THE HANFORD SITE

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

Management of Pretreated Tank Waste from Tank AP-106

DOE/EIS-0391-SA-06

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ACRONYMS AND ABBREVIATIONS

200E	200 East Area
200W	200 West Area
AROD	amended Record of Decision
BOF	balance of facilities
BTU	British thermal units
CFR	*Code of Federal Regulations*
Ci	curie
CO	carbon monoxide
CO_2eq	carbon dioxide equivalent
Cs	cesium
CST	crystalline silicotitanate
DFHLW	direct-feed high-level waste
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	U. S. Environmental Protection Agency
ETF	Effluent Treatment Facility
EIS	environmental impact statement
FMCSA	Federal Motor Carrier Safety Administration
FONSI	finding of no significant impact
FR	*Federal Register*
FRA	Federal Railroad Administration
FWF	WCS Federal Waste Facility
GHG	greenhouse gas
H2C	Hanford Tank Waste Operations and Closure
HFFACO	Hanford Federal Facility Agreement and Consent Order (*see* TPA)
HIHTL	hose-in-hose transfer line
HLW	high-level radioactive waste
IDF	Integrated Disposal Facility
IHLW	immobilized high-level radioactive waste
IX	ion exchange
IXC	ion exchange column
LAB	analytical laboratory
LAW	low-activity waste
LCF	latent cancer fatality
LLW	low-level radioactive waste
LSA	low specific activity
MCS	material conveyance system
MLLW	mixed low-level radioactive waste
mrem	millirem
MT	metric ton
NEPA	*National Environmental Policy Act of 1969*
NRC	U.S. Nuclear Regulatory Commission

PFNW	Perma-Fix Northwest
RCRA	*Resource Conservation and Recovery Act of 1976*
ROD	Record of Decision
ROI	region of influence
SA	supplement analysis
Sr	strontium
SST	single-shell waste storage tank
START	*Stakeholder Tool for Assessing Radioactive Transportation*
TBI EA	*Final Test Bed Initiative Demonstration Environmental Assessment*
TC&WM EIS	*Tank Closure and Waste Management Environmental Impact Statement for the Hanford Site, Richland, Washington*
TCEQ	Texas Commission on Environmental Quality
TPA	Tri-Party Agreement
TRU	transuranic
TSCR	Tank-Side Cesium Removal
TSD	treatment, storage, and disposal
UDEQ	Utah Department of Environmental Quality
USDOT	U.S. Department of Transportation
WCS	Waste Control Specialists LLC
WDOH	Washington State Department of Health
WM PEIS	*Waste Management Programmatic Environmental Impact Statement*
WRF	waste receiver facility
WRPS	Washington River Protection Solutions LLC
WTP	Waste Treatment and Immobilization Plant

1 INTRODUCTION

1.1 Background

The Hanford Site in southeastern Washington state stores approximately 56 million gallons of mixed chemical and radioactive waste in underground tanks—the result of more than four decades of plutonium production (1944 through 1987). The U.S. Department of Energy (DOE) is responsible for the retrieval, treatment, and disposal of this waste in a safe, efficient manner, reducing the threat posed to the Columbia River by Hanford's hazardous, radioactive tank waste (DOE 2023a).

In December 2012, 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 (SSTs) at the Hanford Site. DOE issued the first in a series of Records of Decision (RODs) for the TC&WM EIS on December 13, 2013 (Volume 78 of the *Federal Register*, page 75913 [78 FR 75913]). For the tank closure portion of the alternatives, which encompasses operations of the tank farms and Waste Treatment and Immobilization Plant (WTP), DOE selected Tank Closure Alternative 2B,[2] 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 and construct immobilized HLW (IHLW) interim storage modules to store the IHLW prior to disposal.

DOE prepared this *Supplement Analysis of the Final Tank Closure and Waste Management Environmental Impact Statement for the Hanford Site* (AP-106 Tank Waste Management SA or "SA") in accordance with DOE's *National Environmental Policy Act* (NEPA) Implementing Procedures[3] to assess the Proposed Action of managing the volume of pretreated tank waste (e.g., currently stored in AP-106) in 200 East Area (200E). The proposal includes transportation, treatment, and disposal of this tank waste at appropriately licensed and permitted commercial treatment, storage, and disposal (TSD) facilities (*see* Chapter 2 of this SA for a detailed description of the Proposed Action). Treatment could occur through a combination of onsite and offsite facilities. The Proposed Action would differ somewhat from the actions analyzed in the TC&WM EIS. This SA evaluates the impacts of the Proposed Action against the impacts presented in the TC&WM EIS (and previously prepared SAs on the TC&WM EIS) to determine if there are substantial changes to the proposal or significant new circumstances or information relevant to environmental concerns that would warrant further NEPA review. Based on this SA, DOE will determine whether the existing TC&WM EIS remains adequate, if a new environmental impact statement (EIS) is warranted, or if the existing EIS should be supplemented. The following paragraphs provide background information related to the Proposed Action in this SA.

[1] The TC&WM EIS analyzed 11 tank closure alternatives, 3 waste management alternatives, and 3 Fast Flux Test Facility decommissioning alternatives.
[2] 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 SA.
[3] On June 30, 2025, DOE published new NEPA Implementing Procedures. The latest version of the Implementing Procedures can be found at https://www.energy.gov/nepa/articles/doe-nepa-implementing-procedures-february-2026

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 included an analytical laboratory (LAB) and 22 other support facilities referred to collectively as the "balance of facilities" (BOF). When DOE issued the ROD in 2013, its plan was to start operation of all WTP facilities at the same time. Changes in operations since 2013 have been reviewed as necessary through previous supplement analyses (*see* Section 1.4).

The LAW Vitrification Facility, LAB, and BOF have been completed, and DOE began hot commissioning of the LAW Vitrification Facility in October 2025. To treat waste as soon as practicable, DOE is utilizing a multi-faceted approach to address LAW at Hanford including the usage of the direct-feed low-activity waste (DFLAW) program, which treats a portion of the tank waste first (*see* Section 1.4). Because the actions evaluated in this SA are directly related to the actions previously evaluated under DFLAW, the following text box is included to provide a description of that process.

Direct Feed Low-Activity Waste (DFLAW) Program

DFLAW separates and pretreats some of the tank waste from certain underground tanks at the Hanford Site and immobilizes (vitrifies[1] in a glass matrix) the pretreated LAW at the LAW Vitrification Facility.

DFLAW is a two-phased approach that separates and pretreats 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 includes in-tank settling; separation (removal by decanting) of the supernate (including dissolved saltcake and interstitial liquids); filtration; and cesium removal using ion exchange columns (IXC) in a tank-side cesium removal (TSCR) unit. For Phase 2, DOE will treat additional supernate (including dissolved saltcake and interstitial liquids) using the same processes. DOE considered using either an additional TSCR unit or constructing a filtration and cesium removal system. Phase 2 currently involves construction of a filtration and cesium removal system. Collectively, these two phases are generically referred to in this SA as "pretreatment capability."

Facilities and equipment necessary to implement the DFLAW include the Effluent Management Facility, the pretreatment capability, transfer lines, and storage pads for cesium IXCs.

[1] Vitrification is a process that uses extremely high temperatures to melt LAW and mix it with glass-forming materials. When cooled, the waste becomes locked within a stable, glass-like solid that prevents contaminants from leaching into the environment.

As additional background on waste tank operations at Hanford, the following bullets provide a broad overview of the operations in 200E that are relevant to the Proposed Action in this SA:

- A priority for DOE under the Hanford Federal Facility Agreement and Consent Order (HFFACO) and the Consent Decree is the retrieval of waste from SSTs.
- Waste (e.g., supernatant liquid, sludge) is retrieved from SSTs and transferred to double-shell tanks (DSTs).
- Under the current configuration for DFLAW, supernate is transferred to a DST in AP Tank Farm (i.e., AP-107) to provide feed material for the pretreatment capability to remove key radionuclides (primarily cesium-137 [Cs-137]).
- The liquid waste that exits the pretreatment capability is referred to as pretreated waste or LAW. This pretreated waste is currently staged in another DST (Tank AP-106) and a portion of this waste is sent to the LAW Vitrification Facility under DFLAW.

With DFLAW hot commissioning beginning in October 2025, DOE has begun to take feed from AP-106 and therefore increase the empty space available in the tank. As more empty space becomes available in AP-106, additional space opens up in other DSTs in AP Tank Farm and the single-shell tank retrieval process can continue.

A specific milestone in the HFFACO (M-045-15), "Completion of Tank A-103 SST Waste Retrieval Project," is scheduled for completion by September 30, 2028. Another milestone in the Consent Decree (B-2), "Complete Retrieval of Tank Wastes from the following SSTs in Tank Farms A and AX: A-101, A-102, A-106; AX-101, AX-102, AX-103, AX-104…," is scheduled for completion by May 1, 2028. Achievement of these milestones requires that AP-106 continue to have available space in the tank to allow continued retrievals and processing of supernate through TSCR. With the LAW Vitrification Facility beginning hot commissioning in October 2025, it is possible that the near-term throughput capacity for managing LAW (or pretreated waste) may not be adequate to allow DOE to ensure that it meets these milestones. Therefore, as a risk mitigation measure, DOE is proposing to send up to 600,000 gallons of pretreated LAW off site for commercial treatment and disposal within the next 12 months. This action would occur in parallel with operation of the LAW Vitrification Facility to reduce the risk of not achieving the milestone, as well as optimize operations of 200E and DFLAW. An additional benefit of the Proposed Action, which is proposed to continue for about 10 years, includes enhanced ability to achieve SST waste retrieval, thereby reducing potential risks to human health and environment. The ultimate volume of pretreated waste that could be sent off site would depend entirely on the efficiency and throughput capability of the LAW Vitrification Facility over the next year. After 2026, when the LAW Vitrification Facility and the pretreatment capability are expected to be fully operational, the volume of pretreated tank waste that could require offsite treatment and disposal could be as high as 1.2 million gallons per year.

Prior to preparation of this AP-106 Tank Waste Management SA, DOE recently published two SAs also related to waste tank operations: (1) a proposal referred to as Direct-Feed High-Level Waste (DFHLW), and (2) a proposal referred to as 200 West Area (200W) Tank Waste Treatment. The DFHLW proposal includes modifications to WTP BOF facilities and systems in 200E to allow HLW to temporarily bypass the WTP Pretreatment Facility and be sent directly to the HLW Vitrification Facility. DFHLW is related to the management and vitrification of HLW and is independent of activities associated with AP-106 tank waste management, which are focused on LAW. The 200W Tank Waste Treatment proposal included installation of pretreatment capabilities in 200W and the offsite transport, treatment, and disposal of pretreated tank waste from 200W. The 200W Tank Waste Treatment SA (SA-05) also evaluated the construction and operation of an onsite treatment facility to allow shipment of a solidified (i.e., grouted) waste form in lieu of shipping liquid, pretreated waste. The potential impacts of both proposals are discussed as part of the cumulative impacts analysis in this SA (*see* Section 4).

Prior to implementation of the disposal actions evaluated in this SA, DOE would determine, pursuant to its authorities under the *Atomic Energy Act of 1954, as amended*, that the pretreated tank waste from AP-106, after separation, pretreatment, and solidification, is not HLW and may be managed and disposed of as low-level radioactive waste (LLW) in accordance with DOE Manual 435.1-1, "Radioactive Waste Management Manual."

1.2 Proposed Action

Retrieving, treating, stabilizing, and safely disposing of mixed radioactive and chemical waste from underground tanks is a high priority for the tank waste mission at the Hanford Site as analyzed as part of the Tank Closure Alternatives in the TC&WM EIS (DOE 2012). A key aspect of implementing that mission is to process tank waste retrievals and manage the vitrification of pretreated LAW in 200E. The specific actions associated with the proposed management of 200E pretreated tank waste include:

- Load U.S. Department of Transportation (USDOT)-compliant transportation packages (e.g., up to 5,000-gallon liquid containers or tanker trucks) with LAW by:
    - Using an existing load-out valve configuration at the Effluent Management Facility (EMF) near the WTP, and possibly
    - Installing a temporary material conveyance system (MCS) near AP Tank Farm in 200E; and
- Ship these filled transportation packages (up to 600,000 gallons of LAW in 2026 and up to 1.2 million gallons of LAW annually thereafter) by truck or rail for appropriate treatment and disposal outside the state of Washington.

The loading (and management) of the transportation packages would require a staging/storage area (described in Section 2.2) to temporarily stage empty packages (and potentially store filled packages for a short time if using rail transportation).

As part of the Proposed Action, DOE could also use the onsite treatment facility evaluated in the 200W Tank Waste Treatment SA (SA-05) for solidification of the pretreated liquid waste prior to shipment of a then-solidified waste form to an appropriately licensed and permitted out-of-state disposal facility. DOE published an amended ROD based on SA-05 to announce the decision to construct and operate the onsite treatment facility (*see* Section 1.4).

The proposed schedule for this action is to begin in 2026 and last up to 10 years. Specific details about the Proposed Action are presented in Chapter 2 of this SA.

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 have not substantively changed since 2012. This purpose and need are to:

- 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 the Hanford Site. 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 post-retrieval residual waste in the 149 SSTs and 28 DSTs.
- Expand or upgrade existing waste TSD capacity at the Hanford Site to support ongoing and planned waste management activities for onsite waste.

The Proposed Action evaluated in this SA would facilitate management of the pretreated tank waste in 200E to allow continued retrieval of waste from SSTs in accordance with the agreement

reached in Holistic Negotiations among the DOE, State of Washington and the U.S. Environmental Protection Agency (EPA) (*see* text box).

HOLISTIC AGREEMENT

The Washington State Department of Ecology (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. In 2016, the court approved an Amended Consent Decree with modified milestones including completion of hot commissioning of the WTP LAW Vitrification Facility by December 31, 2023. Additional amendments to the Consent Decree were made in 2018 and 2020. In July 2022, the court extended numerous milestones, including extending the milestone for LAW hot commissioning to August 2025.

In May 2024, the DOE, Ecology, and EPA announced that an agreement had been reached under Holistic Negotiations, which began in 2020, that proposed a realistic and achievable course for continuing the tank waste retrieval and treatment mission through 2040. The new agreement includes three parts: (1) Settlement Agreement, (2) changes to the Consent Decree, and (3) changes to the Hanford Federal Facility Agreement and Consent Order (HFFACO, or Tri-Party Agreement [TPA]). More information about the highlights of the Holistic Negotiations can be found at https://www.hanford.gov/files.cfm/Public-Meetings_Presentation_Holistic-Agreement_FINAL-(006).pdf.

In December 2024, DOE issued the *Responsiveness Summary for proposed changes to the Tri-Party Agreement and consent decree on Hanford Site tank waste* (DOE, EPA, and Ecology 2024). This document is one of the final steps prior to finalizing the proposed changes. The authoring agencies reviewed and considered all comments received and discussed potential changes raised by the comments submitted.

The Consent Decree was amended by court order and the proposed changes to the TPA were finalized in January 2025.

1.4 NEPA Documents Relevant to the Proposed Action

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). The TC&WM EIS (DOE 2012) revised and updated the analyses of the 1996 document, 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 and TSD of tank wastes and closure of the SSTs. The TC&WM EIS 2013 ROD (78 FR 75913) announced that DOE intended to pursue Tank Closure Alternative 2B; it stated the following with respect 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 [Effluent Treatment Facility], 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."

One of the key differences between the Proposed Action evaluated in this SA and the decisions in the 2013 ROD is that the treated waste (where treatment includes solidification/grouting) is proposed to be disposed of in appropriately licensed and permitted commercial disposal facilities outside of Washington state, as opposed to disposal on the Hanford Site. This difference was also evaluated in the amended ROD (AROD) addressed below for the 200W Tank Waste Treatment SA (SA-05).

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

> "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." [4]

Under the DFLAW SA (SA-02), DOE planned and analyzed a phased approach to cesium removal from the 200E tank waste. Phase 1 included the single TSCR unit that is currently in operation. As discussed in the earlier text box, Phase 2 includes construction and use of a permanent filtration and cesium removal system. The full implementation of this pretreatment capability is the driver for the needed throughput for 200E tank waste management.

Amended ROD for Secondary Waste Management. Implementation of DFLAW 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. These wastes include secondary waste generated by, or derived from, the vitrification of LAW via DFLAW, as well as other secondary waste. In 2023, DOE prepared an SA to evaluate transportation and treatment of certain secondary waste at licensed and

[4] An ion exchange column (IXC) is a cylindrical vessel filled with ion exchange media that selectively removes or exchanges ions from a solution as it flows through. Inside the column, the media is charged with ions that can swap with undesirable ions in the solution, effectively purifying or altering its chemical composition. The process is widely used in waste treatment applications, allowing targeted removal of specific ions based on the media's charge properties. In the case of DFLAW and 200W alternative tank waste treatment, the IXCs use crystalline silicotitanate (CST) as the media.

permitted commercial treatment facilities that are located off the Hanford Site (DOE/EIS-391-SA-03; DOE 2023b). SA-03 also evaluated disposal of some of these secondary wastes (after treatment) off site at licensed and permitted commercial disposal facilities. DOE published an AROD to document that decision (88 FR 6241; January 31, 2023).

Per the 2023 AROD:

> "DOE prepared a supplement analysis (DOE/EIS-0391-SA-03; SA), which evaluated DOE's proposal to transport and treat certain solid and liquid secondary wastes at licensed and permitted commercial treatment facilities off the Hanford Site. DOE also proposes to potentially dispose of some of these secondary wastes (after treatment) offsite at a licensed and permitted commercial disposal facility. This action would be implemented on an interim basis until such time as an enhanced onsite treatment capability is available for Direct-Feed Low-Activity Waste (DFLAW) operations (estimated to be approximately 10 years)."

The AROD concluded:

> "Based on the analysis in the SA, DOE determined that the 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 therefore determined that no further NEPA analysis was required. There are no additional mitigation measures required beyond those commitments in the 2013 TC&WM EIS ROD. As stated in that ROD, all practicable means to avoid or minimize environmental harm have been adopted. DOE's decision is to transport and treat certain solid and liquid secondary wastes at licensed and permitted commercial treatment facilities off the Hanford Site. DOE's decision is also to dispose of some of these secondary wastes (after treatment) offsite at the WCS FWF [Federal Waste Facility], a licensed and permitted commercial disposal facility."

In a recent development, DOE is now planning offsite transportation, treatment, and disposal of a larger volume of EMF bottoms (up from an annual volume of about 86,000 gallons to 414,000 gallons). DOE prepared a NEPA Review Screening Form that illustrated that the larger projected volumes of EMF bottoms would not change the conclusions in SA-03 (DOE 2026a).

Amended ROD for DFHLW. On October 7, 2025, DOE issued an AROD for the TC&WM EIS for the implementation of the DFHLW program in 200E (DOE 2025a). The AROD was supported by the DFHLW SA (SA-04; DOE 2025b). As mentioned in Section 1.1, the DFHLW approach includes modifications to WTP BOF systems in 200E to allow HLW to temporarily bypass the WTP Pretreatment Facility and be sent directly to the HLW Vitrification Facility. The key elements that were evaluated in the DFHLW SA include installation of a Waste Transfer Vault; establishment of the operational capability to receive the immobilized HLW canisters from the WTP HLW Vitrification Facility and store them until a federal repository is available; addition of operational capability to reduce the liquid effluent returns from the HLW vitrification process, preserving DST space; and addition of 1 million gallons of multi-purpose tank waste storage capacity in 200W to reduce risk, support SST retrieval, and store tank waste prior to transfer to SY-Farm and 200E for vitrification. DFHLW is independent of activities associated with AP-106 tank waste management.

Amended ROD for 200W Tank Waste Treatment. Also on October 7, 2025, DOE issued an AROD for the TC&WM EIS for the implementation of the 200W alternative tank waste treatment (DOE 2025c), which was supported by the 200W Tank Waste Treatment SA (SA-05; DOE 2025d). The proposed action in the 200W Tank Waste Treatment SA included installation of pretreatment capabilities in 200W (e.g., processing modules similar in function to TSCR in 200E); potential construction of an onsite treatment (grouting) facility; and the offsite transport, treatment, and disposal of pretreated tank waste from 200W. Depending on the timing of construction of the onsite grout facility, offsite shipment of pretreated waste could either be pretreated liquid or solidified waste. The AROD addresses the potential shipment of up to 32 million gallons of pretreated liquid waste or its equivalent of solidified waste. The waste would be shipped to an appropriately licensed and permitted commercial treatment facility located off the Hanford Site depending on the ultimate waste classification. The 200W Tank Waste Treatment SA evaluated transportation of the waste by truck and rail. The 200W alternative tank waste treatment is independent of activities associated with AP-106 tank waste management in 200E. Because the actions would occur in the same time period, potential cumulative impacts are addressed in Chapter 4 of this SA.

Waste Management Programmatic Environmental Impact Statement for Managing Treatment, Storage, and Disposal of Radioactive and Hazardous Waste (WM PEIS) (DOE/EIS-0200; DOE 1997). During the 1990s, DOE anticipated a need for managing wastes at locations other than where the waste was generated. To address this need, DOE conducted analyses for management of radioactive and hazardous wastes, including LLW and mixed LLW (MLLW). The WM PEIS analyzed the transportation of large volumes of LLW across the country by truck and rail for treatment and disposal. As described in more detail in Section 3.3.4 of this SA, the WM PEIS provides a comparative data set for potential nationwide impacts of radioactive waste transportation. DOE has developed a screening approach based on the results in the WM PEIS to determine whether more detailed analysis of proposed radioactive waste transportation is warranted.

Final Test Bed Initiative Demonstration Environmental Assessment (TBI EA) (DOE/EA-2086; DOE 2023c). DOE-EM evaluated an engineering-scale Test Bed Initiative (TBI) Demonstration to separate and pretreat approximately 2,000 gallons of Hanford Site tank waste supernate, which was then treated (solidified) and disposed of at one or more offsite, permitted, and licensed MLLW disposal facilities. DOE issued a Finding of No Significant Impact (FONSI) with the Final TBI EA (DOE 2023d). Activities associated with the TBI Demonstration were completed in 2025. DOE determined that this engineering-scale test would be most appropriately analyzed as a separate action under NEPA, not as part of the TC&WM EIS proposed action. However, the TBI EA acknowledged that DOE may make a different determination for quantities over 2,000 gallons.

1.5 Scope and Organization

DOE NEPA Implementing Procedures state (DOE 2026b):

> "DOE is required to prepare supplements to environmental documents only if a major Federal action remains to occur, and DOE makes substantial changes to the proposed action that are relevant to environmental concerns; or DOE decides, in its discretion, that there are substantial new circumstances or information about the significance of the adverse effects that [have] bearing on the proposed action or its

> effects…. When it is unclear whether or not a supplement to an environmental document is required, DOE may prepare a supplement analysis."

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.

This SA analyzes whether implementing the Proposed Action constitutes a substantial change to the original proposed action evaluated in the TC&WM EIS or there are substantial new circumstances or information about the significance of adverse effects compared to those presented in the TC&WM EIS. Chapter 2 of this SA presents 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 when combined with other present and reasonably foreseeable future actions. Chapter 5 provides DOE's determination. Chapter 6 presents a bibliographic listing of the references cited in this SA.

This SA also includes an appendix with supporting information for project background on TSCR in 200E.

2 PROPOSED ACTION

2.1 Risk Mitigation Measures for Tank Waste Management in 200E

The Hanford Site is continuing to retrieve tank waste from SSTs in 200E. To ensure continued safe conduct of tank waste operations in 200E and in accordance with standard waste tank operations, tank waste is being transferred from SSTs to DSTs. As described in Section 1.1, retrieved supernate from SSTs in 200E is eventually transferred to DSTs in AP Tank Farm for pretreatment through the evolving pretreatment capability. Pretreated tank waste is currently staged in AP-106 awaiting transfer to the LAW Vitrification Facility under DFLAW.

The Proposed Action evaluated in this SA reflects the implementation of risk mitigation measures to ensure that the flow of waste from the DSTs in AP Tank Farm to AP-106 is not interrupted by a failure to process liquid out of AP-106. This would meet the near-term needs for retrieval of SSTs in 200E. As TSCR and the LAW Vitrification Facility operate, AP-106 must maintain sufficient available capacity to receive pretreated waste. Once a larger pretreatment capability is operating (after 2026), it is expected to produce about 2.4 million gallons of pretreated waste annually. During the same period, the LAW Vitrification Facility is expected to vitrify between 1.5 and 2.0 million gallons per year. This could result in a net excess of up to 0.9 million gallons of pretreated waste in AP-106 each year. To ensure that AP-106 maintains adequate operating space under conservative assumptions—including potential variations in waste production or vitrification rates—this SA evaluates an upper-bound scenario in which up to 1.2 million gallons of pretreated waste may need to be transferred off site annually for treatment and disposal.

To implement the Proposed Action, DOE is considering two options for loading the transportation packages. One option would be to use existing valving configurations at the EMF to load the packages that would be staged near the EMF. The other option would be to install onsite temporary facilities near AP Tank Farm. Both of these options are described in Section 2.2. The other element of the Proposed Action is the transport, treatment, and disposal of the pretreated liquid waste at an appropriately licensed and permitted commercial TSD facility located off the Hanford Site, which is described in Section 2.3. As identified in Section 1.2, DOE could also use the onsite treatment facility evaluated in the 200W Tank Waste Treatment SA (SA-05) for solidification of the pretreated liquid waste prior to shipment of a then-solidified waste form to an appropriately licensed and permitted out-of-state disposal facility.

2.2 Onsite Facilities

As discussed in Section 2.1, DOE could load the transportation packages from an existing configuration at EMF and/or construct a temporary MCS near the AP Tank Farm. The installation of the temporary MCS (if implemented) would be one of two possible areas of land disturbance associated with the Proposed Action. The MCS, depicted in Figure 2-1, would provide a location for the 5,000-gallon transportation packages (one at a time) to be loaded with pretreated tank waste from AP-106. Each transportation package would be placed in a secondary containment enclosure via a crane. After filling, the crane would remove the package from the enclosure and place the package on a truck for direct shipment off site. There would be a single hose-in-hose transfer line (HIHTL) that transfers pretreated tank waste from AP-106 to the MCS and another set of HIHTLs that which would provide a vent/drain connection back to AP-104.

Figure 2-2 provides the possible location of the MCS near AP Tank Farm, the relative proximity of key equipment/facilities (e.g., TSCR, AP-106), and the HIHTLs.

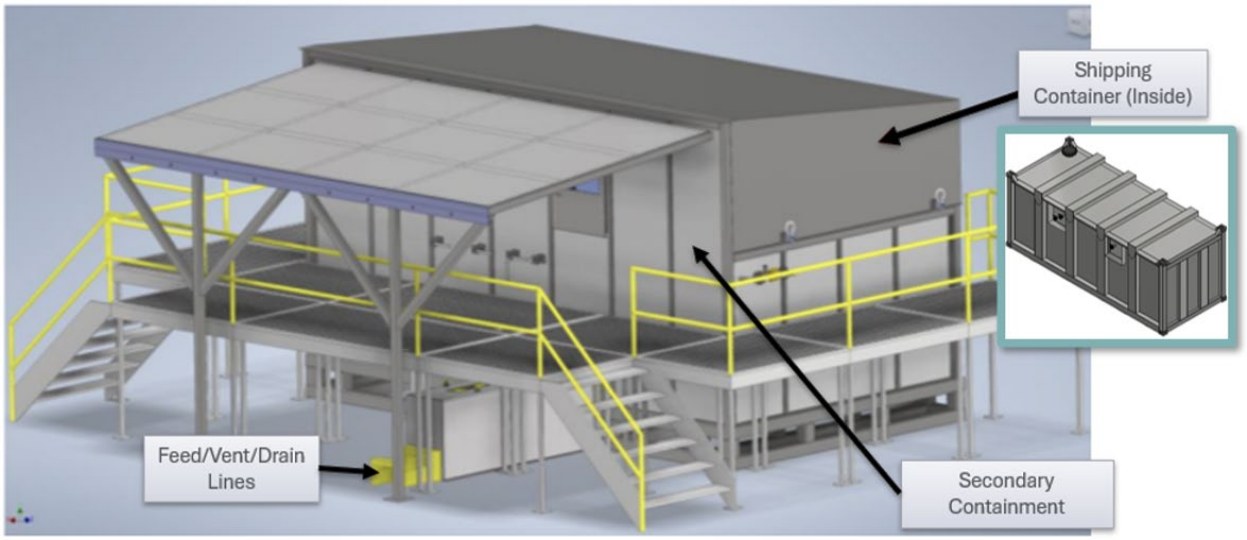


Figure 2-1 Artist Rendering of the Material Conveyance System

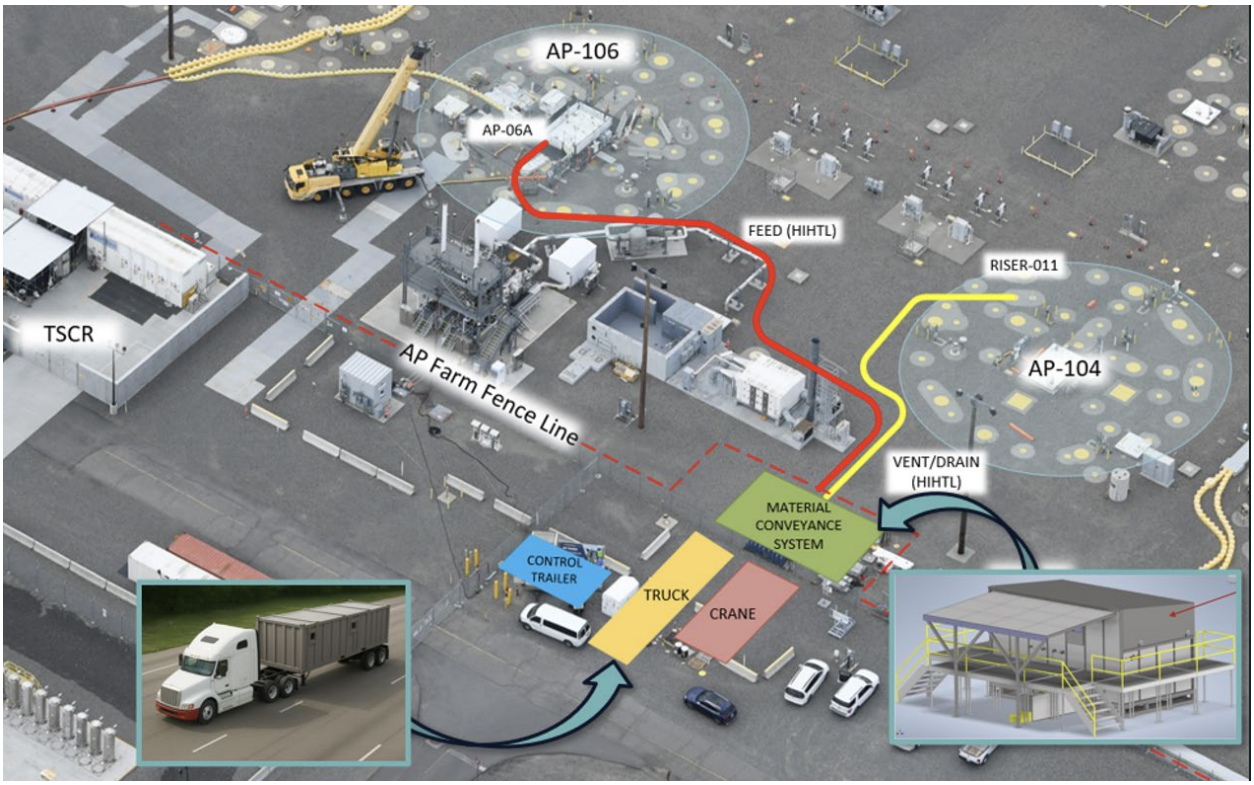


Figure 2-2 Potential Location of the MCS and Support Equipment

General operation of the MCS and its associated transportation packages are generally covered under the TC&WM EIS (as updated by SA-03 [DOE 2023b]) when utilized to perform onsite and offsite waste shipments.

Regardless of the loading option (EMF or MCS), DOE would require an area for staging the empty containers to facilitate seamless operations. For truck transportation, the majority of this area would be used for staging empty containers. If rail transport was used, a large portion of the area would be used to temporarily store an appropriate number of filled transportation packages (either pretreated liquid or solidified waste) to fully load the rail cars involved in the shipment (*see* Section 2.3). For the purposes of analysis, this laydown area would require a footprint of about 1 acre within the 200E Industrial-Exclusive Zone. It is possible that the temporary storage of transportation packages for rail transport could require additional permitting; however, such permitting would be accomplished after this SA is finalized and prior to use of the area for temporary storage.

2.3 Transportation, Solidification/Treatment, and Disposal

As identified in Section 2.1, the pretreated waste collected in AP-106 would be managed in one of three ways: (1) it would be transferred through an existing valving configuration in the EMF and offloaded to a transportation package for onsite or offsite transport, (2) it would be transferred to the MCS and loaded into a transportation package for onsite or offsite transport, or (3) it would be transferred via pipeline to the LAW Vitrification Facility for immobilization under DFLAW. Because treatment of the pretreated waste via the LAW Vitrification Facility was previously evaluated and included in an AROD, this method of treatment is not further evaluated in this SA.

Onsite transportation would be associated with the future potential use of the onsite treatment facility evaluated under the TC&WM EIS and SA-05. If that facility were available, transportation packages could be transported on site to the facility for treatment. As noted in SA-05, dependent on the location of the onsite treatment facility location, there could also be a pipeline connection to the onsite treatment facility. After solidification, the solidified waste form would be transported to an appropriately licensed and permitted out-of-state disposal facility (e.g., Waste Control Specialists LLC [WCS] or Energy*Solutions*).

For offsite transportation of the pretreated liquid waste, DOE would use USDOT-compliant, low specific activity (LSA)-II liquid containers or tanker trucks (referred to as transportation packages). Figure 2-3 is a drawing of a potential transportation package design. The following sections describe the potential waste streams that would be proposed for offsite transportation, treatment, and disposal (Section 2.3.1); the offsite treatment of pretreated liquid waste (Section 2.3.2); the transportation of pretreated liquid or solidified waste (Section 2.3.3); and the out-of-state disposal of the solidified waste form (Section 2.3.4).

The expected mode for transportation would be via legal-weight truck; however, shipment by rail also would be a possibility. Where appropriate, the following sections provide insight into the possible rail shipments of pretreated liquid or solidified waste.

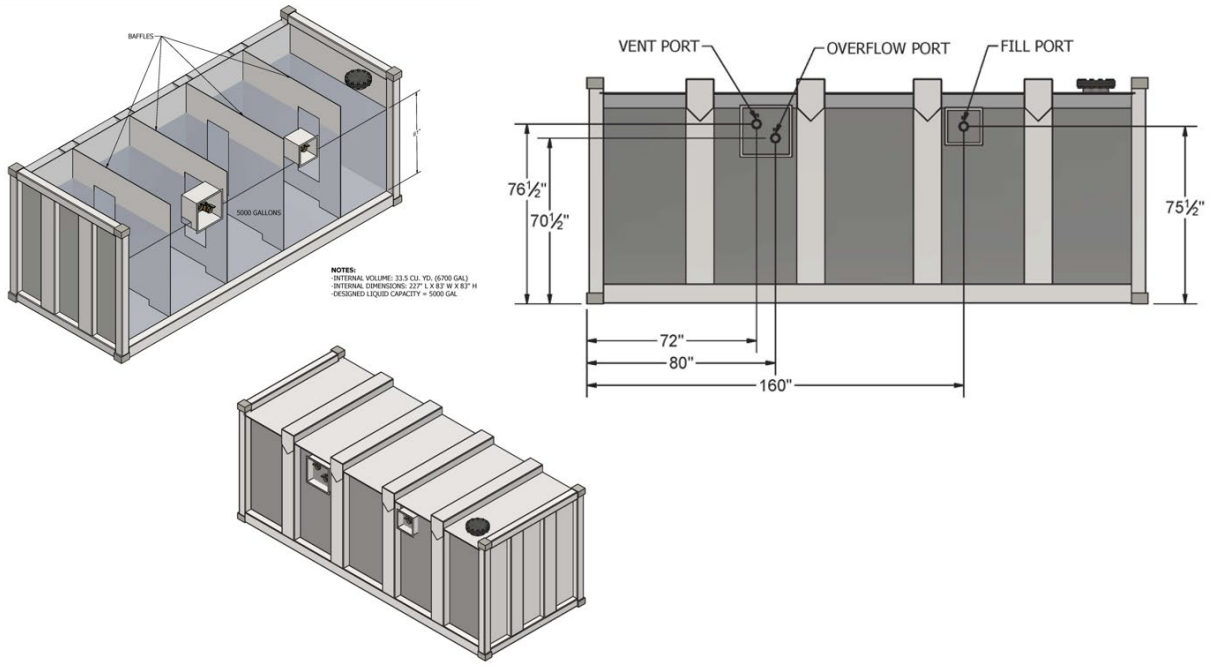


Figure 2-3 Preliminary Drawing of a 5,000-Gallon LSA-II Transportation Package

2.3.1 Pretreated Waste Stream Characteristics

DOE has measured radionuclide concentrations in the pretreated waste that currently has collected in AP-106 (downstream of the cesium and strontium removal in TSCR) (H2C 2026). DOE also has measured radionuclide concentrations for the tank waste supernate in AP-107, the feed tank upstream of TSCR. By applying the expected decontamination factors for the radionuclides removed by the TSCR and combining the weighted concentrations based on volume, DOE can calculate the expected concentrations of the total volume to be removed from AP-106 under the Proposed Action. This projected concentration, by radionuclide, is summarized in Table 2-1.

The volume of liquid, pretreated waste shipped off site could vary from month to month; however, this SA assumes a steady-state shipping campaign starting after July 2026. Because the shipping campaign for liquid, pretreated waste is assumed to consistently use 5,000-gallon transportation packages, and the total annual volume of the retrieved waste stream is up to about 1.2 million gallons after 2026, as many as 240 shipments of pretreated waste could be required over any 12-month period, or about 20 packages per month.

The radionuclide content in a truck shipment of solidified waste would be bounded by the equivalent shipment of liquid waste. Per SA-05, each disposal container for solidified waste holds about 13.1 cubic yards. If the radionuclide inventory from a 5,000-gallon liquid shipment were converted to solid form, it would occupy roughly 37 cubic yards. Therefore, a single solid-waste container of 13.1 cubic yards would hold approximately 35 percent (13.1/37) of the radionuclide inventory contained in a 5,000-gallon liquid shipment.

Table 2-1 Average Radionuclide Concentrations (curie/shipment)

Radionuclide	AP-106
Carbon-14	1.39×10^{-2}
Cobalt-60	5.98×10^{-3}
Nickel-63	3.34×10^{-1}
Strontium-90	1.34×10^{-1}
Technetium-99	1.65
Iodine-129	1.51×10^{-3}
Cesium-137	6.54×10^{-1}
Neptunium-237	8.68×10^{-5}
Plutonium-238	4.94×10^{-4}
Plutonium-239	3.63×10^{-3}
Plutonium-240	7.87×10^{-4}
Americium-241	8.89×10^{-4}
Plutonium-241	6.13×10^{-3}
Curium-242	3.73×10^{-6}
Plutonium-242	9.91×10^{-6}
Americium-243	1.27×10^{-7}
Curium-243	7.46×10^{-7}
Curium-244	1.00×10^{-5}
Total average curies per truck shipment	**2.8**

Source: H2C 2026

For purposes of this SA, to determine the eventual disposal volume at the licensed and permitted TSD, there would be an increased volume of about 50 percent from the addition of treatment reagent materials (e.g., cementitious-based formulations, additives, reductants, and oxidizers).[5]

This increased volume would also affect the number of potential shipments from the Hanford Site if the onsite treatment facility was used. Section 2.3.3 presents the estimated number of truck and rail shipments of solidified waste.

2.3.2 Solidification/Treatment of Pretreated Waste

The pretreated liquid would be solidified and meet applicable *Resource Conservation and Recovery Act of 1976* (RCRA) treatment standards to enable the waste to meet requirements for land disposal of mixed waste. The treatment standards would also include treatment of hazardous constituents in the waste stream, as applicable, to meet TSD disposal requirements.

Treatment (including solidification/grouting) of the pretreated waste would occur either at one or more licensed and permitted commercial TSD facilities in the western United States or potentially at the planned onsite treatment facility at the Hanford Site. Examples of the offsite facilities used for this analysis include, in alphabetical order:

[5] According to PNNL (2013), the volume of pretreated liquid waste increases by an expansion factor ranging from 1.5 to 1.8 when solidified. The lower end of the range (1.5) results in the highest projected radionuclide concentration and the highest waste classification estimate. The expansion factor, final waste volume, and associated impacts vary based on the tank waste composition and grout formulation used. For analysis purposes, this SA also uses a 1.5 expansion factor; however, if the actual expansion was higher during implementation of the Proposed Action, the disposal volume presented in this SA could be higher as well. This is addressed in Section 3.3.

- Energy*Solutions* in Clive, Utah;
- Perma-Fix Northwest (PFNW) in Richland, Washington; and
- WCS FWF in Andrews County, Texas.

At each of the facilities, pretreated liquid waste would be solidified such that the solidified waste form would have an increased volume. All three facilities are designed to treat radioactive waste that requires treatment for RCRA constituents and/or RCRA characteristics prior to disposal. Incorporation of the waste into a solid physical form would be required to meet the waste acceptance criteria for land disposal of waste at the WCS FWF or Energy*Solutions*. Operations at PFNW are conducted in accordance with radioactive material licenses issued by the Washington State Department of Health (WDOH 2024) and a permit for treatment and storage of dangerous waste issued by Ecology (Permit Number WAR 000010355). 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. Because PFNW does not have a disposal facility, solidified waste from PFNW would be shipped to WCS or Energy*Solutions* for disposal.

WCS operates the FWF, which is a disposal facility in Andrews County, Texas that accepts MLLW that is the responsibility of the Federal government. The WCS FWF is permitted, licensed, and authorized to receive, treat, and dispose of Class A, Class B, and Class C LLW and MLLW. Waste from DOE facilities is typically disposed of in WCS' FWF. The WCS waste acceptance criteria document, *FWF Generator Handbook* (WCS 2025), 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 information related to the waste acceptance process, including waste form requirements and a description of the generator and waste approval processes. WCS has previously indicated that it has capacity to treat and dispose of between 1 million and 2 million gallons per year of liquid waste from the Hanford Site. WCS could accommodate the 1 million gallons per year from Hanford immediately without impacting other waste treatment or disposal commitments. WCS could accommodate 2 million gallons per year within one year without the need for additional facilities or resources (WCS 2024a). After receipt and processing of transportation packages containing pretreated waste at the FWF, WCS would ensure that the containers meet release criteria prior to returning them to the Hanford Site (WCS 2025, Section 9.3). According to the *FWF Generator Handbook* (WCS 2025), WCS would dispose of the solidified waste form in modular concrete canisters (either cylindrical or rectangular). Wastes are received on site at WCS via highways and direct rail access (WCS 2025).

Energy*Solutions* operates a MLLW treatment and disposal facility west of the Cedar Mountains in Clive, Utah. Clive is located along Interstate 80, about 60 miles west of Salt Lake City, Utah. The Clive LLW facility is licensed by the Utah Department of Environmental Quality (UDEQ) for the treatment and disposal of Class A MLLW that meets specified waste acceptance criteria (Energy*Solutions* 2025). Disposal of the stabilized waste in the existing MLLW facility at the Energy*Solutions* site would be conducted in accordance with the facility's operating license (Radioactive Material License No. UT 2300249; UDEQ 2025). Energy*Solutions* has indicated that it has capacity to treat and dispose of 1 million gallons per year of liquid waste from the Hanford Site and stay within its existing permitted capacity (Energy*Solutions* 2024).

Energy*Solutions* receives waste shipped via bulk truck, containerized truck, enclosed truck, bulk railcars, rail boxcars, and rail intermodals. The transportation access allows Energy*Solutions* to operate throughout the entire year. The disposal site is accessed by the Union Pacific Railroad at Energy*Solutions*' private siding. Energy*Solutions* uses more than 10 miles of track and three locomotives for railcar management. The covered railcar thaw shed, rotary dumper, and railcar decontamination facilities allow for the efficient unloading, decontamination, and return of rail shipments (Energy*Solutions* 2025). Similar to WCS, Energy*Solutions* would ensure that the re-useable transportation packages would meet release criteria before being returned to the Hanford Site.

A potential scenario for implementation of the Proposed Action would be that pretreated liquid waste would be sent to a combination of PFNW, WCS, and Energy*Solutions*. Based on the preliminary radionuclide concentrations, DOE anticipates that most, if not all, of the shipments of pretreated waste would meet Class A LLW limits; however, it is possible that some of the waste may exhibit radionuclide concentrations higher than Class A limits and could not be treated and disposed of at Energy*Solutions*. Therefore, for transportation purposes, the analysis in this SA assumes that all shipments would be made to WCS because the farther distance per shipment would bound the potential transportation impacts of shipment to any of the facilities. To bound waste management and transportation impacts, this SA assesses disposing of the full inventory (up to 1.2 million gallons prior to solidification) at each facility.

For potential onsite treatment, this SA uses the same assumptions as presented in SA-05 (DOE 2025d).

2.3.3 Transportation of Pretreated Waste or Solidified Waste for Treatment and/or Disposal

As described earlier, the expected volume of each LSA-II transportation container for the shipment of pretreated liquid waste is 5,000 gallons. Figure 2-2, in Section 2.2, provides a representative picture of a USDOT-compliant LSA-II transportation package for liquid waste. Solidified waste would be transported in disposal containers that also meet USDOT specifications.

Offsite transportation of radioactive waste would follow the USDOT requirements for hazardous materials. Radioactive materials must be packaged in accordance with the level of hazard associated with the potential release of material that might occur during normal transport conditions or accidental release of the material during transport. The greater the hazard, the more robust the packaging required to transport the material. All radioactive material transportation would be performed in compliance with 49 CFR Part 173. Transportation of radioactive waste by rail would be performed in accordance with 49 CFR Part 174. For the purpose of the analysis in this SA, DOE assumes that two 5,000-gallon transportation packages or three solidified waste disposal containers could be shipped on a single railcar.

This SA assumes that five loaded railcars would be shipped in a single train consist.[6] The most likely scenario for implementation would be between 5 and 30 railcars per train shipment. While it is possible that fewer than five railcars would be shipped on a single shipment, this would be unlikely, and the overall annual average would be higher than five. The ultimate projected volume of waste to be shipped off site (equivalent of up to 1.2 million gallons per year of liquid, pretreated

[6] A train "consist" is defined as the total of the railcars and locomotives that make up the whole train, which is defined in this SA as a rail shipment. See https://www.trainconductorhq.com/what-is-a-locomotive-consist/.

waste) would be a factor in determining whether rail transportation might be used. As the total shipment volume increases, the attractiveness of rail shipments (considering financial and environmental impacts) also increases. For the maximum annual volume, DOE expects 24 rail shipments of liquid pretreated waste per year or 2 per month (2 packages per railcar, 5 railcars per shipment, 5,000 gallons per package). For solidified waste (if onsite treatment was available), as many as 45 rail shipments could occur each year (less than 4 per month).

USDOT-certified packages must pass stringent tests as part of their certification. Per the requirements of 49 CFR 173.411(b)(5), a cargo tank may be used as a package for transporting LSA-I and LSA-II liquids and gases, provided that:

- It is capable of withstanding a test pressure of 265 kilopascals (38.4 pounds per square inch absolute); and
- It is designed so that any additional shielding that is provided must be capable of withstanding the static and dynamic stresses resulting from handling and routine conditions of transport and of preventing more than a 20-percent increase in the maximum radiation level at any external surface of the tanks.

As identified in Section 2.3.1 of this SA, DOE expects that up to about 20 truck shipments of pretreated liquid (or 57 truck shipments of solidified waste) could be required monthly. Section 2.3.2 provides the expected capacity for each of the commercial treatment facilities. Therefore, this SA uses these assumptions in the following tables to establish the analytical bases for those resources that depend on the estimated number of shipment miles (i.e., air quality, human health, and transportation) and transportation mode.

Per the discussion in Section 2.3.2, PFNW could be used for treatment; however, the solidified waste form would need to be sent to WCS or Energy*Solutions* for disposal. If PFNW were used as an option for treatment, DOE would ensure that pretreated waste meets the PFNW waste acceptance criteria prior to preparing any shipment from 200E. In 2024, PFNW had indicated that it had capacity to treat and disposition about 360,000 gallons per year of liquid pretreated waste from the Hanford Site without impacting its current operations or commitments (Perma-Fix 2024). In early 2026, Ecology issued a permit renewal that increased PFNW's mixed waste processing capacity up to 1.2 million gallons per year (Perma-Fix 2026).

Table 2-2 presents the analytical parameters associated with truck transportation of up to 1.2 million gallons of pretreated waste for offsite treatment and disposal at WCS. As identified earlier, this material is assumed to be shipped to WCS because it would bound potential transportation impacts for the analysis in this SA. If the pretreated waste were shipped to Energy*Solutions*, transportation impacts would be less than presented in this SA. Table 2-2 also presents the analytical parameters associated with annual truck shipments of solidified waste (if onsite treatment were available).

This SA evaluates potential rail shipments of liquid pretreated (or solidified) waste. All liquid pretreated (or solidified) waste for transport to WCS or Energy*Solutions* would be loaded into 5,000-gallon transportation packages (or 13.1-cubic yard disposal containers) and shipped off site on trucks to a local rail spur (i.e., in north Richland or some other location within the surrounding Tri-Cities, Washington, area). The analysis assumes that the transportation packages (or disposal

containers) would be transported individually by trucks to the rail spur[7] and two liquid containers (or three disposal containers of solidified waste) would be placed on each railcar for shipment to either WCS or Energy*Solutions*. As discussed earlier, the analysis assumes that an average of five loaded railcars would be included in each train shipment. Table 2-3 presents the analytical parameters used for the rail analysis for pretreated liquid (or solidified) waste for offsite management. The estimated rail mileage from Richland to WCS was obtained using DOE's computer model *Stakeholder Tool for Assessing Radioactive Transportation* (START).[8]

Table 2-2 Analytical Parameters: Truck Transport

TSD Facility	One-Way Distance (miles)	Gallons (cubic yards)[a]	Shipments	Highway Miles	Round-Trip Miles[b]
Pretreated Liquid Waste Shipments					
WCS Andrews County, TX	1,600	1,200,000	240	384,000	768,000
Solidified Waste Shipments					
WCS Andrews County, TX	1,600	1,800,000 (8,912)	680	1,088,000	2,176,000

TSD = treatment, storage, and disposal; WCS = Waste Control Specialists LLC

a Liquid shipments would be in 5,000-gallon transportation packages. Solidified waste would be in 13.1-cubic yard disposal containers.

b Round-trip highway miles are used for air emissions and nonradiological traffic impacts.

Table 2-3 Analytical Parameters: Rail Transport

TSD Facility	One-Way Distance	Gallons (cubic yards)[a]	Shipments Truck/Rail	Miles Truck/Rail	Round-Trip Miles Truck/Rail[b]
Pretreated Liquid Waste Shipments					
200W to Richland, WA (truck)	25	1,200,000	240/0	6,000/0	12,000/0
Richland, WA to WCS Andrews County, TX (rail)	2,155	1,200,000	0/24	0/51,720	0/103,440
Totals		**1,200,000**	**240/24**	**6,000/51,720**	**12,000/103,440**
Solidified Waste Shipments					
200W to Richland, WA (truck)	25	1,800,000 (8,912)	680/0	17,000/0	34,000/0
Richland, WA to WCS Andrews County, TX (rail)	2,155	1,800,000 (8,912)	0/45	0/96,975	0/193,950
Totals		1,800,000 (8,912)	**680/45**	**17,000/96,975**	**34,000/193,950**

TSD = treatment, storage, and disposal; WCS = Waste Control Specialists

a Liquid shipments would be in 5,000-gallon transportation packages. Solidified waste would be in 13.1-cubic yard disposal containers. Trucks carry single packages to a rail spur. Railcars carry two liquid containers or three disposal containers to the TSD. Each train shipment consists of five loaded railcars.

[7] There are multiple intermodal (truck-to-rail) transfer locations within 10 miles of North Richland (e.g., Port of Benton and Tri-Cities Intermodal) that could be suitable.

[8] Information regarding START is available at https://start.energy.gov/Account/Login?ReturnUrl=%2f.

b Round-trip miles are used for air emissions and nonradiological traffic impacts. Railcars would be used to return empty packages and/or disposal container steel overpacks.

2.3.4 Disposal of Solidified Waste Forms

As identified in Section 2.3.2, the out-of-state disposal of the solidified waste would occur at WCS and/or Energy*Solutions*, depending on the MLLW classification (Class A MLLW can be disposed of at Energy*Solutions* and WCS; Class B and C MLLW can only be disposed of at WCS). DOE anticipates that most, if not all, the shipments of pretreated (or solidified) waste would meet Class A LLW limits; however, the analysis evaluates the potential disposal of the full inventory at each of the facilities to estimate impacts. This estimate is strictly for NEPA analysis only and does not predetermine future procurement actions or imply that a larger total volume is being considered.

Whether disposed at WCS or Energy*Solutions*, all wastes would be verified to meet the TSD's waste acceptance criteria prior to shipment from the Hanford Site (WCS 2025; Energy*Solutions* 2025).

3 ENVIRONMENTAL CONSEQUENCES

3.1 Introduction

DOE conducted an initial screening review to identify the differences between the Proposed Action and the actions 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 200E Tank Waste Management 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

Implementation of the Proposed Action represents the following primary differences from the facilities and actions analyzed in the Final TC&WM EIS (and previous SAs): (1) possible installation of a temporary MCS near AP Tank Farm to facilitate loading 5,000-gallon transportation packages with pretreated waste for offsite shipment; (2) development of about 1 acre of staging and laydown areas for empty packages and potential short-term storage of filled packages for rail transport; and (3) shipment of these transportation packages, up to an equivalent of 1.2 million gallons annually of pretreated LAW, by truck or rail for appropriate treatment and disposal outside the state of Washington. The following paragraphs discuss each of these elements, and Table 3-1 provides a comparative analysis for each of the environmental resource areas evaluated in the TC&WM EIS. In general, location and functional equivalency were the basis for the comparative evaluation and assessment.

1. **Temporary MCS** – The TC&WM EIS included evaluation of the WTP Pretreatment Facility in 200E, which would provide pretreatment of supernate in the 200 Area tank farms. The DFLAW program included the implementation of an EMF, pretreatment capability through TSCR, and new transfer lines between facilities. The potential impacts of the WTP Pretreatment Facility were evaluated in the TC&WM EIS, and impacts from the EMF (added under the DFLAW program) were bounded by the analysis of the WTP Pretreatment Facility (*see* Table 3-1). The TSCR and transfer lines were demonstrated in the DFLAW SA-02 to be substantively similar to the function of the facilities evaluated in the TC&WM EIS (DOE 2019). This previous evaluation fully addresses planned actions, with the exception of the proposed diversion of pretreated waste from AP-106 for offsite treatment and disposal.

   To implement the Proposed Action, DOE could install and operate a temporary MCS near AP Tank Farm (see Figures 2-1 and 2-2) or use existing valve configurations at the EMF (which would not involve any new facilities or land disturbance). The MCS would be functionally equivalent to the Load-in/Load-out facility proposed and evaluated in the 200W Tank Waste Treatment SA-05 (DOE 2025d). As reported in Section 2.2.2.1.5 of the TC&WM EIS, “storage and waste treatment facilities may be required to facilitate waste transfers.”

2. **Staging and Temporary Storage Area** – The Proposed Action would include providing an area, as necessary, for storage and staging of 5,000-gallon liquid containers to allow for uninterrupted processing, offsite shipment, treatment, and return of the packages. The area

could also be used to stage empty disposal containers, if needed, to support the offsite shipment of solidified waste from the onsite treatment facility. The preliminary estimate of the necessary footprint is about 1 acre. This size would accommodate 30-40 empty containers with adequate spacing to facilitate truck and portable crane access.

If DOE implemented the rail transportation option, it could implement a temporary storage area in this same (or similar) location to provide short-term storage of filled packages waiting for truck transport to the rail spur. Some or all of this staging and storage area may be covered to protect the packages from the weather. To provide a sense of the temporary nature of the storage, DOE anticipates filling as many as 20 transportation containers per month and assumes that a single rail consist would include about 10 transportation packages. Therefore, it would require about two weeks to generate a full complement of filled transportation packages to complete a train consist. Thus, it would be unlikely that filled packages would be stored longer than a few weeks before shipment to the rail spur.

The 200W Tank Waste Treatment SA-05 evaluated the development of a 2-acre area in 200W for staging transportation packages or disposal containers (for solidified waste treated on site). The SA-05 determined that this 2-acre development would not represent a substantial change relevant to environmental concerns from the proposal evaluated in the TC&WM EIS (DOE 2025d).

The proposed 1-acre development would be in 200E and is evaluated further in Section 3.3 of this SA.

3. **Offsite Shipment of Waste to a Commercial TSD** – Under the Proposed Action, DOE would load transportation packages with pretreated liquid waste and transport that waste to an appropriately licensed and permitted commercial TSD for solidification/treatment and out-of-state disposal. Alternatively, the Proposed Action includes the option to solidify the pretreated waste on the Hanford Site at the onsite treatment facility and transport the solidified waste to an appropriately licensed and permitted commercial TSD for out-of-state disposal. The offsite shipment, treatment, and out-of-state disposal of tank waste was not specifically evaluated in the TC&WM EIS. However, two recent SAs evaluated offsite shipment, treatment, and disposal of substantive volumes of waste from Hanford: (1) the Secondary Waste Management SA-03 (DOE 2023b) and (2) the 200W Tank Waste Treatment SA-05 (DOE 2025d).

   The Secondary Waste Management SA-03 evaluated annual transportation of about 243,000 gallons of secondary liquid LLW/MLLW and 2.04 million gallons of secondary solid LLW/MLLW for a period of 10 years. The SA-03 determined that the increased volume of offsite treatment and out-of-state disposal of LLW and MLLW under that proposal would not represent a substantive change relevant to environmental concerns from the proposal evaluated in the TC&WM EIS (DOE 2023b).

   The 200W Tank Waste Treatment SA-05 evaluated the annual transportation of about 32 million gallons of pretreated tank waste from 200W over a period of about 11 years (about 2.9 million gallons per year). The SA-05 determined that the offsite shipment, treatment and out-of-state disposal of liquid pretreated waste under that proposal would not represent a substantive change relevant to environmental concerns from the proposal evaluated in the TC&WM EIS (DOE 2025d).

The additional increment of offsite transportation, treatment, and disposal of Hanford Site waste is evaluated in Section 3.3 of this SA.

Table 3-1 provides a comparative evaluation of the potential impacts to 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 implementation of 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 and Alternative 3B	Assessment of Impacts for 200E Tank Waste Management
Land use	Presented as a percent of total land commitment within either the Industrial-Exclusive Zone[a] or Borrow Area C,[b] as appropriate. **Alternative 2B** 41.3 acres of new facilities. Total land commitment of 249 acres (2 percent) associated with tank closure within the Industrial-Exclusive Zone. (TC&WM EIS, Section 4.1.1.3.1)	The footprint of the proposed 200E onsite facilities, including the temporary MCS and staging/storage area, is within the Industrial-Exclusive Zone,[a] which includes the 200 Area tank farms and the WTP complex. The new onsite facilities would require no Borrow Area C[b] materials. There would be negligible differences in the potential land use impacts as evaluated for Alternative 2B. The key differences would be the development of an acre for the staging/storage area within 200E and an adjustment of the fencing around the AP Tank Farm to support the temporary MCS. These differences would all be within the Industrial-Exclusive Zone.
Visual resources	**Alternative 2B** Little change in the overall visual character of the 200 Area. With respect to visual impacts resulting from mining activities at Borrow Area C, both alternatives would result in a moderate change to the area as viewed from nearby higher elevations (principally Rattlesnake Mountain, a Traditional Cultural Property) and State Route 240. (TC&WM EIS, Section 2.8.1.1)	Implementation of the Proposed Action would not introduce any uniquely different or larger facilities 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/departing from the commercial treatment or disposal facilities would not cause notable visual impacts.
Noise and vibration	**Alternative 2B** Negligible offsite impact of onsite activities. Minor traffic noise impacts. (TC&WM EIS, Section 2.8.1.3)	The proposed 200E temporary facilities are functionally equivalent to those evaluated in SA-05 and would not change the potential noise or vibration considerations evaluated for Alternative 2B. There would be negligible noise impacts from the construction of the temporary MCS and staging/storage area. The offsite shipment of pretreated liquid would result in a slight increase in truck traffic south from the Hanford Site (toward Texas or Utah). Per Section 2.4.1, an average of about 20 truck shipments per month (or 2 monthly rail shipments) would be expected for transportation of liquid waste to a TSD facility. If onsite solidification were implemented, the monthly shipment numbers would increase to 57 truck shipments and less than 4 rail shipments. While additional truck traffic would increase the potential noise in the area immediately south of the Hanford Site, there would not be a 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 and Alternative 3B	Assessment of Impacts for 200E Tank Waste Management
Air quality	Peak-year incremental criteria pollutant – most stringent guideline/standard (micrograms per cubic meter). **Alternative 2B** Carbon monoxide (1-hour) standard = 40,000/40,500 Nitrogen oxides (1-hour) standard = 188/35,200 PM_{10} (24-hour) standard = 150/4,910 $PM_{2.5}$ (24-hour) standard = 35/4,910 Sulfur oxides (1-hour) standard = 197/105 *Peak-year incremental toxic chemical concentrations (micrograms per cubic meter)* Ammonia (24-hour) ASIL = 70.8/12.0 Benzene (annual) ASIL = 0.0345/0.00459 Mercury (24-hour) ASIL = 0.09/0.117 Toluene (24-hour) ASIL = 5,000/3.62 Xylene (24-hour) ASIL = NL/1.1 (TC&WM EIS, Tables 4-3 and 4-4)	The proposed 200E facilities are functionally equivalent to those evaluated in SA-05 and would not introduce new sources or significant increases in air quality considerations beyond those potential impacts evaluated for Alternative 2B. There would be typical emissions related to land disturbance of the staging/storage area. There would be no air emissions associated with operations of the staging/storage area. The proposed transportation of pretreated liquid (or solidified) waste to offsite TSD facilities would result in emissions from the transport vehicles, which is evaluated in Section 3.3.1 of this SA.
Geology and soils	**Alternative 2B** Small impact from construction, including potential for short-term soil erosion. Excavation depths limited to 12 meters (about 40 feet). New permanent land disturbance: 276 acres (TC&WM EIS, Section 2.8.1.5)	The footprint of the proposed 200E facilities, including the temporary MCS and the staging/storage area, is within the Industrial-Exclusive Zone,[a] which includes the 200 Area tank farms and the WTP complex. Although development of the staging/storage area would increase the amount of non-permeable surfaces from that evaluated in the TC&WM EIS, there would be no discernible differences in the potential impacts to geology and soils as evaluated for Alternative 2B because the area has been highly disturbed and is gravel and fill.
Water resources	**Alternative 2B** 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 will not exceed site capacity. 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. (TC&WM EIS, Section 2.8.1.6)	Surface Water – The proposed 200E facilities are functionally equivalent to those evaluated in SA-05 and would not introduce new potential surface water releases or water uses beyond those potential impacts evaluated for Alternative 2B. Although development of the staging/storage area would increase the amount of non-permeable surfaces, there would be a negligible effect on surface water runoff. As noted in Section 4.1.6 of the TC&WM EIS, no portion of the 200 Areas lies within a floodplain. Vadose Zone and Groundwater – Similar to surface water, the Proposed Action would not introduce new potential impacts to the vadose zone or groundwater beyond those potential impacts evaluated for Alternative 2B. Under normal conditions, there would be no releases to groundwater from operation of the temporary MCS or the

Resource Area	Impacts in 2012 TC&WM EIS for Alternative 2B and Alternative 3B	Assessment of Impacts for 200E Tank Waste Management
		staging/storage area. Transportation packages would be monitored for leakage and would only be staged for a few days at a time. For long-term groundwater impacts, the TC&WM EIS assumed that the immobilized LAW would be disposed of in the IDF on the Hanford Site. The annual disposal of the equivalent of 1,200,000 gallons of pretreated Hanford Site tank waste at out-of-state facilities would not increase the potential risk to local groundwater in the region from that presented in the TC&WM EIS. Offsite transportation would not have any potential for impacts to surface or groundwater except during accident conditions. These are discussed in Section 3.3.4 of this SA.
Ecological resources	**Alternative 2B** Terrestrial Resources – 3 acres of sagebrush habitat affected in 200E that would be unmitigable. No affected sagebrush habitat in 200W. Wetlands – No impact on wetlands within the 200 Area. Aquatic Resources – No impact on aquatic resources within the 200 Area. Threatened and Endangered Species – No impact on any federally listed threatened or endangered species. Potential impacts on two State-listed species in 200E. No potential impact in 200W. (TC&WM EIS, Section 4.1.7.3)	The footprint of the proposed 200E facilities, including the temporary MCS and staging/storage area, is within the Industrial-Exclusive Zone,[a] which includes the 200 Area tank farms and the WTP complex. There would be no differences in potential impacts to ecological resources as evaluated for Alternative 2B. There would be no potential for impacts to ecological resources from the operation of the temporary MCS or from offsite transportation of pretreated liquid (or solidified) waste. Prior to construction of the onsite facilities, DOE's tank farm contractor would follow the requirements in the *Hanford Site Biological Resources Management Plan* to ensure that there would not be any inadvertent impacts to biological resources beyond those identified in the TC&WM EIS (DOE 2017). As part of the normal process of environmental review, DOE performs an ecological clearance review of the specific potential areas of disturbance associated with proposed project construction (e.g., staging/storage area). The ecological clearance process will evaluate the area once the siting location for the staging/storage area is finalized (DOE 2017).
Cultural and paleontological resources	**Alternative 2B** Prehistoric, historic, and paleontological resources – No impacts. American Indian Interests – After closure, the 200 Area's containment structures and closure barriers will be visible from higher elevations. (TC&WM EIS, Section 2.8.1.8)	The footprint of the proposed 200E facilities, including the temporary MCS and staging/storage area, is within the Industrial-Exclusive Zone,[a] which includes the 200 Area tank farms and the WTP complex. There would be no significant differences in potential impacts to cultural and paleontological resources as evaluated for Alternative 2B. There would be limited potential for additional impacts to cultural and paleontological resources from the development of the staging/storage area. Prior to development, the tank farm contractor would follow the requirements in the *Hanford Site Cultural Resources Management*

Resource Area	Impacts in 2012 TC&WM EIS for Alternative 2B and Alternative 3B	Assessment of Impacts for 200E Tank Waste Management
		Plan to identify and minimize inadvertent impacts on cultural resources (DOE 2003). As part of the normal process of environmental review, DOE performs a cultural clearance review of the specific potential areas of disturbance associated with proposed project construction. The cultural clearance process will evaluate the area once the siting location for the staging/storage area is finalized.
Socioeconomics	**Alternative 2B** Peak annual workforce (full-time equivalent) = 6,860 Peak daily commuter traffic (vehicles per day) = 5,500 Peak daily truck loads, off site = 48 Impact on the 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. (TC&WM EIS, Section 4.1.9.3)	The proposed 200E facilities are functionally equivalent to those evaluated in the TC&WM EIS and would not require substantively more resources than full WTP operations. Therefore, the Proposed Action would not require a substantively increased workforce beyond that evaluated for Alternative 2B. There would be a small number of additional truck drivers to implement the offsite shipment of pretreated or solidified waste (between 20 and 57 truck trips or 2–4 rail shipments per month).
Public and occupational health and safety (normal operations)	**Alternative 2B** <u>Normal Operations</u> *Offsite population impact – life of project* Dose (person-rem)/latent cancer fatality (LCF) = 1,600/1 *Peak-year maximally exposed individual impact* Dose (mrem/yr)/increased risk of an LCF = $10/6\times10^{-6}$ *Peak-year onsite maximally exposed individual impact* Dose (mrem/yr)/increased risk of an LCF = $1.7/1\times10^{-6}$ *Radiation worker population impact – life of project* Dose (person-rem)/LCF = 11,000/7 *Average annual impact per radiation worker* Dose (mrem/yr)/increased risk of an LCF = $160/1\times10^{-4}$ *Peak-year noninvolved worker impact* Dose (mrem/yr)/increased risk of an LCF = $3.4/2\times10^{-6}$ (TC&WM EIS, Section 4.1.10.3)	The proposed 200E facilities are functionally similar to those evaluated in the TC&WM EIS and SA-05. Potential health and safety impacts to workers and the public from the proposed onsite facilities are evaluated in more detail in Section 3.3.2 of this SA. Increasing the amount of offsite treatment and disposal of pretreated (or solidified) waste would transfer some of the potential worker health impacts from onsite DOE contractors to those working at the commercial TSD 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.

Resource Area	Impacts in 2012 TC&WM EIS for Alternative 2B and Alternative 3B	Assessment of Impacts for 200E Tank Waste Management
Public and occupational health and safety (facility accidents)	**Alternative 2B** Facility Accidents *Offsite population consequences* Dose (person-rem)/LCFs = 75,000/50 *Maximally exposed offsite individual consequences* Dose (rem)/increased risk of LCF = $4.3/3\times10^{-3}$ *Noninvolved worker consequences* Dose (rem)/increased risk of LCF = 13,000/1 *Offsite population risk* Annual number of LCFs/number of LCFs over the life of the project = 0/1 *Maximally exposed offsite individual risk* Annual increased risk of an LCF/increased risk of an LCF over life of the project = 1×10^{-6} /3×10^{-5} *Noninvolved worker risk* Annual increased risk of an LCF/increased risk of an LCF over life of the project = 8×10^{-3} /2×10^{-1} (TC&WM EIS, Section 2.8.1.11)	The proposed 200E facilities are functionally similar to those evaluated in the TC&WM EIS and SA-05. The only facility accident attributable to the Proposed Action would be potential spills or inadvertent transfer, which were already evaluated in the TC&WM EIS. More details related to potential health and safety impacts from facility accidents associated with the proposed onsite facilities are included in Section 3.3.3 of this SA.
Public and occupational health and safety (transportation)	**Alternative 2B** Transportation *Incident-free transportation (Dose/LCF)* Workers = 260 person-rem/0.16; Public = 73 person-rem/0.04 *Traffic accidents* (nonradiological fatalities) = 0.05 Assumed no offsite radioactive waste shipments *Offsite population (accident risk)* Dose (person-rem)/LCFs = 3.5×10^{-6}/2.1×10^{-9} (TC&WM EIS, Section 4.1.12.3)	There would be an increase in health risks to transportation crews for the shipments of pretreated (or solidified) waste 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 pretreated (or solidified) waste. These elements of the Proposed Action are evaluated in further detail in Section 3.3.4 of this SA.
Industrial safety	**Alternative 2B** Worker Population Impact – Total project Total recordable cases (fatalities) = 3,880 (0.50) (TC&WM EIS, Table 4-98)	The proposed 200E facilities are functionally similar to those evaluated in the TC&WM EIS and SA-05 and would not introduce any new industrial hazards that were not included in the evaluation of Alternative 2B. The addition of the temporary MCS and staging/storage area would introduce negligible industrial safety risks from the construction activities. Operations of the facilities would not add staff that could increase the estimated total recordable cases or fatalities. The Proposed Action would not introduce any new industrial hazards that were not included in the evaluation of Alternative 2B.

Resource Area	Impacts in 2012 TC&WM EIS for Alternative 2B and Alternative 3B	Assessment of Impacts for 200E Tank Waste Management
Waste Management	**Alternative 2B** Disposed of off site and/or stored on site (cubic meters unless otherwise noted) IHLW glass (# of canisters) = 14,200 (12,000) IHLW cesium and strontium glass (# of canisters) = 400 (340) HLW melters (# of melters) = 1,350 (11) Mixed TRU waste (includes tank and secondary, CH and RH) = 206 Hazardous waste = 79,600 Disposed of on site ILAW glass (# of canisters) = 213,000 (92,300) LAW melters (# of melters) = 8,000 (31) LLW (secondary) = 37,600 Liquid LLW (liters) = 9,690 Closure LLW = 679 MLLW (secondary) = 36,900 Closure MLLW = 468,000 (TC&WM EIS, Table 4-86)	The proposed 200E facilities are functionally similar to those evaluated in the TC&WM EIS and SA-05 and do not introduce new waste types beyond those evaluated for Alternative 2B. The Proposed Action includes onsite and offsite treatment and offsite disposal of liquid pretreated (and solidified) waste, which was not specifically evaluated in the TC&WM EIS, although this approach was evaluated recently in the SA-05. The waste management elements of the Proposed Action are evaluated in more detail in Section 3.3.5 of this SA.

a Industrial-Exclusive Zone: Land within the 200 Area suitable and desirable for treatment, storage, and disposal of hazardous, dangerous, radioactive, and nonradioactive wastes as designated by DOE/EIS-0222-F, *Final Hanford Comprehensive Land-Use Plan Environmental Impact Statement* and *Record of Decision* (64 FR 61615, November 12, 1999).

b Borrow Area C: Located south of 200W 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.

ASIL = Acceptable Source Impact Level; CH = contact-handled; DFLAW = direct-feed low-activity waste; DWPF = Defense Waste Processing Facility; HLW = high-level radioactive waste; IDF = Integrated Disposal Facility; IHLW = immobilized high-level radioactive waste; ILAW = immobilized low-activity waste; IXC = ion exchange column; LAW = low-activity waste; LCF = latent cancer fatality; LLW = low-level radioactive waste; MEI = maximally exposed individual; MLLW = mixed low-level radioactive waste; mrem/yr = millirem per year; NL = not listed; PM = process module; PMn = particulate matter with an aerodynamic diameter less than or equal to n micrometers; RCRA = Resource Conservation and Recovery Act; RH = remote-handled; ROI = region of influence; SA = Supplement Analysis; SST = single-shell waste storage tank; TRU = transuranic; TSD = treatment, storage, and disposal; WTP = Waste Treatment and Immobilization Plant.

3.3 Resource Areas Analyzed in Detail

The environmental resource area screening process described in Section 3.2 (Table 3-1) identified five resource areas related to 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 include the installation and operation of temporary facilities in 200E that would be similar to those evaluated in 200W in the SA-05 (DOE 2025d). It would also include the development of a staging/storage area similar to, but smaller than, the one evaluated in SA-05. Otherwise, the proposal does not involve the construction or operation of any facilities that have not been evaluated previously under NEPA (including subsequent SAs) or existing facilities that have not been licensed and permitted for air emissions by the applicable state regulatory agency. The potential use of the onsite treatment facility was analyzed in both the TC&WM EIS and SA-05. 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 out-of-state disposal facilities. The TC&WM EIS presented potential emissions of criteria and toxic air pollutants associated with the construction, operation, and deactivation of proposed facilities 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 (selected in the ROD) are presented in Table G-167 of the TC&WM EIS (DOE 2012).

The transportation of pretreated (or solidified) waste by truck or rail to offsite TSD facilities 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.[9] These evaluations did not include offsite transportation of waste for treatment and/or disposal for Alternative 2B but did include some offsite transportation of radioactive waste as an element of Alternative 3B. To estimate the relative contribution of air emissions that include offsite transportation of pretreated or solidified waste for treatment and/or disposal, DOE compared the transportation emissions of carbon monoxide, nitrogen oxides, and GHGs to similar emissions for Tank Closure Alternative 2B (the bounding value) during operations.

Two scenarios are considered for this analysis: truck transport of pretreated (or solidified) waste and rail transport of pretreated (or solidified) waste. These are addressed separately below.

Truck Transportation

To estimate vehicle emissions of total hydrocarbons, carbon monoxide, nitrogen oxides, and total GHGs (expressed as carbon dioxide equivalent [CO_2eq]), total truck transportation miles were multiplied by emission rates for each pollutant (Table 3-2). These emission rates are consistent with those used in SA-03 for secondary waste management and SA-05 for 200W Tank Waste Treatment. 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

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

mile (Quiros et al. 2017). The GHG emission rate for regional highway driving conditions was selected because it best characterizes the average driving conditions for the transportation routes for the shipments to WCS or Energy*Solutions*, which are characterized by varying amounts of higher-speed Interstate highway and slower-speed hill-climb driving conditions. 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.

Table 3-2 Emission Rates for Heavy-Duty Diesel Vehicles

Emission Pollutant	Emission Rate (grams/mile)[a]
Total hydrocarbons[b]	0.269
Exhaust carbon monoxide[b]	2.000
Exhaust nitrogen oxides[b]	4.169
Total particulate matter less than 2.5 microns[b]	0.119
Total GHG (CO_2eq)[c]	1,755

CO_2eq = carbon dioxide equivalent; GHG = greenhouse gas; $PM_{2.5}$ = 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.

The estimated truck emissions from transporting pretreated liquid (or solidified) waste are presented in Table 3-3. Although the transportation of solidified waste would generate the highest air emissions, the estimated annual truck emissions for either scenario would represent a small addition to the projected emissions from the TC&WM EIS.

Table 3-3 Estimates of Emissions (MT per year) - Truck Transportation

TSD Facility	Round-Trip Truck Miles/Year	Emission Pollutant (MT per year)				
		Total HC	Exhaust CO	Exhaust NO_X	Total $PM_{2.5}$	Total GHG (CO_2eq)
Pretreated Liquid Waste Shipments						
WCS	768,000	0.21	1.5	3.2	0.092	1,348
Solidified Waste Shipments						
WCS	2,176,000	0.59	4.4	9.1	0.26	3,818

CO = carbon monoxide; CO_2eq = carbon dioxide equivalent; HC = hydrocarbon; MT = metric ton; NO_x = nitrogen oxides; $PM_{2.5}$ = particulate matter less than 2.5 microns; TSD = treatment, storage, and disposal.

The air quality impacts in the TC&WM EIS included the operational emissions of the WTP Pretreatment Facility concurrently with the operation of WTP and the 200 Area tank farms. As noted in the DFLAW SA-02, the Pretreatment Facility has been indefinitely delayed. Conservatively adding the emissions from offsite truck transportation of pretreated waste would increase Alternative 2B estimated emissions by less than 1 percent for all criteria pollutants.[10] This proposed offsite transportation would not substantially increase the annual estimated emissions of carbon monoxide, nitrogen oxide, or $PM_{2.5}$. The TC&WM EIS did not estimate emissions of total hydrocarbons, so there is no direct comparison. The truck transportation of pretreated waste would

[10] 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.

add such a small amount of hydrocarbons (up to 0.57 metric tons [MT]) to the environment, air quality impacts would not be expected.

As indicated in Table 3-3, GHG emissions could increase by less than 4,000 MT annually for truck transportation of pretreated (or solidified) waste. To put this into perspective, the estimated GHG emissions for Alternative 2B were 145,000 MT per year (DOE 2012, Appendix G, Table G-167). The incremental increase in annual GHG emissions from adding offsite truck transportation of pretreated waste would be about 2.6 percent for the Proposed Action. Although there would be an increase in GHG emissions, the increase would be very small compared to the annual estimate of GHG emissions for Alternative 2B, especially considering that the total includes full operations of the WTP Pretreatment Facility.

Rail Transportation

Similar to the analysis for truck transportation, this section estimates locomotive emissions of total hydrocarbons, carbon monoxide, nitrogen oxides, particulate matter, and total GHGs (expressed as CO_2eq) associated with rail transportation of pretreated (or solidified) waste. Since some truck transportation would also be required (*see* Table 2-3), that contribution is also included. The EPA has published emission standards for locomotives that would be used for freight transportation from the Hanford Site to either WCS or Energy*Solutions* (40 CFR Part 1033). EPA (2009) provides emission rates that can be applied to meet these emission standards. This analysis uses emission rates associated with line-haul freight locomotives and assumes that the locomotives would meet Tier 4 requirements for equipment manufactured after 2015. Table 3-4 presents the emission factors used to develop the appropriate emission rates. These factors are presented in units of grams per brake-horsepower-hour. By applying a conversion factor of 20.8 brake-horsepower per gallon of diesel fuel, which is used by EPA (2009) for large line-haul freight locomotive applications, the factors are converted to grams per gallon emission rates.

Table 3-4 Emission Rate Information for Freight Locomotives

Emission Pollutant	Line-Haul Emission Factors (g/bhp-hr)
Total hydrocarbons	0.04
Exhaust carbon monoxide	1.28
Exhaust nitrogen oxides	1.00
Total particulate matter less than 10 microns	0.015

Source: EPA 2009
bhp = brake-horsepower; g = gram; hr = hour

The USDOT provides annual reporting statistics that include energy intensity (or efficiency) for rail freight transportation. The most recent published data (2019) indicates that rail freight transportation had an energy intensity of 14,453 British thermal units (BTU)/freight car mile (USDOT 2024). By applying the energy conversion factor for diesel fuel (137,381 BTU/gallon), the analysis estimates the number of gallons per year required to transport the pretreated waste (EIA 2024). For rail transportation of pretreated waste, the locomotives would use approximately 10,882 gallons of diesel fuel for the year (assuming five railcars per train shipment). For rail transportation of solidified waste, the locomotives would use approximately 20,400 gallons of diesel fuel for the year These emissions assume a round-trip mileage because DOE expects that the transportation packages would be returned to the Hanford Site for re-use.

Based on the emissions factors in Table 3-4 and the conversion to the estimated gallons per year, Table 3-5 presents the annual emissions from rail transportation of pretreated liquid (and solidified) waste. The contribution of truck usage during the rail scenario (approximately 12,000 miles per year for liquid waste and about 32,000 miles for solidified waste) would add 1–2 percent of the emissions estimated in Table 3-3 to the values presented in Table 3-5. The estimated annual emissions from a rail transportation scenario would represent a small addition to the projected emissions from the TC&WM EIS—smaller than those associated with truck transportation. Therefore, each of these entries would be less than the impacts discussed above and are not further evaluated.

Table 3-5 Estimates of Emissions (MT per year) - Rail Transportation

TSD Facility	Freight Car Miles/Year	Emission Pollutant (MT per year)				
		Total HC	Exhaust CO	Exhaust NOx	Total $PM_{2.5}$	Total GHG (CO_2eq)
Pretreated Liquid Waste Shipments						
WCS	103,440	0.009	0.29	0.23	0.0034	171
Truck transportation to railhead	0	0.0032	0.025	0.051	0.0015	22
Total	103,440	0.013	0.31	0.27	0.0055	194
Solidified Waste Shipments						
WCS	193,950	0.017	0.54	0.42	0.0064	321
Truck transportation to railhead		0.009	0.064	0.133	0.004	56
Totals	**193,950**	**0.026**	**0.6**	**0.55**	**0.01**	**377**

CO = carbon monoxide; CO_2eq = carbon dioxide equivalent; HC = hydrocarbon; MT = metric ton; NO_x = nitrogen oxides; $PM_{2.5}$ = particulate matter less than 2.5 microns; TSD = treatment, storage, 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 hundreds of thousands of canisters/packages of radioactive waste (e.g., HLW, LLW, MLLW, and transuranic [TRU] waste) that would result from the operations of all facilities needed to support treatment of tank waste (DOE 2012, Tables 4-23 and 4-142). This included both contact- and remote-handled waste canisters/packages.

Personnel operating the temporary MCS or the loading via external valving at the EMF would be subject to radiation exposure associated with the external radiation emitted from the 5,000-gallon transportation package during the connection and disconnection process. This would be no different than the typical exposure associated with connection and disconnection of HIHTLs during normal tank farm operations and likely would involve even less exposure. This would be because pretreated waste in AP-106 will have previously been processed through TSCR or other pretreatment capability and had the key radionuclides (e.g., Cs-137) removed. Additionally, because no radioactive air emissions are expected, there would be no potential radiological exposure to the offsite public from normal operations of the Proposed Action.

As presented above in Table 3-1, the TC&WM EIS projected an average annual worker dose of 160 mrem and the peak dose to a member of the offsite public of 10 mrem (DOE 2012). Nothing associated with the Proposed Action would increase the expected annual exposure to workers or the public.

The staging/storage area may contain a number of filled transportation packages that could range as high as 30 at any one time. The external exposure rates for these filled packages would be relatively low; however, DOE would manage access to the storage area to keep worker doses under the regulatory limit. Additionally, normal worker exposure at the Hanford Site would continue to be monitored and administratively controlled.

Transportation of pretreated waste off site for treatment and out-of-state for disposal, as opposed to onsite treatment and disposal evaluated in the TC&WM EIS, would essentially transfer a portion of the potential normal operational health impacts from the Hanford Site workforce to workers at commercial treatment and disposal facilities. 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, radiation protection programs would maintain doses within compliance limits set by their respective governing authorities (e.g., U.S. Nuclear Regulatory Commission [NRC], Occupational Safety and Health Administration, WDOH, Texas Commission on Environmental Quality (TCEQ), UDEQ, or governing state equivalent).

Operations at the commercial TSD facilities would be conducted in accordance with licenses and permits issued by their respective states (i.e., Texas and/or Utah). Because the pretreated 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.

Based on the above considerations regarding both workers and the public, there would be no substantive difference in normal operational radiological health impacts to workers or the public from those originally estimated in the TC&WM EIS associated with the treatment and disposal of pretreated waste. Potential health impacts associated with onsite treatment were previously evaluated in the TC&WM EIS and SA-05. 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 include 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 5×10^{-4} per year, or once in 2,000 years.

The TC&WM EIS also evaluated a spray release of pressurized liquid from a mispositioned jumper in an SST transfer into or out of a receiver tank. A jumper is a short connection pipe that is used to route tank waste from one line to another when transferring waste to a specific location. It was

postulated in the TC&WM EIS (Section K.3.4.5.1 of DOE 2012) that a release could occur if a jumper is mispositioned and pinhole leaks develop at both ends of the jumper. All spray particles were assumed to evaporate to less than 10 microns before reaching the ground. All of the spray was considered respirable. The release was estimated to be 14 gallons of untreated tank waste. For this accident, the potential consequences are presented in Table 4-50 of DOE (2012). Since this accident involved untreated waste from an SST (as opposed to pretreated waste from AP-106), it bounds potential consequences of a potential spill or spray release from the MCS operations or associated with external valving or piping from the EMF to the tanker truck or transportation package. Potential impacts from accidents associated with onsite treatment were previously evaluated in the TC&WM EIS and SA-05.

Because the USDOT-compliant transportation packages would be rated as LSA-II, they would meet NRC requirements for *Packaging and Transportation of Radioactive Material* (10 CFR 71.71), which require the package to survive drop tests based on its weight. Therefore, any accidents involving staged transportation packages would be bounded by the accident scenarios presented in the TC&WM EIS (DOE 2012).

Proposed treatment and disposal of the pretreated waste at WCS or Energy*Solutions* 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 pretreated (or solidified) waste would meet the existing waste acceptance criteria and would be within the volumes stipulated in the facilities' state permit(s) or license(s).

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 pretreated (or solidified) waste to TSD facilities 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 contact- and remote-handed TRU waste canisters and packages over a wide array of radiological concentrations and intensities. 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 (DOE 2012). As mentioned earlier, SA-05 evaluated the offsite transportation, treatment, and disposal of up to 32 million gallons of pretreated tank waste from 200W.

Offsite transportation of LLW and MLLW is strictly regulated. In accordance with 49 CFR, Subtitle B, Subchapter C, 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 Orders 460.2B, *Departmental Materials Transportation Management*, and 460.1D, Chg. 1, *Hazardous Materials Packaging and Transportation Safety*.

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 to truck or rail crews

and the public being directly dependent upon external dose rates associated with the waste packages.[11]

Pretreated liquid (or solidified) LLW/MLLW to be shipped off site are expected to have low levels of radioactivity. This is substantiated by the following considerations: (1) as identified in Section 2.3.3, the pretreated liquids would all qualify to be transported in LSA-II tankers or transportation packages;[12] and (2) 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 (DOE 1997). To support the SA-05 analysis (DOE 2025d), H2C prepared dose estimates for four different groups of 5,000-gallon transportation packages loaded with pretreated tank waste (H2C 2025). Based on a comparison of the curie loading for the pretreated tank waste from AP-106 (as presented in Section 2.3.1) and the range of curie loadings for transportation packages considered in SA-05 (Table 2-1 of DOE 2025d), the estimated exposure rates for the transportation packages carrying the waste from AP-106 would range from 0.3 to 0.85 millirem/hour.

Under the Proposed Action, the pretreated liquid (or solidified) waste could be transported off site by truck or rail. DOE (and state inspectors, where required) would inspect vehicles and loads for shipments leaving the Hanford Site. States may inspect shipments to confirm regulatory compliance. The shipments would be expected to use the most direct routes that minimize radiological risk (DOE 1999). Shipments leaving the Hanford Site area for out-of-state destinations (e.g., Texas or Utah) would be transported over federal highways for the majority of their routes. For rail shipments, DOE would transport the packages to a rail spur in the southern portion of the Hanford Site or in a suitable location in the surrounding Tri-Cities, Washington, area and transfer the transportation packages to a suitable railcar for shipping.

For truck shipments, data from the Federal Motor Carrier Safety Administration (FMCSA) for 2021 indicates that large trucks are involved in 35.2 accidents involving an injury or fatality per 100 million miles traveled (FMCSA 2024).[13] For rail shipments, the Federal Railroad Administration (FRA), an agency within the USDOT, annually prepares a safety analysis report that includes a 10-year overview and statistics regarding accident safety. The latest 10-year overview (2015−2024) indicates that freight trains travel an average of about 460 million miles each year and have an average of about 7.65 accidents or events either at highway crossings or along the rail line per 1 million train miles. From those accidents, the average number of fatalities that occur per year is about 0.37 fatality per 1 million train miles—98.5 percent of which occur at highway intersections (FRA 2024).

DOE has an outstanding transportation safety record. During fiscal year 2022, DOE transported more than 3,800 hazardous materials shipments for more than 7.5 million miles without a single USDOT-recordable transportation accident.[14] DOE's transportation contractors 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

[11] 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.
[12] Per 49 CFR 173.427(a)(1), the external dose rate of an LSA package may not exceed an external radiation level of 1 rem per hour at 3 meters from the unshielded material.
[13] FMCSA (2024) reports that 33.6 accidents involving injury and 1.57 accidents involving a fatality occurred in 2021 per 100 million miles of large truck transportation.
[14] Latest available data published in a May 2024 fact sheet regarding the Hanford Site transport of TBI liquid, https://www.hanford.gov/files.cfm/TBI_Transportation_Fact_Sheet.pdf

training and emergency planning through its Transportation Emergency Preparedness Program.[15] 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.

Impact Assessment

The analysis in this SA evaluates four transportation scenarios to ship the equivalent of up to 1.2 million gallons of pretreated liquid waste annually. These scenarios include (1) truck transportation of the pretreated liquid waste to the WCS FWF (approximately 1,600 roadway miles); (2) rail transportation of the pretreated liquid waste (approximately 2,155 rail miles); (3) truck transportation of solidified waste to the WCS FWF; and (4) rail transportation of the solidified waste. Tables 2-2 and 2-3 above provide the specific analytical parameters for these scenarios, which include the assumption of an average of five railcars per train shipment. The Proposed Action is assumed to operate at this rate for about 10 years. As identified in Section 2.1, DOE expects to only ship up to 600,000 gallons of pretreated liquid in the first year. However, for analysis purposes in this section, the impacts are evaluated for the full volume of 1.2 million gallons per year (or its solidified equivalent) for 10 years.

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 1997). 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 evaluated multiple alternatives for decentralization, centralization, and regionalization of LLW/MLLW. Under a few of the truck alternatives for decentralization and regionalization, DOE determined that the impacts of transporting approximately 25,000 truck shipments of LLW and MLLW (over approximately 9 million miles) would be as follows (DOE 1997, Section 7.4.2 and Table E-15):

- Between 0.1 and 0.2 LCF from radiological doses to either the truck crews or the public along the transportation routes;[16]
- About 0.1 fatality from vehicle emissions; and
- About 0.5 fatality from physical injuries from traffic accidents.

Similarly, the WM PEIS also demonstrated that rail transportation has slightly lower risks than truck transportation. For the same decentralization and regionalization alternatives as above but using rail transport, there would be about 9,600 shipments of LLW and MLLW (over approximately 3.75 million rail miles) that would result in the following impacts (DOE 1997, Section 7.4.2 and Table E-16):

- Between 0.02 and 0.07 LCF from radiological doses to either the rail crews or the public along the transportation routes;
- About 0.12 fatality from locomotive emissions; and

[15] *See* https://teppinfo.com

[16] The WM PEIS (DOE 1997) analyses reflect a lower dose-to-LCF risk factor (5×10^{-4} LCFs per person-rem) than DOE uses present-day (6×10^{-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.

- About 0.0075 fatality from physical injuries from rail accidents.

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.[17] 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 into an SA and used to develop estimates for use in a screening analysis. This SA uses an analytical comparison based on the impact results presented in the WM PEIS as a primary mechanism for determining dose estimates to the public and truck or rail crews for the proposed offsite shipment of Hanford Site pretreated and/or solidified waste to one or more appropriately licensed and permitted commercial TSD facilities. The associated findings from this screening assessment are presented below in Table 3-6 (for truck and rail transportation of pretreated liquid waste) and Table 3-7 (for truck and rail transportation of solidified waste from onsite treatment). Both tables provide 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 Proposed Action.

Table 3-6 Estimated Radiological Impacts to the Public and Truck Crews for Offsite Pretreated Liquid Waste Transportation (Annual and Total)

Analytical Parameter	Truck Transportation	Rail Transportation[a]
Annual miles	384,000	6,000/51,720
Total miles (10 years)	3,840,000	60,000/517,200
Annual shipments	240	240/24
Total shipments (10 years)	2,400	2,400/240
Annual public LCFs	1.4×10^{-2}	1.4×10^{-3}
Total public LCFs (10 years)	0.14	0.014
Annual crew LCFs	8.1×10^{-3}	4.5×10^{-4}
Total crew LCFs (10 years)	8.1×10^{-2}	4.5×10^{-3}
Annual traffic accident fatalities (nonrad)	6.5×10^{-3}	7.2×10^{-2}
Total traffic accident fatalities (10 years)	0.065	0.072
Maximum reasonably foreseeable accident probability (per year)	9.3×10^{-6}	3.2×10^{-6}

[17] Examples include (1) 46,000 truck shipments of LLW from Paducah to WCS would result in 0.1 LCFs to the public and about 6 nonradiological traffic fatalities (DOE 2020, Table 4-38) and (2) 33,700 shipments of greater than Class C waste across the US would result in 0.04 LCFs and about 2 nonradiological traffic fatalities (DOE 2016, Table 4.3.9-1).

Analytical Parameter	Truck Transportation	Rail Transportation[a]
Probability of a maximum reasonably foreseeable accident in 10 years	9.3×10^{-5}	3.2×10^{-5}
Maximum reasonably foreseeable accident consequences (LCFs)	2.7	7.9
Maximum reasonably foreseeable accident risk from Proposed Action (LCF/year)	2.5×10^{-5}	2.5×10^{-5}
Total risk from a maximum reasonably foreseeable accident over 10 years (LCFs)	2.5×10^{-4}	2.5×10^{-4}

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

a For the rail mode scenario, the packages must first be transported from the Hanford Site to a nearby rail spur by truck. Therefore, the values for shipments and miles report two values (X/Y), where X is the value for truck and Y is the value for rail (i.e., numbers of shipments and shipment miles).

Table 3-7 Estimated Radiological Impacts to the Public and Truck Crews for Offsite Solidified Waste Transportation (Annual and Total)

Analytical Parameter	Truck Transportation	Rail Transportation[a]
Annual miles	1,088,000	17,000/96,975
Total miles (10 years)	10,880,000	170,000/969,750
Annual shipments	680	680/45
Total shipments (10 years)	6,800	6,800/450
Annual public LCFs	3.8×10^{-2}	2.9×10^{-3}
Total public LCFs (10 years)	0.38	0.029
Annual crew LCFs	2.3×10^{-2}	9.7×10^{-4}
Total crew LCFs (10 years)	0.23	9.7×10^{-3}
Annual traffic accident fatalities (nonrad)	1.8×10^{-2}	0.14
Total traffic accident fatalities (10 years)	0.18	1.4
Maximum reasonably foreseeable accident probability (per year)	2.6×10^{-5}	6.2×10^{-6}
Probability of a maximum reasonably foreseeable accident in 10 years	2.6×10^{-4}	6.2×10^{-5}
Maximum reasonably foreseeable accident consequences (LCFs)	2.7	7.9
Maximum reasonably foreseeable accident risk from Proposed Action (LCF/year)	7.1×10^{-5}	4.9×10^{-5}
Total risk from a maximum reasonably foreseeable accident over 10 years (LCFs)	7.1×10^{-4}	4.9×10^{-4}

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

a For the rail mode scenario, the packages must first be transported from the Hanford Site to a nearby rail spur by truck. Therefore, the values for shipments and miles report two values (X/Y), where X is the value for truck and Y is the value for rail (i.e., numbers of shipments and shipment miles).

The screening analysis mentioned above is a tool developed in an Excel spreadsheet based on the results from the WM PEIS transportation analysis; however, it updates certain parameters to allow those results to be scaled to represent potential impacts for relevant transportation projects. Examples of these updated parameters include:

- population data based on the 2020 U.S. Census data;
- changes to the dose-to-LCF conversion factors for workers and the public to reflect updates from those used in1997; and
- updates to accident and fatality incident rates for truck and rail accidents that apply 2017 data from a 2019 USDOT publication.

Incident-free impacts are those associated with routine transportation if no accidents occurred to affect the shipment. These impacts could be from the radiation emitted from the transportation cask or they could be from the exhaust and fugitive dust emitted by the truck or train. Of the four scenarios, annual incident-free impacts to the public would range between 0.0014 and 0.038 LCF—the largest of which would be associated with truck transportation of solidified waste after onsite treatment. Similarly, the annual incident-free impacts to truck and rail workers would range between 0.00045 and 0.023 LCF—the largest of which would also be associated with truck transportation of solidified waste after onsite treatment.

The potential consequences for a maximally foreseeable truck accident would be about 2.7 LCF. Combining this consequence with the annual probability of a maximally foreseeable truck accident, which varies by the number of shipments involved, the annual risk of a maximally foreseeable truck accident would be 0.000025 LCF for shipping pretreated liquid waste and/or 0.000071 LCF for shipping solidified waste. The potential consequences for a maximally foreseeable rail accident would be about 7.9 LCFs. Combining this consequence with the annual probability of a maximally foreseeable rail accident, which varies by the number of shipments involved, the annual risk of a maximally foreseeable rail accident also would be 0.000025 LCF for shipping pretreated liquid and/or 0.000049 for shipping solidified waste. As mentioned above, these estimates were derived from the scaling analysis from the WM PEIS, which assumed that 100 percent of the MLLW would be released from its packaging; 10 percent of that release would be entrained in an aerosol, and 5 percent of the aerosolized release would be respirable. Such aerosolized fraction and respirable fraction are attributed, in the analysis, to both heterogeneous MLLW solids (i.e., a powder) and nonvolatile MLLW liquids. Therefore, both fractions would be applicable to the analysis of an accident scenario involving pretreated liquid waste. However, this assumption would not be applicable for the waste that had been solidified at the onsite treatment facility. Therefore, the scaling analysis over-estimates the relative risk of shipping solidified waste. The solidified waste form would not be in a dispersible configuration.

As mentioned above, the TC&WM EIS Alternative 2B did not include offsite transportation of tank waste; however, the Secondary Waste Management SA-03 and the 200W Tank Waste Treatment SA-05 did evaluate and provide the basis for a decision to transport liquid and solid waste streams to offsite treatment and disposal facilities (*see* Section 1.4 of this SA).

3.3.5 Waste Management

The TC&WM EIS evaluated management of several radiological waste streams, including LLW, MLLW, TRU waste, and HLW. There are two key differences to the proposed waste management in this 200E Tank Waste Management SA and that evaluated in the TC&WM EIS: (1) onsite

management of pretreated waste and (2) the transportation of pretreated (or solidified) tank waste for out-of-state treatment and/or disposal at appropriately licensed and permitted commercial TSD facilities.

3.3.5.1 Onsite Waste Management

The DFLAW SA-02 evaluated the removal of key radionuclides from tank waste and the onsite handling of the LAW by sending the LAW directly to the LAW Vitrification Facility (DOE 2019). SA-02 determined that under DFLAW, the potential waste management impacts were not significantly different from those analyzed in the TC&WM EIS. Under DFLAW, pretreated waste (or LAW) is staged in AP-106 prior to being sent to the LAW Vitrification Facility.

Under the Proposed Action, up to 1,200,000 gallons of waste from 200E would be diverted for either onsite treatment or to offsite commercial TSD facilities annually to ensure that risks associated with the initial processing capability of the LAW Vitrification Facility do not cause an interruption in the retrieval of waste from the SSTs in 200E (as explained in Section 1.1). Ultimately, under the Proposed Action, the same amount of tank waste would be retrieved from SSTs, supernate would be processed through TSCR or future pretreatment capability, and LAW would be staged for treatment. The only differences would be the type of treatment and the location of the treatment and disposal. The Proposed Action would mitigate operational risks of meeting Consent Order and Consent Decree milestones by using either the planned onsite treatment facility or licensed and permitted commercial TSD facilities to grout and dispose of the pretreated waste at their facilities in Texas or Utah as opposed to DOE vitrifying the waste in the LAW Vitrification Facility and disposing of it in the IDF on the Hanford Site.

As noted in Section 2.2, DOE may prepare a staging/storage area in 200E to facilitate onsite management of the empty and filled transportation packages. This area would be the largest under the rail shipment scenario because train shipments would include 5–30 loaded railcars, each with two transportation packages onboard, therefore necessitating a storage capacity of at least 10 filled transportation packages. The estimated 1-acre laydown area would allow DOE to stage/store about 45 containers at any one time—about 30 of which would be empty (either new or returned from the TSD). Having an adequate supply of empty transportation packages would be necessary to provide efficient use of processing capacity and maximize the shipment of the pretreated waste to its offsite destination.

DOE may utilize the planned onsite treatment facility to solidify or grout the pretreated tank waste in 200E. The construction of the onsite treatment facility, which was included in the TC&WM EIS and SA-05, has not yet been initiated, and the Proposed Action would not start in 2026 using this option; however, it could be implemented in the future. Because the operation of the onsite treatment facility was evaluated in the TC&WM EIS and SA-05, the potential waste management impacts have already been addressed. Future potential impacts associated with onsite treatment and the Proposed Action are primarily related to transportation and are addressed in Section 3.3.4.

3.3.5.2 Out-of-State, Commercial Waste Management

As reported in Section 2.3 of this SA, some of the differences evaluated in this SA are related to the transportation, treatment, and disposal of the equivalent of up to 1.2 million gallons of pretreated waste annually. As noted in Section 1.1, a formal waste determination will be made prior to treatment and disposal in accordance with DOE Manual 435.1-1.

The TC&WM EIS did not anticipate offsite treatment or disposal of pretreated tank waste because all tank wastes would be processed through either the LAW Vitrification Facility or the HLW Facility. As discussed above, offsite treatment and disposal of pretreated tank waste (after a LLW determination) would facilitate compliance with the HFFACO/TPA.

Offsite Solidification/Treatment

Potential impacts related to treatment of pretreated liquid waste at the offsite, appropriately licensed and permitted commercial TSD facilities would be minimal under the Proposed Action. Each potential facility is discussed below.

As identified in Section 2.3.2, WCS is permitted, licensed, and authorized to receive, treat, and dispose of Class A, Class B, and Class C LLW and MLLW. Waste treated at WCS would be disposed of in the FWF. DOE would ensure that pretreated wastes meet the *FWF Federal Generator Handbook* (WCS 2025) prior to preparing any shipment from the MCS. This handbook provides guidance and specific criteria for waste acceptance at the FWF in compliance with WCS licenses, permits, and procedures. WCS has capacity to treat and dispose of up to 2 million gallons per year of liquid pretreated waste from the Hanford Site without impacting other waste treatment or disposal commitments (WCS 2024a). Considering that the maximum volume that would be shipped during any 12-month period would be 1,200,000 gallons, WCS' current capacity would be adequate without any necessary adjustments.

Also described in Section 2.3.2, Energy*Solutions* operates a MLLW treatment and disposal facility in Clive, Utah. The Clive LLW facility is licensed by UDEQ for the treatment and disposal of Class A MLLW that meets specified waste acceptance criteria (Energy*Solutions* 2025). Energy*Solutions* has indicated that it has capacity to treat and dispose of 1 million gallons per year of liquid pretreated waste from the Hanford Site without impacting its current operations or commitments (Energy*Solutions* 2024). Considering that the maximum volume that would be shipped during the 12-month period would be slightly over 1 million gallons, DOE would coordinate with Energy*Solutions'* prior to any planned shipment to ensure that the facility had the capacity to accept the waste. The fact that any pretreated liquid waste destined for Energy*Solutions* (Class A waste) could also be sent to WCS for treatment and disposal provides additional options should the need arise.

Per the discussion in Section 2.3.2, PFNW could be used for treatment; however, the solidified waste form would need to be sent to WCS or Energy*Solutions* for disposal. If PFNW were used as an option for treatment, DOE would ensure that pretreated waste meets the PFNW waste acceptance criteria prior to preparing any shipment from 200E. PFNW has indicated that it has capacity to treat and disposition about 1.2 million gallons per year of liquid pretreated waste from the Hanford Site without impacting its current operations or commitments (Perma-Fix 2026).

Although the TC&WM EIS did not anticipate or evaluate offsite treatment of tank waste, any pretreated wastes would meet the appropriate waste acceptance criteria of the proposed commercial TSD, and the proposed volumes would not impact these facilities' current commitments or licensed capacities.

Out-of-State Disposal

Waste Control Specialists Federal Waste Facility

DOE considers any license limits on specific radionuclides when identifying key radionuclides. WCS is licensed for disposal of LLW and MLLW in the WCS FWF under *Radioactive Material*

License No. R04100 Amendment 40 issued by the TCEQ in January 2024.[18] The license for the WCS FWF currently contains a total volume limit of 300,000 cubic yards and total activity limit (total decay corrected radioactivity) of 5,500,000 curies for containerized Class A, Class B, and Class C LLW, collectively. As of December 2024, approximately 97 percent of the current license limit remained available at the WCS FWF (WCS 2024b).

As noted in Table 2-1, the average curie content of a single 5,000-gallon package would be about 2.8 curies and the total maximum inventory of 1,200,000 gallons over 10 years would contain about 6,700 curies. Even if all the waste was sent to WCS, the total activity would represent 0.12 percent of the activity limit. From a volume perspective, the solidified volume of 12,000,000 gallons (over 10 years) would represent about 59,400 cubic yards of solidified waste requiring disposal.[19] This would represent about 20 percent of the remaining available capacity as of December 2024 (WCS 2024b).

EnergySolutions Clive Disposal Facility

Energy*Solutions* (Clive Disposal Facility) is licensed under *Radioactive Material License UT 2300249* (UDEQ 2023), issued by the State of Utah, to receive Class A LLW. The license contains a volume limit for the mixed waste landfill cell of 1,354,092 cubic yards.

If all of the pretreated waste were sent to Energy*Solutions*, the same 59,400 cubic yards as described above would represent about 4 percent of the volume limit. There is no activity limit specified in the license for disposal of waste in the mixed waste landfill cell as long as the Class A waste meets the waste acceptance criteria.

[18] The current license expired in September 2024 but is in "timely renewal status" based on the timely renewal request letter submitted by WCS in September 2023. This status allows the facility to operate under the current license until TCEQ reviews and issues a renewal amendment or the request is denied.

[19] For the purposes of this SA, the waste volume expands by a factor of 1.5 when the pretreated liquid is solidified into a solidified matrix.

4 CUMULATIVE IMPACTS

This chapter presents an analysis of the potential cumulative impacts (or effects) resulting from the Proposed Action. The TC&WM EIS defined cumulative impacts as "impacts that can result from individually minor, but collectively significant, actions taking place over a period of time." This analysis includes impacts from other past, present, and reasonably foreseeable future actions.[20]

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 current Proposed Action and those evaluated in the TC&WM EIS. The chapter also evaluates if there are any new 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 the Proposed Action.

4.1 Incremental Impacts of the 200E Tank Waste Management

As noted in Chapter 3 of this SA, implementation of the 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. These impacts are discussed in the following section in combination with potential impacts from new present and reasonably foreseeable future actions that were not previously included in the TC&WM EIS.

4.2 Evaluation of New 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 when the Proposed Action is scheduled—over the next 10 years. Ongoing and reasonably foreseeable future actions that are considered in this SA include the following:

- Under **DFLAW**, DOE will separate the LAW from other waste in the Hanford Site tanks and vitrify a portion of the LAW. During DFLAW, the supernate portion of the radioactive waste in 200E is transferred and pretreated through the TSCR to remove Cs-137 and solids. The pretreated waste is staged in AP-106 then fed to the WTP LAW Vitrification Facility. The vitrified waste will be disposed of on site at the IDF in 200E. An integral element of DFLAW is the construction of an IXC storage pad in 200E for the loaded IXCs.

  DOE decided to implement DFLAW in an AROD, which was based on the DFLAW SA (SA-02) (*see* Section 1.4 of this SA). The activities evaluated in this 200E Tank Waste Management SA would be accomplished in parallel with DFLAW; however, activities in this SA would remove up to 1.2 million gallons of LAW annually that was destined for treatment in the LAW Vitrification Facility and send it to offsite facilities for treatment and disposal. Therefore, the "cumulative impact" of the Proposed Action would be to reduce

[20] With the rescission of the CEQ NEPA Regulations (40 CFR 1500-1508), subsequent revision of the DOE NEPA implementing procedures (10 CFR 1021), and publication of separate DOE NEPA Implementing Procedures (DOE 2026b), the term "cumulative impacts" is no longer used and defined as the analysis of impacts from other past, present, and reasonably foreseeable future actions. However, DOE remains responsible under the NEPA statute and the DOE NEPA Implementing Procedures for analyzing reasonably foreseeable future actions that have a close causal relationship to the proposed agency action and alternatives. This section of this SA continues to refer to these as cumulative impacts; consistent with the TC&WM EIS.

potential impacts of DFLAW and transfer those impacts of treatment and disposal to the commercial facilities outside of the Hanford ROI. There was no offsite transportation, treatment, or storage proposed under DFLAW.

- Implementation of **DFHLW** (*see* Section 1.1 of this SA) would occur primarily in 200E and would involve bypassing the planned WTP Pretreatment Facility to send HLW directly to the HLW Vitrification Facility. The potential impacts of implementing DFHLW were presented in DFHLW SA-04. The primary elements of DFHLW include the addition of a waste transfer vault in 200E, the construction and operation of a HLW effluent treatment system adjacent to the HLW Vitrification Facility in the WTP, construction of Hanford Site interim storage modules for storage of immobilized HLW until a federal repository becomes available, and the potential construction of multi-use storage tanks with a total 1-million gallon capacity in 200W. This potential 1 million gallons of additional tank storage would add DST storage capacity to 200W to be able to store untreated tank waste and to manage solids and slurries that accumulate as a result of retrievals associated with tank waste treatment at 200W. None of these specific actions have the potential to be cumulative with the Proposed Action.

- As addressed in the **Secondary Waste Management SA** (SA-03) and detailed in Section 1.4 of this SA, DOE plans to transport and treat certain solid and liquid secondary wastes at licensed and permitted commercial treatment facilities off the Hanford Site. DOE also plans to dispose of some of these secondary wastes (after treatment) off site at a licensed and permitted commercial disposal facility. This action would be implemented on an interim basis until such time as enhanced onsite treatment capability is available for DFLAW operations (estimated to be in approximately 10 years). Therefore, much of this action would occur in parallel with the Proposed Action.

  DOE (2023b) presents the potential impacts of this secondary waste management and describes the potentially affected resource areas in addition to those analyzed in the TC&WM EIS. Primarily, the increases in potential impacts were associated with the offsite transportation of secondary waste and included potential impacts to air quality (vehicle emissions), transportation health and safety (incident-free and accident risks), and waste management (TSD facility capacity).

- As mentioned in Section 1.4 of this SA, DOE decided to solidify and dispose of approximately 32 million gallons of pretreated tank waste in 200W off site between 2029 and 2040 as part of **200W Tank Waste Treatment** (DOE 2025c). As identified in that SA, DOE would send an estimated 400 truck shipments annually to WCS, 175 truck shipments annually to Energy*Solutions*, and 8 shipments annually to PFNW. These shipments of liquid pretreated waste were assumed to occur for 11 years (DOE 2025d). Like the Proposed Action in this SA, the shipments of pretreated liquid waste were assumed to use 5,000-gallon transportation packages and be sent to WCS and Energy*Solutions* for treatment and disposal over a period 10 years.

  Similar to the action described for secondary waste management, the actions associated with 200W Tank Waste Treatment would also contribute potential impacts associated with the offsite transportation of pretreated liquid waste (or solidified waste if treated on site) and included potential impacts to air quality (vehicle emissions), transportation health and safety (incident-free and accident risks), and waste management (TSD facility capacity).

4.2.1 Air Quality

The cumulative impacts to air quality result from the combination of vehicle emissions associated with 10 years of offsite truck transportation of pretreated liquid or solidified waste (as reported in Section 3.3.1 of this SA), secondary waste for offsite management and disposal (as evaluated under the Secondary Waste Management SA-03; DOE 2023b), and either pretreated liquid or solidified waste from 200W Tank Waste Treatment (DOE 2025d). Section 3.3.1 also shows that the potential air quality impacts of truck transportation of solidified waste bound those associated with any other transportation or waste form scenario; therefore, only truck transportation of solidified waste is included here. Because implementation of the DFLAW and DFHLW approaches would not notably add radiological or nonradiological emissions to those already analyzed as part of the TC&WM EIS, these actions are not further evaluated in this SA. The combined annual vehicle emissions are presented in Table 4-1.

Table 4-1 Estimated Vehicle Emissions Associated with Cumulative Hanford Waste Transportation

Waste Stream	Emission Pollutant (MT per year)				
	Total HC	Exhaust CO	Exhaust NO_x	Total $PM_{2.5}$	Total GHG (CO_2eq)
200E Solidified Waste	0.59	4.4	9.1	0.26	3,818
Solidified 200W Waste[a]	1.18	8.74	18.22	0.52	7,668
Secondary Waste	0.03	0.24	0.51	0.01	215
Totals	**1.8**	**13.4**	**27.8**	**0.78**	**11,701**

Source: Section 3.3.1, DOE (2023b, 2025d)

CO = carbon monoxide; CO_2eq = carbon dioxide equivalent; GHG = greenhouse gas; HC = hydrocarbon; MT = metric tons; NO_x = nitrogen oxides; $PM_{2.5}$ = particulate matter less than 2.5 microns.

a Because solidified waste resulting from the onsite treatment option in DOE (2025d) results in the largest number of shipments and thus the largest volume of emissions, that option is presented in this table.

Per the discussion provided in Section 3.3.1, these small additions to air emissions would represent less than a 1-percent increase in hydrocarbons, carbon monoxide, nitrogen oxides, and $PM_{2.5}$. The potential GHG emissions would represent an 8-percent increase from those projected in the TC&WM EIS; however, because the Pretreatment Facility would not be operating, these small increases likely would still be within the projected air emissions from the TC&WM EIS.

4.2.2 Public and Occupational Health and Safety (Normal Operations)

The cumulative impacts to health and safety of workers and the public at or near the Hanford Site would not be notably different than those presented in the TC&WM EIS. Implementation of the DFLAW and DFHLW approaches would not be expected to increase the radiological doses to either the workforce or members of the public beyond those projected in the TC&WM EIS. The addition of 1 million gallons of multi-use storage capacity in 200W would be similar to the addition of four WRFs (equal to about 1.8 million gallons) evaluated under each of the TC&WM alternatives (DOE 2012, Section E.1.2.2.8.4).

As stated in both the Secondary Waste Management SA-03 and the 200W Tank Waste Treatment SA-05, transportation of secondary waste and pretreated tank waste off site for treatment (and 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 Site

workforce to workers at commercial treatment and disposal facilities, given that the scopes of work would be similar in nature regardless of location (DOE 2023b, 2025d). 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.

The cumulative impacts at the TSD facilities would be within their existing operating envelopes. Operations at these facilities would be conducted in accordance with licenses and permits issued by their respective states (i.e., Washington, Utah, and/or Texas). Because the pretreated, solidified, and 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 accommodate the entire projected quantity of pretreated and secondary waste being sent from the Hanford Site over the analyzed period (i.e., through 2040).

4.2.3 Public and Occupational Health and Safety (Facility Accidents)

The cumulative impacts associated with facility accidents at or near the Hanford Site would not be notably different than those presented in the TC&WM EIS. Implementation of the DFLAW and DFHLW approaches would not be expected to increase the potential accident consequences or risks beyond those that were projected in the TC&WM EIS (DOE 2019, 2025b).

Treatment and stabilization of pretreated (whether from 200E or 200W) or secondary waste at any of the proposed TSD facilities 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 respective states (DOE 2023b). DOE would ensure that the wastes met the respective waste acceptance criteria before transporting the waste for treatment and disposal.

4.2.4 Public and Occupational Health and Safety (Transportation)

The cumulative impacts associated with radiological transportation would add to the potential impacts presented in the TC&WM EIS. Transportation of radiological materials was evaluated in this SA (*see* Section 3.3.4), the Secondary Waste Management SA-03 (DOE 2023b), and the 200W Tank Waste Treatment SA-05 (DOE 2025d).

The Secondary Waste Management SA, 200W Tank Waste Treatment, and the TBI EA used the same screening analysis (based on the 1997 WM PEIS) as presented in Section 3.3.4 of this SA. The Secondary Waste Management SA-03 evaluated transportation of an average of 8,650 cubic meters per year of solid and liquid LLW/MLLW from the Hanford Site to permitted TSD facilities (DOE 2023b). The 200W Tank Waste Treatment SA-05 evaluated 11 years of transportation of pretreated tank waste (about 2.9 million gallons per year). When the potential transportation impacts from these three actions are combined (Table 4-2), the potential cumulative impacts to the public and the crew remain quite small.

Table 4-2 Cumulative Radiological Impacts to the Public and Truck Crews for Hanford-Related Waste Transportation

Analytical Parameter	200E Solidified Waste	200W Solidified Waste	Secondary Waste	Total
Total miles/year (public)	1,088,000	2,184,600	51,070	3,323,670
Total miles over multi-year Proposed Action period (public)[b]	10,880,000	24,030,600	510,700	35,421,300
Total miles/year (crews)	1,088,000	2,184,600	103,800	3,376,400
Total miles over multi-year Proposed Action period (crews)[b]	10,880,000	24,030,600	1,038,000	35,948,600
Total shipments/year	680	1,650	2,156–2,200	4,486–4,530
Total shipments over multi-year Proposed Action period	6,800	18,150	21,560–22,000	46,510–46,950
Public LCFs from 1 year of shipping	3.8×10^{-2}	0.076	0.0021	0.12
Public LCFs from multi-year Proposed Action period	0.38	0.84	0.021	1.24
Crew LCFs from 1 year of shipping	2.3×10^{-2}	0.050	0.0019	0.075
Crew LCFs from multi-year Proposed Action period	0.23	0.55	0.019	0.80
Accident fatalities (nonrad) per year	1.8×10^{-2}	0.041	0.0017	0.061
Accident fatalities (nonrad) over multi-year Proposed Action period	0.18	0.45	0.017	0.65
Maximum reasonably foreseeable accident probability per year	2.6×10^{-5}	5.0×10^{-5}	1×10^{-6}	(a)
Maximum reasonably foreseeable accident cumulative probability over multi-year Proposed Action period	2.6×10^{-4}	5.5×10^{-4}	1×10^{-5}	(a)
Maximum reasonably foreseeable accident consequences (LCFs)	2.7	2.7	2.6	(a)
Maximum reasonably foreseeable accident risk from 1 year of Proposed Action (LCF/year)	7.1×10^{-5}	1.3×10^{-4}	4×10^{-6}	(a)
Maximum reasonably foreseeable accident cumulative risk from multi-year Proposed Action period (LCFs)	7.1×10^{-4}	1.4×10^{-3}	4×10^{-5}	(a)

Source: Section 3.3.4 and DOE (2023b, 2025d)

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

a 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.

Table 4-2 includes the potential contribution of shipping the solidified waste (because this scenario bounds the shipment of pretreated liquid). Table 4-2 assumes the use of trucks for transportation because that scenario provides the higher potential impacts for incident-free transportation. The potential accident risks (radiological and nonradiological) are provided later in this section.

4.2.5 Waste Management

The cumulative impacts to waste management would include contributions from the current and reasonably foreseeable future actions identified in the preceding discussion.

Under DFLAW, DOE will not be sending any pretreated tank waste off site for treatment or disposal but would manage loaded IXCs on site in 200E. Per DOE (2019), these waste management actions would not be substantively different than the proposed action evaluated in the TC&WM EIS.

Under the DFHLW approach, DOE would not send any waste off site for treatment or disposal. There would be no substantive differences in impacts related to onsite waste management from this approach compared to the management of HLW in the TC&WM EIS. This would include the addition of up to 1 million gallons of multi-use tank storage in 200W.

Three projects (pretreated tank waste from 200E, 200W Tank Waste Treatment [as analyzed in SA-05 DOE 2025d], and secondary waste management [as analyzed in SA-03 DOE 2023b]) would result in a reduction of onsite waste management (including onsite disposal) of solid and liquid LLW/MLLW because waste would be sent to out-of-state, appropriately licensed and permitted, commercial TSD facilities for treatment and disposal. However, there would be a potential cumulative impact of sending additional waste to the same commercial TSD facilities under the three separate proposals. In SA-03, secondary waste was separated into three groups for management: Group 1 is the largest projected annual volume (7,700 cubic meters of solid LLW/MLLW and 590 cubic meters of liquid MLLW) and would be sent to PFNW for treatment and returned to the IDF on the Hanford Site for disposal; Group 2 is a much smaller annual volume (15 cubic meters of solid MLLW and 3 cubic meters of liquid MLLW) and would be sent to a facility in Kingston, Tennessee, for treatment and ultimate disposal at WCS; and Group 3 (annual volumes of 6 cubic meters of solid MLLW and 326 cubic meters of liquid MLLW) would be sent to WCS for treatment and disposal. No secondary waste was assumed to be sent to Energy*Solutions* in Utah.

The 200W Tank Waste Treatment SA-05 evaluated two scenarios for waste treatment and disposal of pretreated tank waste. Under one scenario, 100 percent of the 32 million gallons would be sent as a liquid and grouted at the commercial TSD; under the other scenario, DOE would complete construction of an onsite treatment facility, grout the waste at Hanford, and send the solidified waste for disposal at the commercial TSDs (DOE 2025d). Preliminary indications in the SA-05 were that as much as 70 percent of the 200W tank waste may be required to be sent to WCS (could be greater-than-Class A LLW).

As identified in Section 3.3.5, in 2024 WCS indicated that it had the capacity to treat up to 2 million gallons per year of waste from the Hanford Site without impacting other waste treatment or disposal commitments. At the same time, Energy*Solutions* identified that it could treat an additional 1 million gallons per year of liquid MLLW. PFNW recently updated its capacity to 1.2 million gallons per year (Perma-Fix 2026). By conservatively combining all potential liquid waste streams that have been identified from Hanford over the past several years (as shown in

Table 4-3), DOE could be sending nearly 4.2 million gallons of MLLW to a combination of these facilities. While this is roughly equivalent to the current stated capacity, DOE will only ship waste off site to commercial TSDs in accordance with their facility licenses and waste acceptance criteria. Thus, one of two scenarios will occur: (1) a combination of WCS, Energy*Solutions*, and PFNW will be able to accept and treat, then dispose of the solidified MLLW at WCS or Energy*Solutions* within their permitted authority or (2) DOE will not implement the full volume of its proposed actions. Neither scenario would increase potential environmental impacts, and DOE would consider the need for additional NEPA review at that time.

Table 4-3 Cumulative Hanford Waste Volumes Projected for Treatment and Disposal at a Commercial TSD (MLLW, cubic meters)

Waste Type	200E Tank Waste	200W Tank Waste	Secondary Waste[a]	Total
Maximum Potential Liquid Volume Requiring Treatment (gallons)				
Annual	1,200,000	2,909,091	86,000	4,195,091
Multi-year [c]	12,000,000	32,000,000	860,000	44,860,000
Solidified Waste Requiring Disposal (cubic meters)[b]				
Solid (annual)	6,814	11,012	332	18,158
Solid (multi-year) [c]	68,140	121,132	3,320	192,592

Source: Section 3.3.4 and DOE (2023b, 2025d)

MLLW = mixed low-level radioactive waste

a MLLW secondary waste was identified as Group 3 in DOE (2023b) and was assumed to be treated and disposed of at WCS.

b According to PNNL (2013), the volume of pretreated liquid waste increases by an expansion factor ranging from 1.5 to 1.8 when solidified. The lower end of the range (1.5) results in the highest projected radionuclide concentration and the highest waste classification estimate. The expansion factor, final waste volume, and associated impacts vary based on the tank waste composition and grout formulation used. For purposes of analysis, this SA also uses a 1.5 expansion factor; however, if the actual expansion is higher during implementation of the Proposed Action, the disposal volume presented in this SA could be higher as well. Solid waste volumes are provided in cubic meters and 1 cubic meter is equivalent to about 264 gallons.

c The duration of the proposed 200E action is 10 years (2026–2035). The duration of the 200W action is 11 years (2029–2049). The duration of the secondary waste management action is also 10 years (2026–2035).

With respect to disposal capacity, Table 4-3 also provides the annual and multi-year totals of solidified waste volumes for all three Hanford projects. Assuming an expansion factor of 1.5, the waste would represent a disposal volume of almost 193,000 cubic meters. As identified in Section 3.3.5.2, WSC had a remaining permitted volume capacity of about 291,000 cubic meters as of 2024. If all of the pretreated waste from AP-106 were to be disposed of at WCS in combination with the other reasonably foreseeable actions from Hanford, it would represent 66 percent of the remaining volume capacity. If the higher expansion factor was encountered (1.8) for the three Hanford waste streams disposed of at WCS, the resultant disposal volumes would represent more than 79 percent of the remaining volume capacity.

As stated in Section 2.3.2, DOE anticipates that most, if not all, of the shipments of pretreated waste would meet Class A LLW limits; therefore, the actual volume of treated waste that would be disposed of at WCS would be much lower.

5 DETERMINATION

DOE prepared this SA in accordance with DOE's NEPA Implementing Procedures. The Proposed Action evaluated in this SA is to implement risk mitigation measures in 200E to send up to 1.2 million gallons per year of pretreated waste from 200E to either the onsite treatment facility or off site to licensed and permitted commercial TSD facilities for treatment. In either case, the solidified waste would be disposed of at the commercial TSD outside the state of Washington. These measures would ensure that the flow of waste from the DSTs in AP Tank Farm to AP-106 is not interrupted by a failure to process liquid out of AP-106. This would meet the near-term needs for retrieval of SSTs in 200E.

The Proposed Action would either use existing facilities at EMF or implement temporary onsite facilities in 200E, which would be similar to the facilities implemented under the 200W SA-05, to load 5,000-gallon transportation packages or tanker trucks for transporting the pretreated waste. The offsite transport, treatment, and disposal of tank waste would be similar to the actions evaluated in the 200W Tank Waste Treatment SA-05, Secondary Waste Management SA-03, and the TBI EA. While the TC&WM EIS did not originally anticipate offsite treatment and disposal of tank waste, the volume of projected pretreated waste would be within the permitted capacity of the commercial TSD facilities and would not result in significant impacts. Implementation of the Proposed Action of this SA would facilitate compliance with the HFFACO/TPA without a significant increase in environmental impacts.

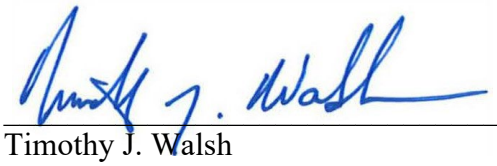
The TC&WM EIS evaluated potential environmental impacts from the emission of criteria pollutants, toxic pollutants, and carbon dioxide. The incremental increase in emissions related to the transportation of pretreated waste from 200E for treatment and out-of-state disposal would add less than 1 percent to the nonradiological emissions analyzed in the TC&WM.

Transportation of pretreated liquid waste from 200E for treatment and/or disposal outside the state, as opposed to the onsite treatment and disposal evaluated in the TC&WM EIS, would transfer a portion of the potential normal operational health impacts from the Hanford Site workforce to workers at commercial TSD facilities. Additionally, the Proposed Action would not introduce any unique facility accidents that had not been evaluated in the TC&WM EIS (including previous SAs). Accordingly, radiological impacts and accident risk resulting from the Proposed Action would be comparable to those presented in the TC&WM EIS for treatment/disposal activities originally proposed for the Hanford Site.

The estimated radiological health risks to the public and transportation crews from transportation of solidified waste are low (0.38 and 0.23 LCF, respectively, for the truck scenario for solidified waste) for the approximate 10-year Proposed Action period. Potential radiological health risks for rail transport of the pretreated waste would be even smaller.

The pretreated waste would be treated and/or disposed of at appropriately licensed and permitted commercial TSD facilities within their permitted capacity and would not impact their current operations or commitments.

In accordance with NEPA and DOE's NEPA Implementing Procedures, DOE prepared this SA to evaluate whether the proposed change and new circumstances and information require supplementing the existing TC&WM EIS or preparing a new EIS. DOE has considered all relevant information in this SA and the project record. DOE concludes that the changes to the Proposed Action are not substantial changes relevant to environmental concerns, nor are there substantial new circumstances or information about the significance of any adverse effect. Consistent with DOE's NEPA Implementing Procedures, Section 3.9, these changes do not require a new or supplemental EIS. No further NEPA documentation is required.



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Appendix A: Project Background Details

A.1 Tank-Side Cesium Removal

The TSCR system supports DOE's initial strategy for DFLAW and separates cesium and undissolved solids from tank waste, resulting in pretreated waste that will provide initial feed to the WTP LAW Facility. The TSCR system is located adjacent to the Hanford Site's AP Tank Farm on a 3,000-square-foot site and comprises three enclosures: a Process Enclosure, a Control Enclosure, and an Ancillary Enclosure containing supporting equipment and chemicals. The TSCR system began operating in January 2022. Waste is staged in a DST from which the waste is transferred to the TSCR system. The waste first passes through a pair of parallel filters that removes undissolved solids. From there, the filtered waste proceeds to a series of three IXCs where the cesium is removed. The pretreated waste then passes through a delay tank and gamma detectors before leaving the system, after which it is transferred into a second DST (AP-106) that will act as the feed tank for the WTP LAW Facility. The solids removed by filtration are returned to a DST and the spent IXCs are transferred to an interim storage pad for eventual disposal. At the end of the mission, the current baseline plan includes sending the IXCs to a future crystalline silicotitanate (CST) Processing Facility to remove the resin and feed it to the WTP HLW Facility. Figures A-1 and A-2 provide an overview of the TSCR and the Process Enclosure.

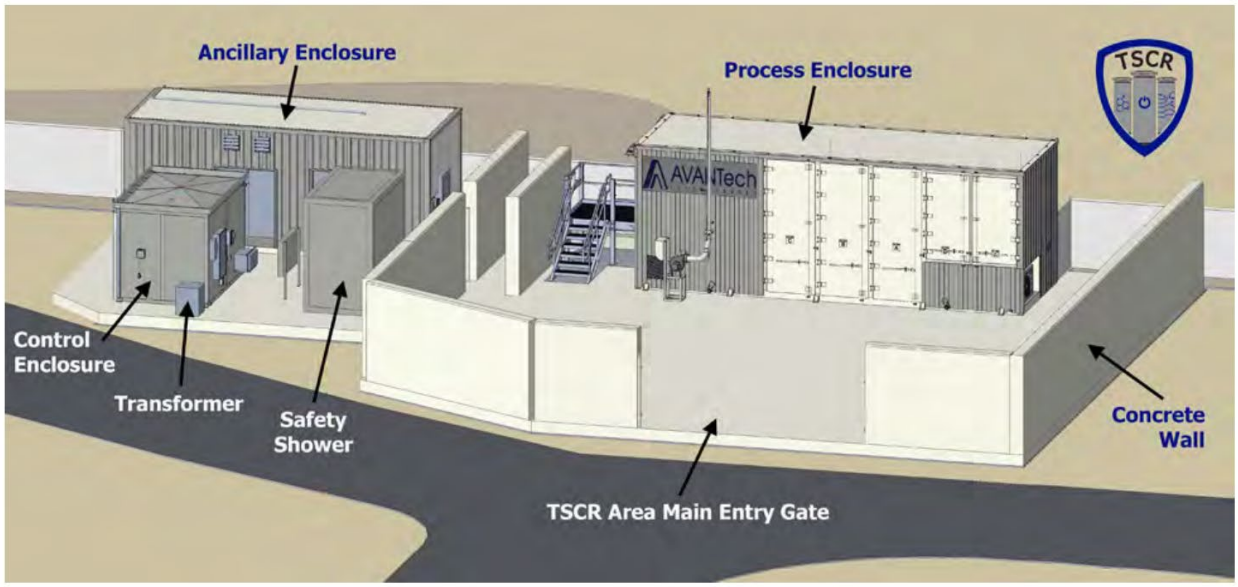

Figure A-1 TSCR Overview

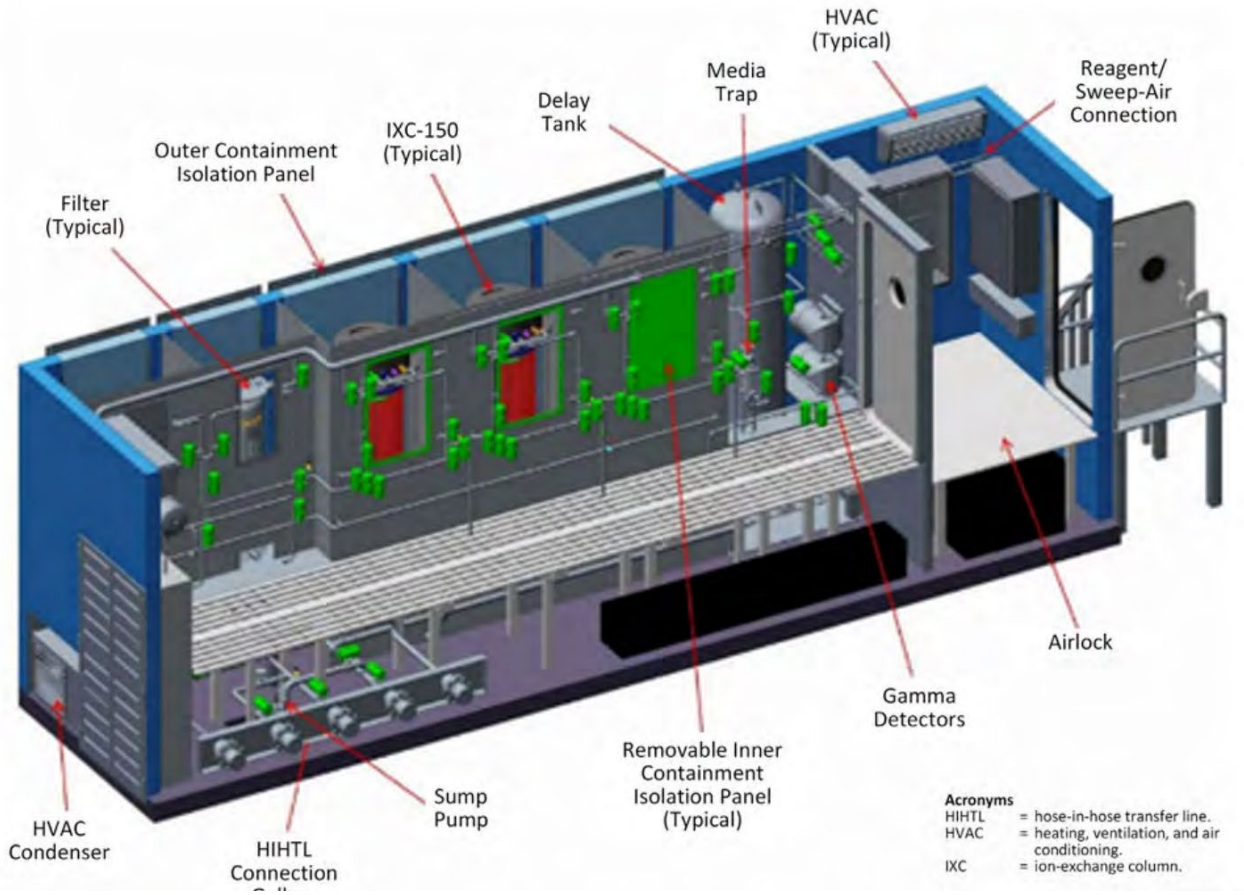

Figure A-2 TSCR Process Enclosure