shipments of waste but did evaluate onsite shipments of LLW and MLLW between various facilities, waste processing locations, and disposal locations. Additionally, the TC&WM EIS Waste Management Alternative 2 included the evaluation of offsite shipments of LLW and MLLW to the Hanford Site for treatment and disposal at the IDF.

The TC&WM EIS evaluated TRU secondary waste and assumed it would be shipped to the WIPP facility for disposal. This assumption still applies today. Because the secondary LLW and MLLW would be transported off the Hanford Site for treatment and disposal under the Proposed Action of this SA, only potential transportation impacts associated with LLW and MLLW are evaluated herein. Transportation of LLW and MLLW is strictly regulated. In accordance with 49 CFR Subchapter C, "Hazardous Materials Regulations," USDOT regulates packaging, labeling, preparation of shipping papers, handling, marking, and placarding of shipments and establishes standards for personnel as well as conveyance (e.g., truck and train) performance and maintenance (49 CFR 173.401). USDOT and the NRC set radioactive material packaging standards (10 CFR Part 71). In addition, DOE LLW and MLLW shipments must comply with DOE requirements (DOE Orders 460.2A and 460.1D).

Proper packaging is a key element in transportation safety, and the selection of appropriate packaging typically is based on the level and form of radioactivity inherent to the materials that are being shipped. LLW and MLLW must be packaged to protect workers and the public (as well as the environment) during transport due to potential radiological exposures of truck crews and the public being directly dependent upon external dose rates associated with the waste packages.[24] Solid and liquid secondary LLW and MLLW to be shipped offsite for treatment and stabilization are expected to have low levels of radioactivity. This is substantiated by the following considerations: (1) the WM PEIS (from which this SA's dose-rate estimates are scaled) conservatively assumed a *generically representative* dose rate of 1 mrem per hour at 1 meter for all LLW and MLLW packages; (2) recent historical (2-year) *measured* dose-rate data for LLW and MLLW packages shipped from the Hanford Site exhibited quantities that are comparable to, but smaller than (i.e., on the order of 0.5 mrem per hour at 1 meter) the WM PEIS's general estimate of 1 mrem per hour in the vast majority (i.e., greater than 97 percent) of cases (WRPS 2022b); and (3) MicroShield calculations performed for EMF-concentrate have shown that associated shipping containers ("supertainers") for liquid MLLW would have an expected dose rate of approximately 0.63 mrem per hour at 2 meters and approximately 9 mrem per hour on contact (WRPS 2022c). Although such a case (0.63 mrem per hour at 2 meters and 9 mrem per hour on contact) would be expected to yield an equivalent dose rate of approximately 2.5 mrem per hour at 1 meter, this value would still result in conditions far below allowable USDOT 49 CFR Part 173 limits for radiological shipping packages. It is furthermore noteworthy to emphasize that since these Group 3 supertainer shipments would only account for about one-third of the proposed total shipping-miles (e.g., roughly 36 percent for truck crews) for all secondary waste groups evaluated in this SA, that the preponderance of Group 1 and 2 wastes that will be expected to exhibit dose rates in the 0.5 mrem per hour range (at 1 meter) would resultantly bring the overall weighted dose-rate average for the entire collective cadre of shipments down to near the 1 mrem per hour (at 1 meter) mark, which is consistent with the WM PEIS's representative estimate.

Under the Proposed Action, the secondary LLW and MLLW would be transported strictly by truck. DOE (and state) inspectors would inspect vehicles and loads for shipments leaving the Hanford Site. States may also inspect shipments to confirm regulatory compliance. The shipments would be expected to use the most direct routes that minimize radiological risk (DOE

[24] USDOT regulations (49 CFR Part 173) limit the external dose rates for LLW/MLLW packages to 200 mrem per hour at the contact surface of the package and 10 mrem per hour at 2 meters from the surface of the transport vehicle.

1999). Shipments leaving the Hanford Site area for out-of-state destinations (e.g., Tennessee or Texas) would be transported over federal highways for the majority of their routes.

Data from the Federal Motor Carrier Safety Administration (FMCSA) for 2017 indicate that large trucks are involved in 35.9 accidents per 100 million miles traveled (FMCSA 2019). DOE has an outstanding transportation safety record. In fiscal year 2020, DOE transportation contractors safely transported more than 3,200 hazardous materials shipments over 6 million miles with no USDOT recordable accidents. DOE's transportation contractors and those contracted by PFNW or Perma-

Fix DSSI would follow the same USDOT and NRC regulations for transporting hazardous material. DOE has response systems in place for accidents involving shipments of LLW or MLLW. Further, DOE supports training and emergency planning through its Transportation Emergency Preparedness Program. State, tribal, and local government officials respond to any such accident within their jurisdiction. DOE also responds to transport emergencies at the request of states and tribes. Radiological assistance program teams are available to provide field monitoring, sampling, decontamination, communications, and other related services.

**Impact Assessment**

For Group 1 waste (see Tables 2-1 and 2-2), the analysis in this SA conservatively estimates that approximately 7.7 cubic meters of solid LLW and MLLW or 15 cubic meters (approximately 4,000 gallons) liquid LLW and MLLW could be shipped from the Hanford Site to the PFNW facility (approximately 26 miles) in a single truck shipment. DOE used a conservative assumption that all such wastes (solid or liquid) would be transported in USDOT-certified 55-gallon drums, which would maximize the number of shipments. This assumption would result in the highest potential mass of container material (e.g., steel) per unit volume of cargo, thus limiting or reducing the allowable quantity of LLW and MLLW waste to be transported on any given shipment in order to comply with USDOT cargo limits (34,000 pounds for a tandem-axle trailer). The 55-gallon drums (or other USDOT-certified container) would be suitable for transportation in accordance with USDOT requirements and would meet all appropriate USDOT requirements for the transport of the subject wastes to PFNW, in accordance with 49 CFR Subchapter C.

Consistent with the above approach, transport of Group 2 MLLW containers from the Hanford Site to Perma-Fix DSSI were also assumed to consist of USDOT-certified 55-gallon drums, with approximately 7.7 cubic meters of solid MLLW or 3.1 cubic meters (approximately 820 gallons) liquid MLLW shipping from the Hanford Site to Perma-Fix DSSI in Kingston, Tennessee (approximately 2,370 miles), in a single truck shipment. Similar bounding assessments were also performed for shipping treated Group 1 wastes from PFNW to the IDF (26 miles) for disposal (up to 7.7 cubic meters of treated waste per shipment); shipping treated Group 2 waste from Perma- Fix DSSI to WCS (approximately 1,200 miles) for disposal (up to 7.7 cubic meters of treated waste per shipment); shipping Group 3 treated and solidified MLLW from PFNW to the IDF (26 miles) for disposal (up to 7.7 cubic meters of treated waste per shipment); and shipping Group 3b MLLW from the Hanford Site to WCS. Since Group 3a or 3b liquid MLLW shipments are most likely to be transported from Hanford in 350-gallon "supertainers" (or 300-gallon totes) to PFNW or WCS, a licensed and permitted commercial treatment and disposal facility, those specific transport cases were assessed in those particular containers. Up to nine filled supertainers (approximately 3,150 gallons, or 12 cubic meters) would be expected as a bounding load per shipment to either destination.

The WM PEIS includes a comprehensive analysis of LLW and MLLW transportation impacts and found that transporting LLW and MLLW has the potential to affect the health of truck crews and the public along transportation routes (DOE 1997a). These health effects include both radiological and nonradiological impacts. The radiological impacts are the result of radiation received during incident-free transport, as well as accidents in which the waste containers are assumed to fail. Nonradiological impacts could occur as a result of exposure to vehicle exhaust and physical injury from vehicle accidents. In the WM PEIS, DOE determined that the impacts of transporting approximately 25,000 shipments of LLW and MLLW (over approximately 9 million miles) would be as follows (DOE 1997a, Section 7.4.2):

- Less than 0.5 LCFs from radiological doses to either the truck crews or the public along the transportation routes;[25]
- Less than 0.5 fatality from vehicle emissions; and
- One fatality resulting from physical injuries from traffic accidents.

Consistent with CEQ's instruction to discuss potential impacts "in proportion to their significance" (40 CFR 1502.2(b)), DOE determines the appropriate level of detail of impact analysis, including transportation impact analysis, on a case-by-case basis. This determination is based on the nature of the proposed action and the potential significance of potential impacts. DOE transportation analyses have consistently shown that the impacts of the transportation of radioactive materials are generally small and are occasionally even overwhelmed by nonradiological impacts associated with the same shipments. Accordingly, for DOE actions where only minimal radiological impacts would be expected from the transportation of certain radioactive materials (e.g., LLW, MLLW), completely new quantitative analyses are often not deemed necessary to assess potential impacts of newly proposed actions. Instead, DOE often endorses the approach of a simple screening analysis (with appropriately conservative inputs) to identify an upper bound on potential impacts, which would be expected to show whether potential new impacts could be of a significant magnitude and whether the need for further analysis is warranted.

As such, analytical tools that have built in assumptions, such as similar materials being transported, similar packaging, similar origination and destination locations, similar travel routes, similar population densities, and similar modes of transport, may be incorporated by reference (40 CFR 1501.12) into an SA and used to develop estimates for use in a screening analysis. Combining aspects of previously existing analyses into new evaluations can help reduce duplicative effort and paperwork (40 CFR 1506.4). This SA uses an analytical comparison based on the impact results presented in the WM PEIS as a primary mechanism for determining dose

[25] The WM PEIS (DOE 1997a) analyses reflect a lower dose-to-LCF risk factor ($5 \times 10^{-4}$ LCFs per person-rem) than DOE uses present-day ($6 \times 10^{-4}$ LCFs per person-rem). The updated factor reflects an increase of approximately 20 percent over the impacts calculated in 1997. The results presented in this SA reflect the current dose-to-LCF risk factor. The comparison to the WM PEIS to obtain potential impacts in this SA also reflects national population increases and updated truck accident rates since publication of the WM PEIS.

estimates to the public and truck crews for the proposed offsite shipment of Hanford secondary LLW and MLLW to their candidate destinations. The associated findings from this screening assessment are presented below in Table 3-4, which provides both annual and total LCF estimates resulting from the anticipated 10-year (approximate) period to crews and the public for incident-free transport, as well as the projected public consequences from a maximum reasonably foreseeable transportation accident occurring during the 10-year Proposed Action period. For comparison perspective as discussed earlier, the estimated number of nonradiological accident fatalities is also shown for the entire duration of the Proposed Action's transportation activities. Additional information regarding the derivation of these results and principal assumptions that support the overall screening exercise are provided in Appendix A of this SA.

Potential transportation impacts depend primarily on the waste form and associated dose rate, number of shipments and shipment-miles, and the affected populations along travel routes.

Assuming that the estimated cumulative dose to exposed populations along the routes would be on the order of 3.5 person-rem per year (for example, a realistic collective population-dose of 3.5 person-rem could result from a hypothetical total population of 1 million people being exposed to an *average* individual dose of 0.0035 millirem per year [1/100,000$^{th}$ of that incurred annually from natural background radiation]), when applying the aforementioned $6\times10^{-4}$ dose-to-LCF risk conversion factor, an associated 0.0021 LCFs to the public would result from the incident-free transportation of approximately 2,200 shipments per year. In a similar fashion, 0.0019 LCFs from 2,200 shipments per year would be estimated for truck crews as a result of discernibly larger exposures expected to a much smaller number of people. For the 10-year Proposed Action period, both of these values would increase by a factor of 10 (0.021 LCFs and 0.019 LCFs, respectively), which are both statistically equivalent to zero. As a point of comparison, the number of nonradiological fatalities from these shipments over the same 10-year period is estimated at 0.017.

USDOT-certified packages must pass stringent tests as part of their certification. Of Type A packages, only 1 percent of those involved in accidents have historically failed; of those, only 39 percent have released their contents (NRC 2003). As shown in Table 3-4 below and further discussed in Appendix A of this SA, the estimated cumulative radiological risk for a severe transportation accident under the Proposed Action over the entire proposed 10-year offsite transportation duration would be on the order of $4\times10^{-5}$ LCFs.

**Table 3-4 Estimated Radiological Impacts to the Public and Truck Crews for Offsite Secondary Waste Transportation**

| Analytical Parameter | LLW | MLLW | Total |
|---|---|---|---|
| Total miles/year (public) | 1,870 | 49,200 | 51,070 |
| Total miles over 10-year Proposed Action period (public) | 18,700 | 492,000 | 510,700 |
| Total miles/year (crews)[a] | 40,400 | 63,400 | 103,800 |
| Total miles over 10-year Proposed Action period (crews) | 404,000 | 634,000 | 1,038,000 |
| Total shipments/year | 1,555 | 601–645 | 2,156–2,200 |
| Total shipments over 10-year Proposed Action period | 15,550 | 6,010–6,450 | 21,560–22,000 |

| Analytical Parameter | LLW | MLLW | Total |
|---|---|---|---|
| Public LCFs from 1 year of shipping | $6\times10^{-5}$ | 0.002 | 0.0021 |
| Public LCFs from 10-year Proposed Action period | $6\times10^{-4}$ | 0.02 | 0.021 |
| Crew LCFs from 1 year of shipping | $9\times10^{-4}$ | 0.001 | 0.0019 |
| Crew LCFs from 10-year Proposed Action period | 0.009 | 0.01 | 0.019 |
| Accident fatalities (nonrad) per year | $7\times10^{-4}$ | 0.001 | 0.0017 |
| Accident fatalities (nonrad) over 10-year Proposed Action period | $7\times10^{-3}$ | 0.01 | 0.017 |
| Maximum reasonably foreseeable accident probability per year | $9\times10^{-7}$ | $1\times10^{-6}$ | (b) |
| Maximum reasonably foreseeable accident cumulative probability over 10-year Proposed Action period | $9\times10^{-6}$ | $1\times10^{-5}$ | (b) |
| Maximum reasonably foreseeable accident consequences (LCFs) | 3 | 3 | (b) |
| Maximum reasonably foreseeable accident risk from 1 year of Proposed Action (LCF/year) | $4\times10^{-6}$ | $4\times10^{-6}$ | (b) |
| Maximum reasonably foreseeable accident cumulative risk from 10-year Proposed Action period (LCFs) | $4\times10^{-5}$ | $4\times10^{-5}$ | (b) |

LCF=latent cancer fatality; LLW=low-level radioactive waste; MLLW=mixed low-level radioactive waste.

a The projected crew shipment-miles are notably higher than the public shipment-miles because, for the majority of the waste shipments (those to/from PFNW), 24.8 of the 26 miles transported are on the Hanford Site and not accessible to the public.

b. The probabilities and consequences of maximum reasonably foreseeable accident scenarios involving different waste forms are not additive. Additionally, the potential risks of these scenarios represent the consequence times the probability of the scenario and are likewise not additive.

As mentioned above, the TC&WM EIS Alternative 2B did not include offsite transportation of waste; however, it did include onsite transportation of wastes, and the potential impacts of that transportation can be used to provide perspective of the relative increase expected under the Proposed Action. The estimated incident-free impacts presented in this SA reflect a potential health risk of about 0.019 LCFs to transportation crews over the 10-year Proposed Action period (as compared to 0.16 LCFs for onsite transportation presented in the TC&WM EIS) and about 0.021 LCFs to the public over the 10-year period (as compared to 0.044 LCFs for onsite transportation presented in the TC&WM EIS).

As discussed earlier in this section, this SA bases its "comparison-approach" methodology on impact results derived from previous analytical assumptions deployed in the WM PEIS. Maximum reasonably foreseeable accident risks are also comparable between the two impact assessments. Details regarding these assessments are provided in Appendix A. The fact that, ultimately, there may be small increases in some of the overall risks previously evaluated in the

TC&WM EIS for certain transportation situations and scenarios is essentially moot given that the magnitude of such risk deltas is extremely small (virtually zero LCFs), for both incident-free transport and accidents, over the Proposed Action period.

Section 3.3.3 of this SA discusses the comparison of intentional destructive acts related to onsite scenarios. From a transportation perspective, the potential consequences from an intentional destructive act on a shipment of LLW/MLLW would be expected to be similar to the consequences of the maximum reasonably foreseeable accident presented in Table 3-4. Additional details regarding the derivation of these consequences are discussed in Appendix A, Section A.3.

### 3.3.5 Waste Management

The TC&WM EIS evaluated management of the secondary wastes. As reported in Section 2.1 of this SA, the main differences evaluated in this SA are related to the transportation, treatment, and disposal of LLW and MLLW secondary wastes. The management approach for other potential secondary wastes (TRU, hazardous waste, nonradiological, nonhazardous waste) remains the same as was presented in the TC&WM EIS.

The TC&WM EIS projected the amount of solid LLW and MLLW generated during operations to be approximately 55,000 cubic meters. The current projections of solid LLW and MLLW that would be generated during DFLAW operations are approximately 77,000 cubic meters. Of this estimate, 26,000 cubic meters of the secondary waste in the NEPA data package (WRPS 2022a) is contaminated soils, which could require disposition during this time period. The TC&WM EIS included over 468,000 cubic meters of contaminated soils in the closure period (Table 4-86). Without accounting for the additional contaminated soils in the operations phase, the projected volume of solid secondary waste is consistent with that evaluated in the TC&WM EIS.

The TC&WM EIS did not anticipate offsite treatment of liquid LLW or MLLW because there were processes in place or planned to manage liquids such that they were either returned to the tanks or evaporated to powders and grouted onsite prior to disposal at the IDF. Under the Proposed Action, about 920 cubic meters of liquid LLW and MLLW would be treated annually at licensed and permitted commercial facilities that have the capability and capacity to perform this treatment. Once treated, these wastes would either be disposed of at the IDF or at the WCS FWF, a licensed and permitted commercial disposal facility.

The secondary waste stream that could be treated and disposed of at a licensed and permitted commercial disposal facility would consist primarily of EMF-concentrate. The estimated radioactivity contained in the Group 2 and Group 3 waste streams would be approximately 5,700 curies of all isotopes over the 10-year period (WRPS 2022a).[26]

The volume of treated secondary waste that could be disposed of at the commercial disposal facility would be about 5,800 cubic meters over the 10-year Proposed Action period. As reported in Section 2. 2.5 of this SA, the WCS FWF has volume and curie limits associated with its licenses for disposal of LLW. These secondary wastes would contribute only a fraction of the initial volume limit (2.5 percent) and activity limit (0.10 percent) of the WCS FWF. Considering

[26] The estimated total disposal volume and curies over the 10-year period are provided with two significant figures.

that all wastes would be verified to meet the facilities' waste acceptance criteria before leaving the Hanford Site, there would be no adverse impacts to waste management at WCS.

As reported in Section 2.1, DOE has previously decided to construct a single IDF and an RPPDF. The IDF has a capacity of 1.2 million cubic meters and the RPPDF has a capacity of 1.08 million cubic meters. According to Table 4-86 of the TC&WM EIS, the total waste destined for disposal at the IDF was 296,000 cubic meters. Another 469,000 cubic meters was planned for disposal in the RPPDF, which is primarily planned for contaminated soils during closure of the tank farms. Considering that the IDF was designed with excess capacity, the disposal of the currently planned LLW and MLLW waste volumes at the IDF would not cause any additional impacts to waste management beyond those identified in the TC&WM EIS.

# 4 CUMULATIVE IMPACTS

This chapter presents an analysis of the potential cumulative impacts resulting from the Proposed Action. CEQ regulations at 40 CFR 1508.1(g)(3) define cumulative impacts as "effects on the environment that result from the incremental effects of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time."

The TC&WM EIS presented the cumulative impacts analysis in Chapter 6, specifically identifying the past, present, and reasonably foreseeable future actions relative to that proposed action. This chapter evaluates the incremental impacts of implementing the Proposed Action to treat and potentially dispose of secondary waste in licensed and permitted commercial facilities and those evaluated in the TC&WM EIS. The chapter also evaluates if there are any new past, present, or reasonably foreseeable future actions that were not considered in the TC&WM EIS that could contribute to cumulative impacts with the incremental impacts of secondary waste management.

## 4.1 Incremental Impacts of Secondary Waste Management

As noted in Chapter 3 of this SA, the implementation of DOE's Proposed Action has the potential for impacts to air quality, occupational and public health and safety (normal operations, facility accidents, and transportation), and waste management.

## 4.2 Evaluation of New Past, Present, and Reasonably Foreseeable Future Actions

As part of the analysis of cumulative impacts for this SA, DOE considered both the timing and the ROI for each environmental resource area that could be affected during the approximately 10-year Proposed Action period. Reasonably foreseeable future actions that could occur during that time include the following:

- Implementation of the Test-Bed Initiative demonstration project to separate and pretreat approximately 2,000 gallons of supernate tank waste from Hanford waste tank SY-101 through in-tank settling, decanting, filtration, and ion exchange media. Following pretreatment, DOE would treat and stabilize the MLLW at a permitted and licensed commercial facility and then dispose of the immobilized waste form in an appropriately permitted and licensed commercial disposal facility.

  This demonstration would involve a single shipment of liquid MLLW to either PFNW, Perma-Fix DSSI, WCS, or Energy*Solutions* in Utah. The disposal of the treated wastes would occur at either WCS or Energy*Solutions*. The addition of one shipment of waste from the Test-Bed Initiative demonstration project would not substantially change the impacts presented in the SA because the number of shipments or the volume of combined number of shipments or volume of treated waste for disposal would not be notably different than the values presented in this SA.

# 5 DETERMINATION

DOE prepared this SA in accordance with 10 CFR 1021.314. The Proposed Action evaluated in the TC&WM EIS acknowledged that secondary waste could be managed through a combination of onsite and offsite treatment capabilities. The TC&WM EIS analyzed the disposal of grouted secondary waste at the IDF. DOE has been implementing a moderate amount of offsite treatment (an average of 73 to 145 cubic meters per year of dangerous waste and MLLW) and disposal since publication of the 2013 ROD. The increased volume of offsite treatment and disposal of LLW and MLLW under the Proposed Action evaluated in this SA would not represent a substantive change relevant to environmental concerns from the Proposed Action evaluated in the TC&WM EIS.

The TC&WM EIS evaluated potential environmental impacts from the emission of criteria pollutants, toxic pollutants, and carbon dioxide. The TC&WM EIS assumed that three onsite waste management facilities (Central Waste Complex, Waste Receiving and Processing, and T-plant) would be expanded because it was uncertain which facility would ultimately house the grouting capability. This analysis provided a conservative evaluation of potential impacts (e.g., land disturbance, air quality, waste management), since it is highly unlikely that all three facilities would be expanded for this function. The incremental increase in emissions related to the transportation of secondary waste for treatment and disposal would add less than 1 percent to the values presented in the TC&WM EIS.

Transportation of secondary waste offsite for treatment (and potential subsequent disposal), as opposed to the onsite treatment options evaluated in the TC&WM EIS, would essentially transfer the potential normal operational health impacts from the Hanford workforce to workers at commercial treatment and disposal facilities, given that the scopes of work would be similar in nature regardless of location. Additionally, the Proposed Action would not introduce any unique facility accidents that had not been evaluated either in the TC&WM EIS or in the commercial facility permitting or licensing process. Accordingly, radiological impacts and accident risk resulting from the Proposed Action would be comparable to that presented in the TC&WM EIS for treatment/disposal activities originally proposed for the Hanford Site.

While the TC&WM EIS did not anticipate a large increase in the amount of secondary waste sent offsite for treatment and potential disposal, it did acknowledge that it could occur. The estimated health risks to the public and transportation crews are low (0.021 and 0.019 LCFs, respectively) for the approximate 10-year Proposed Action period.

The majority of the treated secondary waste would be disposed of at the IDF, consistent with the analysis in the TC&WM EIS. Approximately 580 cubic meters of treated Group 2 and Group 3 secondary wastes could be disposed of annually at the WCS FWF. In both instances, the stabilized waste form would be verified to meet the facilities' waste acceptance criteria and would be well within the volume and curie limits for the facilities.

Based on the analysis in this SA, DOE's Proposed Action for secondary waste management does not represent a substantial change to the proposal evaluated in the TC&WM EIS or significant new circumstances or information relevant to environmental concerns that would require preparation of a supplemental EIS. DOE has therefore determined that no further NEPA analysis is required.

Approved: January 25, 2023

William I. White, Senior Advisor for Environmental Management

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# Appendix A: Updated Secondary Waste Inventory

## CONTENTS



## LIST OF TABLES

## A.1 DFLAW Operational Changes from the TC&WM EIS

Since preparation of the TC&WM EIS, DOE has developed a sequenced approach to begin treating waste from the Hanford Site waste tanks as soon as practicable. This approach involves operating DFLAW to treat LAW prior to full operation of WTP. As a result, the projected inventory of secondary waste and its proposed treatment and disposal methods have changed.

One of the changes in processing waste is related to the treatment of acetonitrile. Acetonitrile, a RCRA-listed hazardous material, is generated during the vitrification process. In the DFLAW configuration, the acetonitrile is not mixed with as many waste streams as it is in the baseline configuration (full operation of WTP). As a result, the acetonitrile concentrations in the secondary waste streams are expected to be slightly higher in DFLAW operations than the waste streams analyzed in the TC&WM EIS. Under the Proposed Action, the acetonitrile waste stream would be included in the liquid MLLW proposed for offsite treatment at PFNW and disposal at the IDF (identified below as Group 1). Under the baseline configuration, liquid secondary wastes containing acetonitrile are designed to be sent to the onsite ETF, where a steam stripper will be used to remove the acetonitrile. ETF is one of the four liquid-waste processing facilities on the Hanford Site. The ETF facility is designed to reduce the concentration of contaminants, including ammonia, residual organics, and dissolved radionuclides, to levels that allow for direct disposal of the treated liquid effluent to the SALDS. The liquid processing facilities are designed to accept and treat regulated effluent discharges prior to disposal. At ETF, the treated effluent from the facilities' primary treatment train is designed to be contained in verification tanks where the effluent will be sampled to confirm that the effluent meets the delisting criteria. Under 40 CFR Part 261, incorporated by reference by Washington Administrative Code Chapter 173-303-910(3), the treated effluent from the 200 Area ETF is considered a delisted waste; that is, the treated effluent is no longer a listed dangerous waste subject to the hazardous waste management requirements of RCRA, provided that the delisting criteria are satisfied and the treated effluent does not exhibit a dangerous characteristic. The treated effluent is discharged under Discharge Permit Number ST0004500 as non-dangerous. A portion of the treated wastewater from the ETF Facilities Verification Tanks is recycled as service water throughout the facility. For example, the treated wastewater is used to dilute bulk acid and caustic to meet processing needs, thereby reducing the demand for process water. When using the steam stripper, the primary treatment train would generate a secondary waste stream of acetonitrile distillate (i.e., ETF steam stripper concentrate, which would be liquid MLLW). The acetonitrile distillate would not meet delisting criteria and would not be discharged to SALDS. The acetonitrile distillate would be sent to the onsite acetonitrile distillate storage tanks or containerized in the Acetonitrile Distillate Load-out Facility and stored in the acetonitrile tote storage area until it could be sent offsite for treatment.

The second operational change is related to expansion of the facilities at ETF to include onsite grouting capability to treat ETF liquid waste. As identified in Section 2.1 of this SA, the TC&WM EIS assumed that liquid MLLW would be grouted onsite. Additionally, Appendix E, Section E.1.2.3.3.4, of the TC&WM discussed the potential ETF enhancements, which could include a solidification (or grouting) facility. As identified in Part A of the DOE permit application to Ecology for the LERF/ETF, DOE anticipated consolidating all grouting capability at a single location (i.e., ETF).

The LERF/ETF permit application included initial information on modular grout capability with the capacity to expand for full WTP operations; however, as identified in Section 1.2 of this SA, the ETF solidification capability was determined to be a capital project and is not anticipated to be implemented at the Hanford Site for approximately 10 years.

Another change is associated with the EMF evaporator bottoms (or concentrate). Section E.1.2.3.1.7 of the TC&WM EIS, "Waste Treatment Plant Assumptions and Uncertainties," describes the important consideration related to the performance of the vitrified low-activity waste (VLAW) process. With the high temperatures associated with the VLAW process, volatilization of select radionuclides and the offgases captured in secondary waste streams are uncertain. Table E-6 in the TC&WM EIS describes the portioning factors assumed in the tank closure alternatives. The behavior of certain constituents (fluorides and some radionuclides) in the thermal processes and the fractions that would be captured in the final waste form are dependent on residence time in the glass as well as other constituents in the waste. The baseline operations under DFLAW include transferring the EMF evaporator bottoms back to the front end of the LAW Vitrification Facility. At some point, depending on the potential build-up of some radionuclide and chemical constituent concentrations in the LAW and the EMF evaporator bottoms, these constituents could start to concentrate in the recycle stream to the LAW melter and impact glass chemistry. To mitigate this issue, the EMF evaporator bottoms could periodically need to be purged and discarded as waste. This SA assumes that this could be required and therefore analyzes periodic shipments of EMF evaporator bottoms for offsite treatment and disposal as secondary waste (Group 3). Although the current tank farms' operating baseline is to recycle the EMF evaporator bottoms back to the LAW Vitrification Facility, it is recognized that selectively, periodically purging some of the evaporator bottoms provides operational benefits. For the purposes of this SA analysis, a conservative 40-percent purge rate was selected and the associated volume was analyzed (WRPS 2020).

## A.2 Secondary Waste Data Package

WRPS prepared a list of secondary waste streams proposed for offsite treatment under the Proposed Action since the onsite grout facility would not be available in time to support DFLAW start up (WRPS 2022).

The NEPA data package organized the potential wastes by their proposed treatment and disposal locations. The potential treatment locations are:

- onsite
- PFNW
- Perma-Fix DSSI in Kingston, Tennessee, and
- WCS in Andrews County, Texas.

The potential disposal locations are:

- Onsite at the IDF and

- WCS FWF.

This SA evaluates the groups of secondary waste based on the various combinations of potential treatment and disposal locations. The NEPA data package identified the following groups:

1. LLW and MLLW treated at PFNW and disposed of onsite at the IDF (Group1);
2. MLLW treated at Perma-Fix DSSI and disposed of at the WCS FWF (Group 2);
3. MLLW treated at PFNW (and disposed of onsite at the IDF) (Group 3a), or treated and disposed of at WCS, a licensed and permitted commercial treatment and disposal facility (Group 3b); and
4. MLLW treated onsite and disposed of onsite at the IDF.

As identified in Section 2.2.1 of this SA, the fourth waste stream includes MLLW that consists of VLAW and debris such as the spent LAW melters and other WTP components contaminated with LAW or VLAW. Because this group of secondary waste is being managed (treatment onsite and disposal onsite) in the same manner as presented in the TC&WM EIS, it is not evaluated further in this SA.

Group 1 includes solid and liquid LLW and solid and liquid MLLW. These secondary waste streams are planned for treatment at PFNW and onsite disposal at the IDF. Some examples of the primary contributors to this group include radioactive debris from tank farm operations, radioactive brines, steam stripper concentrate (acetonitrile), and possibly carbon-bed adsorbers (which is also evaluated for treatment at DSSI in Group 2). This group also includes roughly 2,600 cubic meters per year of contaminated soils.

Group 2 includes waste streams that require treatment with a capability that DOE does not have at the Hanford Site but exists commercially. In the 1997 WM PEIS, DOE recognized there were commercial MLLW treatment methods available and that it would be advantageous for DOE to use these methods and locations rather than develop the same treatment capability for a DOE site. Some of these secondary waste streams currently generated as part of tank farm and 222-S laboratory operations have been and currently are shipped to a commercial treatment facility. The carbon-bed adsorbers would be secondary waste streams generated as part of DFLAW operations under this group. This SA proposes that they would be disposed of at the WCS FWF.

Group 3 includes waste streams that could be treated at PFNW or treated and disposed of at WCS, a licensed and permitted commercial treatment and disposal facility. If the wastes are treated at PFNW, they would be returned to Hanford to be disposed of at the IDF. If the wastes are treated at WCS, they would be disposed of at the WCS FWF. DFLAW-generated waste in this group includes WTP LAW Vitrification Facility offgas system HEPA filters[27] and EMF evaporator concentrate (bottoms).

[27] The LAW Vitrification Facility HEPA filters are considered under Group 1 and Group 3 and their disposal would primarily depend on the technetium-99 levels on the filters and whether they would meet the IDF waste acceptance

Tables A-1–A-3 summarize the waste streams and average annual generation rates for Groups 1, 2, and 3 waste streams, respectively. These values reflect average annual generation rates over an approximate 10-year Proposed Action period.

**Table A-1 Average Annual Generation Rates of Group 1 Waste Streams**

| Waste Stream | Annual Average (cubic meters) |
|---|---|
| **Solid** | |
| LLW debris | 5,700 |
| MLLW debris | 2,000 |
| MLLW non-debris | 14 |
| **Total Solid** | **7,700** |
| **Liquid** | |
| LLW liquid | 8 |
| MLLW liquid | 380 |
| MLLW brine | 100 |
| Steam stripper concentrate | 100 |
| **Total Liquid** | **590** |

LLW=low-level radioactive waste; MLLW=mixed low-level radioactive waste
Note: Values presented with two significant figures. Totals may vary due to rounding.
Source: WRPS 2022

**Table A-2 Average Annual Generation Rates of Group 2 Waste Streams**

| Waste Stream | Annual Average (cubic meters) |
|---|---|
| **Solid** | |
| MLLW non-debris[a] | 15 |
| **Total Solid** | **15** |
| **Liquid** | |
| MLLW liquid[b] | 3 |
| **Total Liquid** | **3** |

HEPA=high-efficiency particulate air; LAW=low-activity waste; MLLW=mixed low-level radioactive waste
a Includes carbon-bed adsorbers from LAW Vitrification Facility offgas system, and Eichrom resin from LAB operations.
b Includes spent chemical laboratory reagents.
Source: WRPS 2022

**Table A-3 Average Annual Generation Rates of Group 3 Waste Streams**

| Waste Stream | Annual Average (cubic meters) |
|---|---|
| **Solid** | |
| MLLW non-debris[a] | 5.6 |
| **Total Solid** | **5.6** |
| **Liquid** | |
| MLLW liquid[b] | 326 |

criteria. Once generated, HEPA filters would be characterized. If these filters meet the IDF waste acceptance criteria limits, including limits for technetium-99, then the filters would be treated at PFNW and returned for disposal at IDF per Group 3a. If these filters exceed the IDF waste acceptance criteria limit for technetium-99, then they would be treated and disposed of offsite at WCS per Group 3b. The IDF waste acceptance criteria limit for technetium-99 is 1.47 curies per cubic meter, which is lower than the 10 CFR 61.55 Class C concentration limit for technetium-99 of 3 curies per cubic meter.

| | |
|---|---|
| **Total Liquid** | **326** |

EMF=Effluent Management Facility; HEPA=high-efficiency particulate air; LAW=low-activity waste; MLLW=mixed low-level radioactive waste
a LAW Vitrification Facility offgas system HEPA filters
b EMF-concentrate (bottoms).
Note: Values presented with two significant figures. Totals may vary due to rounding.
Source: WRPS 2022

## A.3 Estimated Shipments of Projected Secondary Waste Inventory

As identified in Section 3.3.4 of this SA, the TC&WM EIS did not specifically analyze transportation of secondary waste to offsite treatment or disposal facilities. This SA assesses the potential incident-free and accident risks associated with transportation of these wastes.

Solid and liquid secondary LLW/MLLW containers to be shipped offsite for treatment and stabilization are expected to present low levels of radiation exposure to the public and truck crews. The radiological dose rates would be below the limiting provisions specified per 49 CFR 173.441 regarding transport-indexes and exclusive-use shipments. For incident-free transportation, the potential radiological exposure of truck crews and the public would be directly related to the external dose rates associated with the LLW/MLLW packages.

Under the Proposed Action, the secondary LLW/MLLW packages would be transported exclusively by truck (i.e., no rail or air). No matter what distance is to be traveled, shipments would be expected to use the most direct route(s) that minimize radiological risk. Shipments leaving the immediate Richland area for out-of-state destinations (e.g., Tennessee, Texas) would be transported over federal highways for the majority of their routes.

As stated in Section 3.3.4, DOE actions for which only minimal radiological impacts would be expected from the transportation of certain radioactive materials (e.g., LLW, MLLW), do not require new modeling to assess potential impacts of a particular action. Instead, DOE and CEQ endorse the approach of a simplified analysis (with appropriately conservative inputs) to identify an upper bound on potential impacts. This "bounding" analysis would show whether potential impacts would warrant further analysis. Accordingly, the impact assessment for radiological transportation human health in this SA followed this approach.

This SA used a Microsoft Excel spreadsheet screening tool based on the data extracted from the WM PEIS (inclusive of the updated dose-to-LCF risk factor [$6x10^{-4}$ LCFs per person-rem] discussed in Section 3.3.4), including normalized public and crew dose data per mile traveled for various waste forms. These data were directly applied to the number of estimated miles to be traveled per waste form (for the Proposed Action) to attain conservative radiological health risk estimates (in terms of LCFs) for both the public and truck crews. The associated results from this screening assessment are presented in Table A-4, which provides both annualized and total LCF estimates resulting from the Proposed Action's estimated 10-year period to the public and crews for incident-free transport, as well as projected public LCF consequences from a maximum reasonably foreseeable transportation accident.

## Table A-4 Estimated Radiological Impacts to the Public and Truck Crews for Offsite Secondary Waste Transportation

| *Analytical Parameter* | **Untreated + Treated LLW** | **Untreated + Treated MLLW** | **Total** |
|---|---|---|---|
| Total miles/year (public) | 1,870 | 49,200 | 51,070 |
| Total miles over 10-year Proposed Action period (public) | 18,700 | 492,000 | 510,700 |
| Total miles/year (crews) | 40,400 | 63,400 | 103,800 |
| Total miles over 10-year Proposed Action period (crews) | 404,000 | 634,000 | 1,038,000 |
| Total shipments/year | 1,555 | 601-645[a] | 2,156-2,200 |
| Total shipments over 10-year Proposed Action period | 15,550 | 6,010-6,450 | 21,560-22,000 |
| Public LCFs from 1 year of shipping | $6\times10^{-5}$ | 0.002 | 0.0021 |
| Public LCFs from 10 years of shipping | $6\times10^{-4}$ | 0.02 | 0.021 |
| Crew LCFs from 1 year of shipping | $9\times10^{-4}$ | 0.001 | 0.0019 |
| Crew LCFs from 10 years of shipping | 0.009 | 0.01 | 0.019 |
| Accident fatalities (nonrad) per year | $7\times10^{-4}$ | 0.001 | 0.0017 |
| Accident fatalities (nonrad) over 10-year Proposed Action period | $7\times10^{-3}$ | 0.01 | 0.017 |
| Maximum reasonably foreseeable accident probability per year | $9\times10^{-7}$ | $1\times10^{-6}$ | (b) |
| Maximum reasonably foreseeable accident cumulative probability over 10-year Proposed Action period | $9\times10^{-6}$ | $1\times10^{-5}$ | (b) |
| Maximum reasonably foreseeable accident consequences (LCFs) | 3 | 3 | (b) |
| Maximum reasonably foreseeable accident risk from 1 year of Proposed Action (LCF/year) | $4\times10^{-6}$ | $4\times10^{-6}$ | (b) |
| Maximum reasonably foreseeable accident cumulative risk from 10-year Proposed Action period (LCFs) | $4\times10^{-5}$ | $4\times10^{-5}$ | (b) |

LCF=latent cancer fatality; LLW=low-level radioactive waste; MLLW=mixed low-level radioactive waste.

a. The range in number of annual shipments is because no additional shipments are required between the treatment facility and the disposal location for Group 3b; they would both occur at the same licensed and permitted commercial facility. In the case of the Group 3a option, however, 44 additional shipments per year would be required for transporting treated waste back to the IDF from PFNW for disposal.

b. The probabilities and consequences of maximum reasonably foreseeable accident scenarios involving different waste forms are not additive. Additionally, the potential risks of these scenarios represent the consequence times the probability of the scenario and are likewise not additive.

The two key input parameters for the screening tool include the number of shipments *per waste form* and total number of miles traveled *per waste form* (see Table A-7 below). To develop these parameters, DOE applied the following assumptions:

- All untreated solid and liquid waste shipments are assumed to occur in USDOT-certified 55-gallon drums (or equivalency in boxes), except for EMF-concentrate and other Group 3 liquid wastes, which would be shipped in supertainers. An empty 55-gallon drum weighs approximately 50 pounds, and an empty 350-gallon supertainer weighs approximately 500 pounds. This assumption does not limit the size of the USDOT-certified container that could be used during implementation; it is an analytical construct to maximize (i.e., bound) numbers of potential shipments.

- Maximum weight capacity of waste cargo per shipment would be 34,000 pounds (for solid or liquid wastes) per the USDOT cargo limit for a tandem-axle trailer. The TC&WM EIS used a maximum payload weight limit of 44,000 pounds (DOE 2012, Section H.4.2). The lower value used in this SA would tend to maximize the estimated number of shipments used in the analysis and bound potential impacts.

- Estimated bulk density of untreated liquid wastes = 1 gram per cubic centimeter ($g/cm^3$) (water analog); EMF-concentrates are assumed to have a bulk density of 1.09 $g/cm^3$ (PNNL 2018).

- Estimated bulk density of untreated solid wastes = 2 $g/cm^3$ (dense-soil analog: includes personal protective equipment and metallic components with considerable void-space).

- Solid vs. liquid waste volume estimates extracted from WRPS (2022; Table 6-1).

- Standard semi-truck trailer dimensions = 53 feet by 8.5 feet by 13.5 feet (length × width × height; cargo height typically does not exceed 9 feet). Assumes that no waste drums/boxes would be stacked atop one another under any circumstances.

- Estimated filled weight of a 55-gallon drum (or box-equivalent) with solid waste = 968 pounds (maximum safe-weight capacity assumed = 1,000 pounds).

- Estimated filled weight of a 55-gallon drum (or box-equivalent) with liquid waste = 509 pounds.

- Solids would only ship with solids, and liquids would only ship with liquids. There would be no mixing of waste-phases on any given shipment.

- A typical USDOT-certified 55-gallon drum measures 34 inches by 23 inches (height × diameter). A typical 350-gallon supertainer measures 42 inches by 48 inches by 47 inches (length × width × height).

- A 34,000-pound cargo limit per shipment would result in a limit of 35 drums for a single solid-waste shipment, 66 drums for a single liquid-waste shipment, or 9 supertainers for an EMF-concentrate or other Group 3 liquid shipment.

- For conservatism and normalization, *all* waste is assumed to be in solid form (2 g/cm$^3$) after treatment. It is moreover conservatively assumed that compaction, solidification/grouting of liquids, and other dynamic processes would not substantively change (i.e., decrease) the overall volume of waste to be transferred to disposition locations.

- The analysis assumes that the candidate offsite treatment locations would consistently keep in "throughput-step" with Hanford's delivery schedule/rate. Such an assumption is necessary to support the "maximum possible number of annual shipments" approach in this SA.

Tables A-5 and A-6 repeat waste volume and shipping information (by waste stream group) from Table 2-1 in Chapter 2 of this SA. The subject quantities provided in these tables were integrated into the catalog of assumptions stated above (as appropriate) to develop estimated shipment numbers (Table A-7).

### Table A-5 Projected Annual Average Volumes of Secondary Waste under the Proposed Action

| Waste Stream Group[a] | Treatment Location | Disposal Location | Annual Average (cubic meters)[b] |
|---|---|---|---|
| 1 | PFNW | IDF | 8,300 |
| 2 | DSSI | WCS FWF | 18 |
| 3a | PFNW | IDF | 332[c] |
| 3b | WCS | WCS FWF | 332[c] |

PFNW=Perma-Fix Northwest; DSSI=Perma-Fix Diversified Scientific Services, Inc.; IDF=Integrated Disposal Facility; WCS=Waste Control Specialists; FWF=Federal Waste Facility

a Waste stream groups are analytical constructs. They represent groups of waste that have common proposed treatment and disposal locations.

b WRPS (2022) provides secondary waste volume projections on an annual basis for 10 years. This SA normalizes these values to use an annual average. Values presented with two significant digits.

c The estimates for Group 3 are not meant to be additive. If DOE shipped the waste to PFNW for treatment, the treated waste would be returned to the Hanford IDF for disposal. If DOE shipped the waste to DSSI or WCS for treatment, the treated waste would be disposed of at the WCS FWF.

### Table A-6 Projected Annual Average Number of Shipments of Secondary Waste by Destination and Form

| Waste Stream Group[a] and Type | Originating Location | Destination Location | Driving Distance (miles) | Annual Average Number of Shipments |
|---|---|---|---|---|
| **Group 1** | | | | |
| 1 (solids) | Hanford | PFNW (treatment) | 26[b] | 1,005 |
| 1 (liquids) | Hanford | PFNW (treatment) | 26[b] | 39 |
| 1 (solids & solidified liquids) | PFNW | IDF (disposal)[c] | 26[b] | 1,082 |
| **Group 2** | | | | |
| 2 (solids) | Hanford | DSSI (treatment) | 2,370 | 2 |

| Waste Stream Group[a] and Type | Originating Location | Destination Location | Driving Distance (miles) | Annual Average Number of Shipments |
|---|---|---|---|---|
| 2 (liquids) | Hanford | DSSI (treatment) | 2,370 | 1 |
| 2 (solids & solidified liquids) | DSSI | WCS FWF (disposal) | 1,200 | 3 |
| **Group 3** | | | | |
| 3a (liquids) | Hanford | PFNW (treatment) | 26[b] | 24 |
| 3a (solidified liquids) | PFNW | IDF (disposal)[c] | 26[b] | 44 |
| 3b (liquids)[d] | Hanford | WCS (treatment & disposal)[c] | 1,580 | 24 |

DSSI=Perma-Fix Diversified Scientific Services, Inc.; FWF=Federal Waste Facility; IDF=Integrated Disposal Facility; PFNW=Perma-Fix Northwest; WCS=Waste Control Specialists

a Waste stream groups are analytical constructs. They represent groups of waste that have common proposed treatment and disposal locations.

b Virtually all Hanford onsite transport, as only 1.2 miles of the route is along offsite roads.

c Transport of the solidified liquids would require additional shipments to account for the increased volume associated with the grout.

d Maximum transportation impact case to both the public and truck crews for waste stream Group 3. In Group 3, the LAW melter offgas HEPA filters would be expected to be treated at PFNW and disposed of at IDF or treated and disposed of at WCS. The EMF evaporator concentrate, also in Group 3, would be expected to be treated and disposed of at WCS. However, the maximum transportation impacts would occur if the full inventory in Group 3 was transported to WCS for treatment/disposal.

**Note:** PFNW and IDF are located in Richland, WA; DSSI is located in Kingston, TN; WCS FWF is located in Andrews County, TX. To conservatively derive bounding estimates of potential shipments between locations, all pretreatment and post-treatment waste (regardless of form) is assumed to be transported in USDOT-certified 55-gallon drums, the only exception being the liquid wastes/EMF-concentrate under Group 3, which are assumed to be transported in 350-gallon "supertainers." Payload/cargo weight per shipment is bounded at the USDOT limit of 34,000 pounds for a tandem-axle trailer.

### Table A-7 Estimated Numbers of Total Shipments and Total Miles Traveled per Waste Type

| Waste Stream Type | Receptor | Frequency | Total Number of Shipments | Total Driving Distance (miles) |
|---|---|---|---|---|
| LLW | Public | Annual / 10 years | 1,555 / 15,550 | 1,870 / 18,700 |
| LLW | Crew | Annual / 10 years | 1,555 / 15,550 | 40,400 / 404,000 |
| MLLW | Public | Annual / 10 years | 601 / 6,010[a] | 49,200 / 492,000 |
| MLLW | Crew | Annual / 10 years | 601 / 6,010[a] | 63,400 / 634,000 |

a The 601-shipment case assumes all Group 3 wastes are transported to WCS for treatment and disposal. Exclusively assuming the WCS FWF shipment case results in the maximum number of potential miles being driven (i.e., largest cumulative driving distance) under the Proposed Action for Waste Stream Group 3 MLLWs and, accordingly, the largest cumulative dose(s) to both the public and truck crews.

The proposed transport of approximately 2,200 shipments per year (bounding dose case) would result in an estimated 0.0021 LCFs to the public and 0.0019 LCFs to crews from incident-free transportation. For an estimated 10-year duration of such shipping activities, both values would increase by a factor of 10 (0.021 LCFs and 0.019 LCFs, respectively). The number of nonradiological fatalities due to these shipments over the 10-year Proposed Action period is estimated at 0.017. The screening tool estimated that the cumulative (lifetime) radiological risk from a severe transportation accident occurring during the SA's Proposed Action (i.e., the entire estimated 10-year offsite transportation duration) would be on the order of $4\times10^{-5}$ LCFs.

The severe accident considered in the consequence assessment was characterized by extreme mechanical (impact) and thermal (fire) forces. The accident is empirically representative of any low-probability, high-consequence event that could potentially lead to the release of a partial (or even possibly entire) Hanford-based LLW/MLLW cargo shipment to the environment while in transit. Therefore, accidents of this severity are expected to be extremely rare. However, the overall probability that such an accident could occur depends on the potential accident rates for such a severe accident and the shipping distance for each case. This analysis takes both of these factors into account.

The WM PEIS transportation risk assessment, from which this SA's results were scaled, emphasizes the importance of distinguishing between the fraction of released material that can be entrained in an aerosol (part of an airborne contaminant plume) and the fraction of the aerosolized material that is actually respirable (of a size that can be inhaled into the lungs). These fractions depend on the physical form of the material. Compared to solid materials, liquid materials are relatively easy to release if the container is breached in an accident. Once released, liquid waste could become aerosolized and dispersed downwind. Generally, aerosolized liquids are readily respirable (i.e., the respirable fraction is equal to unity [1]) (DOE 1997).

The scaling analysis used in this SA was modified to remove a highly conservative assumption used in the WM PEIS that is not applicable to the Hanford secondary waste stream evaluated in this SA. As noted in the WM PEIS (DOE 1997, Appendix E, pp. E-70 and E-71), the consequences of a severe accident involving LLW reflected the bounding waste stream from the (former) Argonne National Laboratory West (ANL-W), which included a significant quantity of cobalt-60 within its LLW shipment inventory. The WM PEIS states, "The accident consequence results from ANL-W should be considered extremely conservative for most LLW shipments … The accident dose results from ANL-W are at least a factor of 10 greater than those from LLW from other sites, primarily because of the Cobalt-60 content of the ANL-W waste." The Hanford secondary LLW and MLLW shipments are expected to have a minute fraction of the cobalt-60 quantities (as well as significantly smaller quantities of other high-dose-profile nuclides) assumed in the WM PEIS. Therefore, the MLLW severe accident consequence presented in this SA (derived from the MLLW severe accident consequence in the WM PEIS) is better representative of the potential consequence of a severe accident involving LLW.

The estimated resulting population impacts include the population within 50 miles of the accident site and potentially consider all of the following exposure pathways:

- External exposure to the passing radioactive cloud (plume),
- External exposure to contaminated ground,
- Internal exposure from inhalation of airborne contaminants, and
- Internal exposure from the ingestion of contaminated food.

Although remedial activities after such an event (e.g., evacuation or ground cleanup) would reduce the overall consequences to the public, as a conservative measure, these activities were generally not assumed to occur (DOE 1997).

Finally, with regard to the topic of intentional destructive acts (see Section 3.3.4), DOE estimates that the potential consequences from such an assault on a shipment of Hanford secondary

LLW/MLLW would be expected to be bounded by the consequences of the maximally reasonably foreseeable accident (i.e., "severe accident") presented in Table A-4 above (approximately 3 LCFs). This is due to the notion that a severe accident entails, by definition, the most extreme (yet plausible) mechanical (impact) and thermal (fire) forces (including from a truck-fuel-based explosion) being placed upon a subject container due to a roadway accident event. The prospect of a conventional, detonation-based intentional destructive act attack involving a considerable amount of trinitrotoluene (i.e., TNT) equivalent would not be expected to exceed the substantial mechanical and thermal forces that would result from a maximum reasonably foreseeable accident event. As a result, any released plumes from an intentional destructive act would not be expected to achieve a greater degree of buoyancy, dispersibility, or ease-of-uptake by a maximally exposed receptor.

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