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

OFFICE OF RIVER PROTECTION
United States Department of Energy
P.O. Box 450
Richland, Washington 99352

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ACRONYMS AND ABBREVIATIONS

BOF	balance of facilities
CFR	*Code of Federal Regulations*
DFLAW	direct-feed low-activity waste
DOE	U.S. Department of Energy
DST	double-shell waste storage tank
EMF	Effluent Management Facility
ETF	Effluent Treatment Facility
EIS	environmental impact statement
FR	*Federal Register*
HLW	high-level radioactive waste
IDF	Integrated Disposal Facility
IHLW	immobilized high-level radioactive waste
IX	ion exchange
LAB	analytical laboratory
LAW	low-activity waste
LAWPS	Low-Activity Waste Pretreatment System
LERF	Liquid Effluent Retention Facility
MREM	millirem
NEPA	*National Environmental Policy Act of 1969*
RCRA	*Resource Conservation and Recovery Act*
ROD	Record of Decision
SA	supplement analysis
SST	single-shell waste storage tank
TC&WM EIS	*Tank Closure and Waste Management Environmental Impact Statement for the Hanford Site, Richland, Washington*
TSCR	Tank-Side Cesium Removal
TWRS	Tank Waste Remediation System
TWRS EIS	*Tank Waste Remediation System, Hanford Site, Richland, Washington, Final Environmental Impact Statement*
U.S.C.	*United States Code*
WAC	*Washington Administrative Code*
WTP	Waste Treatment and Immobilization Plant

1 INTRODUCTION

1.1 Background

In December 2012, the DOE issued the *Final 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 SSTs at the Hanford Site. DOE issued the first in a series of RODs for the Final TC&WM EIS on December 13, 2013 (Volume 78 of the *Federal Register*, page 75913 [78 FR 75913]).[2] For the tank closure portion of the alternatives, which encompasses operations of the tank farm and WTP, DOE announced that it would: (1) retrieve 99 percent of the waste from the SSTs; (2) treat tank waste, including pretreatment of tank waste with separation into LAW and HLW; and (3) dispose of the vitrified LAW and secondary waste[3] and construct IHLW interim storage modules to store the IHLW prior to disposal.[4]

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 Facility and the LAW Facility, respectively, for further treatment. The WTP, as analyzed in the TC&WM EIS, also contained a LAB and 22 other support facilities referred to collectively as the BOF. When DOE issued the ROD in 2013, its plan was to start operation of all the WTP facilities at the same time.

Due to technical issues with the WTP Pretreatment Facility and HLW Facility, only the LAW Facility, LAB, and BOF are near completion. To begin treating waste as soon as practicable, DOE has developed a sequenced approach that would treat LAW first—no later than 2023. The sequenced approach, which DOE refers to as DFLAW, would pre-treat and send the LAW waste stream from the tank farms directly to the LAW Facility for immobilization. To do this, DOE would need the facilities and functions identified and discussed in Section 1.2 below.

DOE NEPA implementing regulations at Title 10 CFR 1021.314(c) allow for preparation of a SA to assist in determining whether a change to the proposal represents a substantial change relevant to environmental concerns or if there are significant new circumstances or information relevant to environmental concerns. DOE has prepared this SA in accordance with these

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

[2] DOE issued an amended ROD related to the management of cesium and strontium capsules on May 18, 2018 (83 FR 23270).

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

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

regulations to determine whether a supplemental or new NEPA document should be prepared. This SA provides an analysis of the DFLAW approach relative to the analysis in the TC&WM EIS to determine if there are substantial changes to the proposal or if there are significant new circumstances or information relevant to environmental concerns when compared with those presented in the TC&WM EIS.

1.2 Proposed Action Evaluated in this Supplement Analysis

DOE proposes to implement the DFLAW approach in order to begin treating LAW no later than 2023. To accomplish this, DOE needs the following facilities and functions: the EMF, a cesium removal system to remove cesium from the DST supernatant,[5,6] some additional transfer lines, and a storage pad for cesium IX Column Storage Pad. (Note: As currently envisioned, the cesium removal system [LAWPS] project would be deployed in phases. Phase One would employ a single [TSCR] unit followed by either the use of a permanent cesium removal capability or an additional TSCR units to provide the necessary throughput to support full operation of the LAW Facility [Phase Two of the LAWPS project]). The EMF and cesium removal system facilities, which are further described in Chapter 2 of this SA, would perform some of the same functions that the WTP Pretreatment Facility would perform, thereby allowing DOE to proceed with the DFLAW approach.

In the Final TC&WM EIS, DOE described a concept that involved sequencing the startup of the facilities and operations of the WTP. Under that concept, referred to in the Final TC&WM EIS as the "Vision for WTP Project Transition to Operations," DOE would finish construction and operate certain facilities that would allow DOE to better align tank farm operations and WTP treatment capabilities, which in turn would allow DOE to treat supernatant waste earlier than treatment would occur if all WTP facilities were required to start operations at the same time. In Appendix E, Section E.1.3.3.2 of the Final TC&WM EIS, DOE concluded that this concept, now referred to as DFLAW, was bounded by the tank closure alternatives analyzed in the TC&WM EIS. This SA analyzes the implementation of the DFLAW approach to determine whether NEPA analysis supplemental to the Final TC&WM is needed.

1.3 Purpose and Need for the Proposed Action and this Supplement Analysis

The Proposed Action evaluated in this SA would enable DOE to proceed with DFLAW and enable DOE to comply with the Amended Consent Decree milestone for completion of hot commissioning of the WTP LAW Facility by December 31, 2023 (see text box).

[5] Supernatant waste consists of liquid waste lying above precipitated material or sludge.
[6] This system will also include solids filtration.

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

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

The purpose and need for this SA is to inform a determination by DOE as to whether additional NEPA analysis is required. If there are substantial changes to the proposal or significant new circumstances or information relevant to environmental concerns as that presented in the Final TC&WM EIS, DOE would prepare supplemental NEPA documentation for the Proposed Action. Otherwise, DOE may make a determination that the Proposed Action may proceed without further NEPA documentation.

1.4 National Environmental Policy Act Documents Related to the Proposed Action

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

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

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

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

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

1.5 Scope of this SA and Organization

This SA analyzes whether implementing the DFLAW approach constitutes a substantial change to the proposal or if there are significant new circumstances or information relevant to environmental concerns compared to those presented in the final TC&WM EIS. Chapter 2 of this SA presents a description of the Proposed Action, while Chapter 3 presents the comparative analysis of the potential environmental impacts of the Proposed Action and those in the TC&WM EIS. Chapter 4 presents potential cumulative impacts of the Proposed Action. Chapter 5 provides DOE's conclusion and determination. Lastly, Chapter 6 presents a bibliographic listing of the references cited in this SA.

2 PROPOSED ACTION

2.1 Direct-Feed Low-Activity Waste Overview

As discussed in Section 1.2, the Final TC&WM EIS (Section E.1.3.3.2) described the functions that DFLAW would perform on supernatant waste from Hanford's DSTs. DFLAW would, however, perform some of these functions in facilities that are different from those described in the EIS. To accomplish DFLAW, DOE would need to complete construction of the following facilities: the EMF, a cesium removal system (initially a TSCR unit followed by either an additional TSCR unit or construction and use of a permanent cesium removal capability—all under the LAWPS project), necessary transfer lines, and an IX Column Storage Pad. The facilities would all be located in the 200 East Area, which over the past several decades has been a heavily impacted and highly disturbed, industrial area. The functions of evaporation, filtration, and cesium IX that the WTP Pretreatment Facility would have performed on tank waste[7] would instead be performed by the EMF and the cesium removal system. The AP Tank Farm requires some upgrades, which are addressed in the TC&WM EIS (Section E.1.2.2.7.4).

Other WTP pretreatment functions, such as the HLW Facility's solid wash and leach reagents and strontium/transuranic precipitation, are not needed at this time because DFLAW would not treat the sludge waste in the tanks; this sludge would eventually be treated in the HLW Facility. DFLAW would treat the supernatant tank wastes, which contain very little solids. DOE would control the feed of supernatant to the cesium removal system to prevent the introduction of waste streams that would not meet the LAW Facility waste acceptance criteria and, thus, could not be treated at the LAW Facility. Most of the other facilities that would be needed for DFLAW (e.g., LAW Facility, LAB, and IDF) would be unchanged from those analyzed in the TC&WM EIS.

DOE does not intend to operate the Pretreatment Facility at the same time as the EMF and the cesium removal system. Therefore, potential environmental and human health impacts associated with those facilities would not result in added cumulative impacts compared to the impacts presented in the TC&WM EIS for the WTP Pretreatment Facility.

Table 2-1 identifies the functions needed for DFLAW and whether those functions were evaluated in the Final TC&WM EIS.

[7] These functions are described in Section E.1.2.3.1, "Waste Treatment Plan" and in Figure E-12, "Simplified Block Flow Diagram for the Current Waste Treatment Process," of the Final TC&WM EIS.

Table 2-1. Functions and Facilities Needed for Direct-Feed Low-Activity Waste Treatment

Required Function	Facility Needed to Perform Required Function	Function Analyzed in Final TC&WM EIS under Alternative 2B?	Discussion[a]
Waste transfers among tanks and to a pretreatment facility	Tank farm pumps and transfer lines	Yes (2.2.2.1.2; 2.2.2.1.4; E.1.2.2.7)	The upgrades to the tank farms analyzed in the TC&WM EIS included replacement of components, such as pumps and surface leak detectors, and installation of transfer lines. DFLAW would require these upgrades and the installation of associated transfer lines.
Evaporation of excess liquids from tank waste and management of effluents from LAW and LAB	EMF	Yes (E.1.2.3; E.1.2.3.1; E.1.2.3.1.1)	The EMF function is equivalent to the evaporation capability of the WTP's Pretreatment Facility, which was analyzed in the TC&WM EIS. The EMF is being constructed within the site analyzed for the WTP, about 130 feet from the WTP Pretreatment Facility.
Pretreatment of LAW (cesium removal)	TSCR/permanent cesium removal capability (or two TSCR units)	Yes (2.2.2.2; 2.2.2.2.1; E.1.2.3; E.1.2.3.1; E.1.2.3.1.1)	The function of the cesium removal system is equivalent to the filtration and cesium IX processes of the WTP Pretreatment Facility. The TSCR/permanent cesium removal capability (or two TSCR units) would be located adjacent to the AP Tank Farm.
Production of vitrified LAW	LAW Facility	Yes (2.2.2.2; 2.2.2.2.1; 2.5.2.2.2; E.1.2.3; E.1.2.3.1; E.1.2.3.1.3)	No change.
Laboratory analyses	LAB	Yes (2.2.2.2.10; E.1.2.3; E.1.2.3.1.6)	No change.
Support systems for treatment of LAW	BOF	Yes (2.2.2.2; 2.2.2.2.10; E.1.2.3; E.1.2.3.1.6)	DFLAW would require 13 of 22 WTP facilities designated as BOF. Support systems include electric power, heating, cooling, chilled water, compressed air, sewer, and storm drains All facilities have been constructed and were analyzed in the TC&WM EIS.
Disposal of treated LAW and solid secondary wastes generated by the treatment processes	IDF	Yes (2.2.2.3; E.1.2.4; E.1.2.4.2; E.1.2.4.2.3; E.1.2.4.5)	No change. If it is decided to vitrify the spent resin from the columns, the empty IX columns (after disposition of the resin) would be transported and disposed of as MLLW in accordance with applicable laws and regulations and DOE decisions.
Treatment of liquid secondary waste generated by the treatment process	LERF/ETF	Yes (E.1.2.4; E.1.2.4.5)	No change. Under DFLAW, the function of the LERF/ETF is the same as that analyzed in the TC&WM EIS. The volume of waste that would be sent to LERF/ETF under DFLAW would be a smaller volume than when all the WTP facilities are operational.

Table 2-1. Functions and Facilities Needed for Direct-Feed Low-Activity Waste Treatment (continued)

Required Function	Facility Needed to Perform Required Function	Function Analyzed in Final TC&WM EIS under Alternative 2B?	Discussion[a]
Interim storage of cesium IX columns	IX Column Storage Pad	No	The analysis in the TC&WM EIS treats cesium IX and solids filtration as inherent to all waste processing through the WTP Pretreatment Facility for the life of the plant (E.1.3.3.2, E.1.2.3.1); however, the TC&WM EIS did not explicitly analyze interim storage of spent IX columns loaded with IX media and cesium, nor did it specifically address the construction and operation of an IX Column Storage Pad.

a. All proposed and existing facilities and functions associated with the DFLAW approach are within a previously disturbed, industrial environment, which has been addressed in both the TWRS and TC&WM EISs.

ETF=Effluent Treatment Facility; IDF=Integrated Disposal Facility; LERF=Liquid Effluent Retention Facility.

Figure 2-1 shows the proposed location of the DFLAW facilities. As Figure 2-1 indicates, the TSCR/permanent cesium removal capability (or two TSCR units) would be located adjacent to the AP Tank Farm. Regardless of which cesium removal system is employed, these facilities would pretreat the waste going to the LAW Facility by removing cesium and solids in order to meet the LAW Facility waste acceptance criteria. The waste pretreated by the cesium removal system would be transferred to the LAW Facility through a new transfer line, which would tie into an existing line. The LAW Facility would immobilize the waste by turning it into molten glass and pouring it into steel containers.[8] The containers would be transported by truck to the IDF.

2.2 Effluent Management Facility

The EMF has a footprint of approximately 32,000 square feet and is being constructed within the 65 acres of the WTP complex that were analyzed in the TC&WM EIS. It houses tanks, an evaporator, and process piping systems required to manage effluent from the LAW and LAB facilities.[9] The concentrated effluent from the evaporator will be sent to the LAW Facility for vitrification, consistent with the design analyzed in the TC&WM EIS for the Pretreatment Facility's evaporator function. DOE has installed four vessels in the EMF that were originally intended to be used in the Pretreatment Facility and is using the WTP Pretreatment Facility's evaporator design for the EMF.

The EMF in the DFLAW approach configuration has replaced the function of the "LAW feed evaporator" that was analyzed as part of the WTP's pretreatment capabilities in the TC&WM EIS (Section E.1.2.3.1.1). The EMF will be used to reduce the amount of liquid effluent from the LAW Facility's radioactive liquid waste disposal system, the LAB's radioactive liquid waste disposal system, and the caustic scrubber effluent from the LAW secondary offgas/vessel vent process system.

[8] At full capacity, the LAW Facility would have two melters that could produce 30 metric tons of glass per day. It would treat approximately 2 million gallons of low-activity tank waste each year.

[9] The effluent stream would come from the LAB's radioactive liquid waste disposal system and from the LAW Facility secondary offgas/vessel vent process.

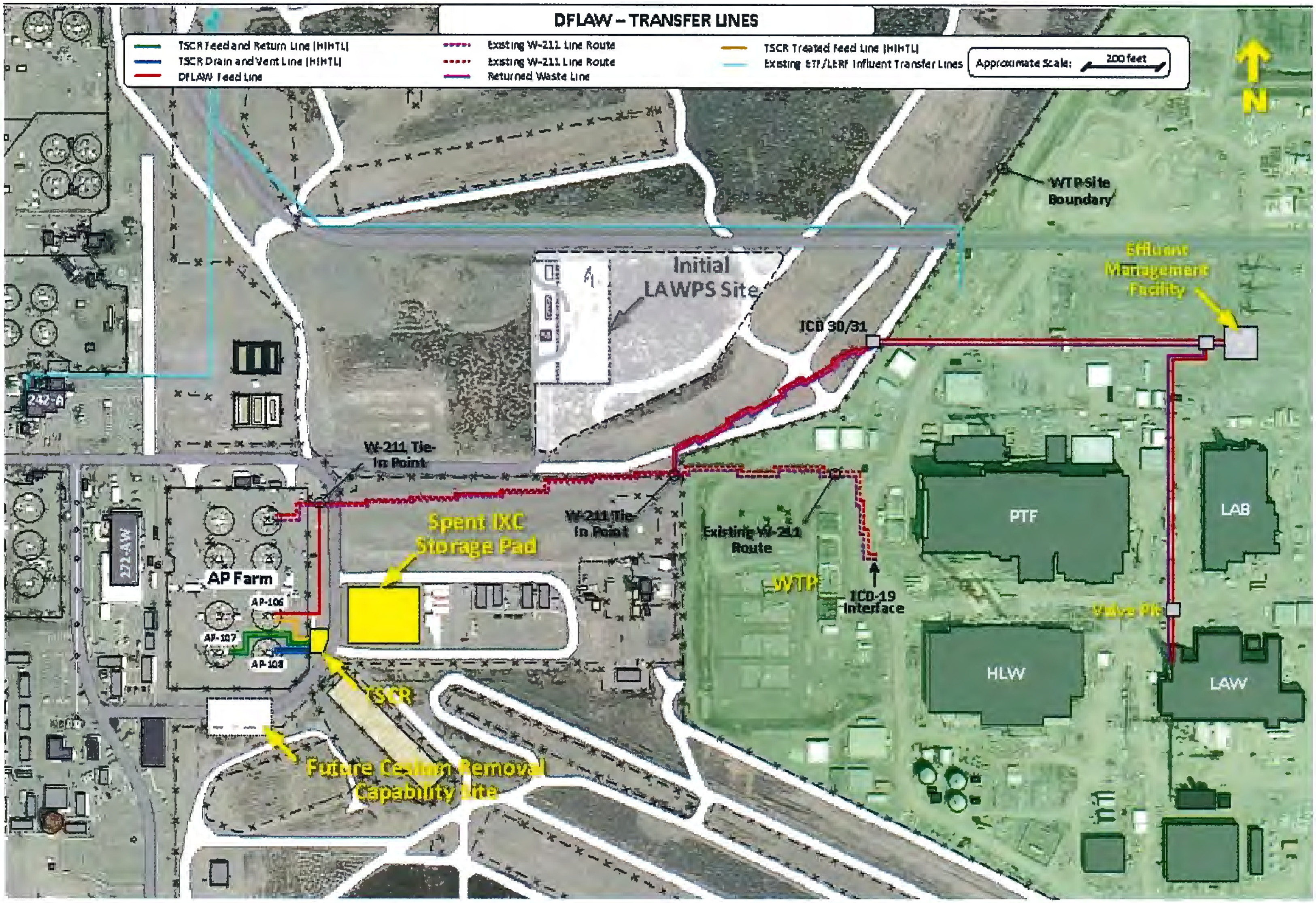

Figure 2-1. Proposed Location of Direct-Feed Low-Activity Waste Facilities

2.3 Cesium Removal System

The WTP Pretreatment Facility evaluated in the TC&WM EIS included functions of "ultrafiltration" and "cesium ion exchange," which involve removal of solids and cesium from tank waste. The TC&WM EIS considered the potential environmental impacts of a standalone facility, which has since been renamed to LAWPS (the initial LAWPS location is identified on Figure 2-1). DOE now has proposed that the DFLAW approach begin with a cesium removal system that uses a single TSCR unit, followed by either use of an additional TSCR unit to provide the necessary throughput to support full operation of the LAW Facility or use of a permanent cesium removal capability. These are described in Section 2.3.1 and Section 2.3.2 of this SA, respectively.

The "cesium ion exchange" function in the WTP Pretreatment Facility is designed to use elutable IX columns that would temporarily bind the cesium to the IX media and then chemically strip the media to return the cesium to the feed stream for the HLW Facility for vitrification (TC&WM EIS, Section E.1.2.3.1.1). The cesium removal system for DFLAW proposes to use non-elutable IX columns that permanently bind the cesium to the IX media; therefore, the spent IX columns would be stored until the media containing the cesium could be sent to the HLW Facility for vitrification.

2.3.1 LAWPS Project Phase One – Single Tank-Side Cesium Removal Unit

The TSCR system would be a modular, skid-mounted unit located just east of the AP Tank Farm (see Figure 2-1), designed to receive tank supernatant waste, use filters to remove suspended solids, and treat the tank supernatant waste by removing radioactive cesium using an IX subsystem. The liquid and gaseous process effluents from the TSCR system would be returned to an AP Tank Farm DST through hose-in-hose transfer lines. Waste with cesium removed would be stored in another AP Tank Farm DST and pumped in batches through buried transfer lines to the LAW Facility for vitrification.

The TSCR system would consist of pre-filtration and cesium IX unit process operations located inside of a process enclosure, approximately the size of an intermodal shipping container (i.e., 35' × 10' × 14'). Waste feed would be delivered from a DST to the process enclosure interface via a transfer pump and hose-in-hose transfer lines. The TSCR process enclosure would contain three IX columns. When one or more of the IX columns becomes fully loaded with cesium, the spent columns would be taken out of service, dewatered, dried, and replaced. The dewatering would entail displacing the liquid waste remaining in the IX column with caustic solution followed by a water rinse. The caustic and water flush would be returned to an AP Tank Farm DST. Following flushing, each spent column would be air-dried. The drying process is expected to consist of draining an IX column and then pushing roughly 30 cubic feet per minute of dry air through each IX column in up-flow for approximately one week. Air and liquids generated during the drying process would be managed with other DFLAW effluents to ensure that there are no inadvertent releases to the environment.[10] The loaded columns are expected to be placed on the IX Column Storage Pad, as described in Section 2.4 of this SA. Newly installed

[10] For the TSCR units, the air and liquid effluents associated with the drying process would be transferred back to an AP Tank Farm DST. For the permanent cesium removal capability, the facility would have a dedicated ventilation system to filter and manage air effluents. The liquid effluents would also be transferred back to a DST.

IX columns may require preconditioning prior to use, which may require flushing with a caustic solution. After preconditioning, the caustic preconditioning solution would be sent to an AP Tank Farm DST. If no preconditioning is required, then no additional secondary waste will be generated. The throughput of a single TSCR unit is approximately 5-10 gallons/minute.

Each of the IX columns used with the TSCR unit would be approximately 10 feet tall with a 34-inch outside diameter and have a cesium load range from approximately 25,000 curies to a maximum loading of about 150,000 curies. At full operation of a single TSCR, DOE expects that, on average, two loaded columns would be generated each month. Therefore, DOE estimates that approximately 120 IX columns would be generated from five years of operation of a single TSCR unit in Phase One.

2.3.2 LAWPS Phase Two – Additional TSCR or Permanent Cesium Removal Capability

Under Phase Two of the LAWPS project, DOE anticipates adding another TSCR unit to provide the necessary throughput to support full operation of the LAW Facility or constructing and using a permanent cesium removal capability to meet the WTP throughput requirements (10 gallons/minute). If selected, the second TSCR unit is expected to be located adjacent to the existing Phase One TSCR and operate in the same manner as the first.

As currently envisioned, the selected site for a permanent cesium removal capability would have a footprint of approximately 20,000 square feet and be located immediately south of the AP Tank Farm and southwest of the Phase One TSCR unit (see Figure 2-1). The permanent cesium removal capability could be a cast-in-place concrete and steel facility designed to receive tank supernatant waste from the DST system, filter out suspended solids, and treat the tank supernatant waste by removing radioactive cesium using an IX subsystem.

LAWPS – TSCR AND PERMANENT CESIUM REMOVAL CAPABILITIES

Functionally, the TSCR unit and the permanent cesium removal capability would operate similarly to filter out suspended solids and treat the tank supernatant waste by removing radioactive cesium using an IX subsystem. While the TSCR unit would be portable and have less treatment capacity than the permanent cesium removal capability, it could be brought online sooner and thus would enable DOE to comply with the milestone for completion of hot commissioning of the LAW Facility by December 31, 2023.

The permanent cesium removal capability would include pre-filtration and cesium IX subsystem operations located inside of a main process building. Waste feed would be delivered from a DST to the process enclosure interface via a transfer pump and an encased waste transfer line. The pre-filtration subsystem would consist of a filter unit that could be back-flushed and/or chemically cleaned to remove fouling. Filter flush solution consisting of back-pulsed waste with solids removed from the filter would be sent back to an AP Tank Farm DST. The LAW feed, with the cesium removed, would then be transferred to another AP Tank Farm DST via a dedicated waste transfer line. From the AP Tank Farm DST, the waste is fed to the LAW facility for vitrification. The main process building would contain three IX columns. When fully loaded, an IX column would be taken out of service, dewatered, dried, and replaced, as described above for the TSCR IX column. The loaded columns would be placed on the IX Column Storage Pad, as described in Section 2.4 of this SA.

The pretreated LAW would flow to a designated AP Tank Farm DST, be sampled periodically to confirm that it meets the waste acceptance criteria for the LAW Facility, and then pumped in batches through a buried transfer line to the LAW Facility for vitrification.

Each of the IX columns used with the permanent cesium removal capability would be larger than those used with the TSCR unit (approximately 12 feet tall with a 38-inch outside diameter) and would have a cesium load range from approximately 100,000 curies to a maximum loading of about 300,000 curies. At full operation of the permanent cesium removal capability, DOE expects that, on average, two loaded columns would be generated each month.

2.4 Ion Exchange Column Storage Pad

The IX Column Storage Pad would be a cast-in-place, steel-reinforced concrete structure designed to accommodate receipt and storage of spent columns from the Phase One and Phase Two cesium removal capability (see Figure 2-1). The pad would include a transport pathway, security fencing, and lighting. Whether the TSCR(s) or a permanent cesium removal capability is used to remove cesium, the management of the cesium-loaded media on the IX columns would be similar. The only difference would be that the IX columns from the TSCR are smaller than those expected from the permanent cesium removal capability. Following drying, a transport vehicle would move the spent IX columns to the IX Column Storage Pad for interim storage prior to final disposition.

The IX Column Storage Pad could be as large as 190 feet wide by 180 feet long, which would accommodate the expected number of spent IX columns for Phase One and Phase Two. The pad size would be designed to meet WAC 173-303, "Dangerous Waste Regulations," for container storage requirements for row and aisle spacing. Design parameters for the storage pad include spent column diameter, height, and weight, including the transport vehicle carrying a spent column, and seismic considerations. The pad would be sloped to remove precipitation and include anchor points for the IX columns, as required, to securely hold the columns in position after placement on the pad.

The IX columns are designed to be self-shielded, in that they would not require additional shielding to protect workers from radiation emitted from the cesium-loaded resin. While the design criteria for the IX columns dictate that they be contact-handled (dose rate less than 5 MREM/hr at a distance of 30 centimeters [approximately 1 foot]); the preliminary shielding calculations demonstrate that the expected dose rates would be less than 1 MREM/hr at 30 centimeters.

3 ENVIRONMENTAL CONSEQUENCES

3.1 Introduction

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

3.2 Initial Screening Review

Implementation of DFLAW represents four primary differences from the way the WTP facilities analyzed in the Final TC&WM EIS were configured. These changes include: (1) the construction and operation of the EMF; (2) solids and cesium removal external from the WTP Pretreatment Facility, which could be accomplished by a single TSCR unit followed by either an additional TSCR unit or construction and use of a permanent cesium removal capability; (3) new or modified transfer lines running to and from these facilities; and (4) the construction and operation of the IX Column Storage Pad. The following paragraphs discuss each of these elements, and Table 3-1 provides a comparative analysis. In general, location and functional equivalency were the basis for the comparative evaluation and assessment.

EMF – The WTP Pretreatment Facility, as evaluated in the TC&WM EIS, included two evaporators (a LAW Feed Evaporator and a LAW Melter Feed Evaporator). The EMF uses the tanks intended for the LAW Melter Feed Evaporator and the same evaporator design (but on a smaller scale). The EMF, which is located within the WTP complex, would be functionally equivalent to part of the WTP's pretreatment capabilities analyzed in the TC&WM EIS. Considering that the facilities are functionally equivalent and would be constructed within the WTP footprint, the EMF is not expected to introduce additional potential for environmental impacts beyond those evaluated in the TC&WM EIS. The potential impacts of the WTP Pretreatment Facility were evaluated in the TC&WM EIS, and impacts from the EMF are bounded by the analysis of the WTP Pretreatment Facility (see Table 3-1).

Cesium Removal – The WTP Pretreatment Facility evaluated in the TC&WM EIS included "ultrafiltration" and "cesium ion exchange," both of which involve the removal of solids and cesium from tank waste. DOE now is proposing that DFLAW, under the LAWPS project, include a phased approach that is initiated with the use of a single TSCR unit (Phase One) followed by an additional TSCR unit or construction and use of a permanent cesium removal capability (Phase Two). This proposal would employ similar technologies for cesium removal as the WTP Pretreatment Facility with the exception that the proposed IX media would be non-elutable.[11] The potential impacts of the WTP Pretreatment Facility were evaluated in the TC&WM EIS and impacts from the DFLAW cesium removal capability, with the exception of column storage, are bounded by the analysis in the TC&WM EIS (see Table 3-1).

New Transfer Lines – DFLAW would require the addition of both hose-in-hose transfer lines and buried transfer lines. Hose-in-hose transfer lines would connect the TSCR unit to the DSTs. Buried transfer lines are used to connect the DSTs to the existing feed lines to the WTP. Under the DFLAW configuration, DOE would use the lines that were installed for the W-211 Project (represented by the dotted lines between the W-211 tie-in points on Figure 2-1). These lines were intended to feed waste from the AP Tank Farm to the WTP Pretreatment Facility. Under the DFLAW configuration, DOE would transfer the waste from AP-106 to the EMF low-point drain and over to the LAW Facility. The new transfer line segments[12] that would branch off of the existing lines are also shown in Figure 2-1. In the TC&WM EIS, DOE evaluated upgrades to the tank farms, which included replacement of components, such as pumps and surface-leak detectors, and installation of transfer lines. DOE uses numerous existing transfer lines—both permanent (buried) and temporary (hose-in-hose)—in the 200 Area to move waste among tanks and tank farms. The TC&WM EIS evaluated several new transfer lines in the 200 East Area that would be used to move tank waste to and within the WTP complex from the AP Tank Farm. The 200 East Area is a heavily impacted and highly disturbed area. The new transfer line segments needed for DFLAW would traverse this same area. In Section E.1.2.2.7.4, "Future Transfer Lines," of the Final TC&WM EIS, DOE pointed out that since the exact locations of the waste transfer lines could not be anticipated for all waste movements needed in the future, the TC&WM EIS analyzed three lines—a primary, a secondary, and a spare—located along each potential transfer route that might be needed to move liquid waste to and from various facilities. The TC&WM EIS did not identify any potentially significant impacts from these lines. Moving radioactive waste through both permanent and temporary transfer lines is a common practice at the Hanford Site, and the potential impacts of this activity were analyzed in the TC&WM EIS; impacts from the anticipated new transfer line segments, whether they are permanent or temporary lines, are bounded by the analysis in the EIS (see Table 3-1 below).

IX Column Storage Pad – The TC&WM EIS did not specifically analyze construction and use of a concrete pad for the interim storage of the cesium IX columns. The TC&WM EIS also did not analyze the long-term storage of cesium in spent IX columns on a pad. Therefore, the potential impacts associated with the IX Column Storage Pad are

[11] Non-elutable IX media bind the cesium permanently and results in the need to store the IX columns until final disposition (vitrification), as opposed to elutable IX media, which would allow the cesium to be chemically stripped from the media and sent to the HLW feed stream (as assumed in the TC&WM EIS for the Pretreatment Facility) or back to a DST (as originally planned for the DFLAW analyzed in Appendix E of the TC&WM EIS for the "Vision for WTP Project Transition to Operations" (see Section 1.2 of this SA).

[12] Transfer lines for DFLAW consist of a feed and return line, but are referred to as one segment because the lines are buried in the same trench.

further assessed as part of this SA evaluation and are discussed in Table 3-1 and Section 3.3.

Table 3-1 provides a comparative evaluation of the potential impacts for each of the environmental resource areas analyzed in the TC&WM EIS. The center column presents the summary of potential impacts from the TC&WM EIS for Alternative 2B, which was selected in the 2013 ROD (78 FR 75913). The right-hand column provides an assessment of the potential impacts from implementation of DFLAW[13] for that resource.

[13] In Table 3-1, "DFLAW facilities" refer to the EMF, cesium removal capability, and transfer lines.

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

Resource Area	Impacts in 2012 TC&WM EIS for Alternative 2B	Assessment of Impacts for DFLAW
Land Use	Presented as percent of total land commitment within either the Industrial-Exclusive Zone[a] or Borrow Area C,[b] as appropriate 101 hectares (2 percent) committed to tank closure within the Industrial-Exclusive Zone; 95.1 hectares (10 percent) affected within Borrow Area C. (TC&WM EIS, Section 2.8.1.1)	The footprint of the proposed DFLAW facilities, including the IX Column Storage Pad, is within the Industrial-Exclusive Zone[a] that includes the tank farms and WTP complex. The DFLAW facilities would require no Borrow Area C[b] materials. There would be very negligible differences in the potential land use impacts as evaluated for Alternative 2B. The only notable differences would be the fencing of the storage pad and the potential adjustment to a dirt road for the permanent cesium removal capability.
Visual Resources	Little change in the overall visual character of the 200 Area. (TC&WM EIS, Section 2.8.1.1)	Implementation of DFLAW 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.
Noise and Vibration	Negligible offsite impact of onsite activities. Minor traffic noise impacts. (TC&WM EIS, Section 2.8.1.3)	The proposed DFLAW facilities are functionally equivalent to those evaluated in the TC&WM EIS 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 pad and use of a transport vehicle to place the IX columns on the storage pad. There would be no other noise impacts from operations of the IX Column Storage Pad.
Air Quality	Peak year incremental criteria pollutant – Most stringent guideline/standard (micrograms per cubic meter) 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, Section 2.8.1.4)	The proposed DFLAW facilities are functionally equivalent to those evaluated in the TC&WM EIS 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 and construction of the concrete pad and DFLAW facilities. There would be negligible emissions from the transport vehicle during storage of the IX columns and during their final disposition. The potential increases beyond the emissions evaluated in the TC&WM EIS would be negligible. There would be no air emissions associated with operations of the IX Column Storage Pad.

Table 3-1. Comparative Resource Screening Analysis of Environmental Impacts (continued)

Resource Area	Impacts in 2012 TC&WM EIS for Alternative 2B	Assessment of Impacts for DFLAW
Geology and Soils	Small impact from construction, including potential for short-term soil erosion. Excavation depths limited to 12 meters. New permanent land disturbance, 112 hectares (TC&WM EIS, Section 2.8.1.5)	The footprint of the proposed DFLAW facilities, including the IX Column Storage Pad, is within the Industrial-Exclusive Zone[a] that includes the tank farms and WTP complex. Although construction of the storage pad would increase the amount of non-permeable surfaces, 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. The storage pad would be designed to meet applicable seismic criteria requirements.
Water Resources	Surface Water – Short-term increase in stormwater runoff during construction, but no direct disturbance to surface-water features. No direct, routine discharge of effluents during operations to surface waters or to the subsurface. Water use 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 DFLAW facilities are functionally equivalent to those evaluated in the TC&WM EIS, would not introduce new potential surface water releases or water uses beyond those potential impacts evaluated for Alternative 2B, and are smaller in size than the original LAWPS facility evaluated in the TC&WM EIS. Although construction of the storage pad would increase the amount of non-permeable surfaces, it would have a negligible effect on surface water runoff. Vadose Zone and Groundwater – Similar to surface water, DFLAW 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 cesium removal or from the storage of solid cesium IX columns. Because the cesium-loaded resin would be dried before storage, there would be no potential for groundwater impacts in the event of a postulated accident.
Ecological Resources	Terrestrial Resources – 1.2 hectares of sagebrush habitat affected in the 200 Areas. 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. (TC&WM EIS, Section 2.8.1.7)	The footprint of the proposed DFLAW facilities, including the IX Column Storage Pad, is within the Industrial-Exclusive Zone[a] that includes the tank farms and 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 IX Column Storage Pad.

Table 3-1. Comparative Resource Screening Analysis of Environmental Impacts (continued)

Resource Area	Impacts in 2012 TC&WM EIS for Alternative 2B	Assessment of Impacts for DFLAW
Cultural and Paleontological Resources	Prehistoric, historic, and paleontological resources – No impacts. American Indian Interests – 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 DFLAW facilities, including the IX Column Storage Pad, is within the Industrial-Exclusive Zone[a] that includes the tank farms and WTP complex. There would be no significant differences in potential impacts to cultural and paleontological resources as evaluated for Alternative 2B. There would be no potential for impacts to cultural and paleontological resources from the IX Column Storage Pad.
Socioeconomics	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 region of influence (ROI) – Potential for change in the socioeconomic ROI, including increases in population, demand and cost for housing and community services, and level-of-service impacts on local transportation. (TC&WM EIS, Section 2.8.1.9)	The proposed DFLAW facilities are functionally equivalent to those evaluated in the TC&WM EIS and would not require more resources than full WTP operations. Therefore, DFLAW would not require an increased workforce beyond that evaluated for Alternative 2B. There would be only negligible impacts to socioeconomics resources from construction of the IX Column Storage Pad.
Public and Occupational Health and Safety (Normal Operations)	Normal Operations *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 2.8.1.10)	The proposed DFLAW facilities and functions are equivalent to those of the WTP Pretreatment Facility, which was evaluated in the TC&WM EIS, would be located in the same Industrial-Exclusive Zone,[a] and would not introduce new or substantively different risks relative to public and occupational health and safety beyond those evaluated for Alternative 2B. However, the TC&WM EIS did not specifically analyze the IX Column Storage Pad or storage of the IX columns on the pad. These elements of the Proposed Action are evaluated in more detail in Section 3.3 of this SA.
Public and Occupational Health and Safety (Facility Accidents)	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*	The proposed DFLAW facilities are functionally equivalent to those evaluated in the TC&WM EIS, would be located in the same Industrial-Exclusive Zone,[a] and would not introduce new or substantively different accident risks relative to public and occupational health and safety beyond those evaluated for Alternative 2B. However, the TC&WM EIS did not specifically analyze the IX Column Storage Pad or storage of the IX columns on the pad. These elements of the Proposed Action are evaluated in more detail in Section 3.3 of this SA.

Table 3-1. Comparative Resource Screening Analysis of Environmental Impacts (continued)

Resource Area	Impacts in 2012 TC&WM EIS for Alternative 2B	Assessment of Impacts for DFLAW
	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 – $1 \times 10^{-6}/3 \times 10^{-5}$ *Noninvolved worker risk* Annual increased risk of an LCF/increased risk of an LCF over life of the project - $8 \times 10^{-3}/2 \times 10^{-1}$ (TC&WM EIS, Section 2.8.1.11) <u>Transportation</u> *Traffic accidents* (nonradiological fatalities) – 1 *Offsite population* Dose (person-rem)/LCFs – $73/4.4 \times 10^{-2}$ *Worker* Dose (person-rem)/LCFs – $260/1.6 \times 10^{-1}$ (TC&WM EIS, Section 2.8.1.12)	
Industrial Safety	Worker Population Impact – Total Project Total recordable cases (fatalities) – 3,880 (0.50) (TC&WM EIS, Section 2.8.1.15)	The proposed DFLAW facilities are functionally equivalent to those evaluated in the TC&WM EIS and would not introduce any new industrial hazards that were not included in the evaluation of Alternative 2B. The addition of the IX Column Storage Pad would introduce negligible industrial safety risks as a result of the construction activities. Operations of the facility would not add staff that could increase the estimated total recordable cases or fatalities.
Environmental Justice - Human health impacts	No disproportionately high and adverse human health impacts on minority or low-income populations due to normal facility operations or postulated facility accidents. (TC&WM EIS, Section 2.8.1.13)	The proposed DFLAW approach would not require an increased workforce beyond that estimated for Alternative 2B and would not contribute to significant and adverse offsite consequences. There would be no disproportionately high or adverse offsite impacts from the IX Column Storage Pad to minority or low-income populations.
Waste Management	<u>Disposed of offsite and/or stored onsite</u> (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 <u>Disposed of onsite</u> ILAW glass (# of canisters) – 213,000 (92,300)	The proposed DFLAW facilities are functionally equivalent to those evaluated in the TC&WM EIS and do not introduce new waste types beyond those evaluated for Alternative 2B. The DFLAW approach could involve temporary storage of the cesium removed from the tank waste until the IX media and the cesium can be run through the HLW Facility for vitrification. However, if that option is exercised, the addition of the IX media is not expected to result in a substantial increase of HLW waste volume or affect the number of HLW glass canisters or HLW melters during full WTP operations. The empty IX columns (after disposition of the cesium-loaded media) would

Table 3-1. Comparative Resource Screening Analysis of Environmental Impacts (continued)

Resource Area	Impacts in 2012 TC&WM EIS for Alternative 2B	Assessment of Impacts for DFLAW
	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, Section 2.8.1.14)	be disposed of as MLLW in accordance with applicable laws and regulations and DOE decisions. The storage and disposition of the IX columns on the IX Column Storage Pad represents a management of waste that the TC&WM EIS did not specifically analyze. These elements of the Proposed Action are evaluated in more detail in Section 3.3 of this SA.

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

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

ASIL=Acceptable Source Impact Level; CH=contact-handled; HLW=high-level radioactive waste; IHLW=immobilized high-level radioactive waste; ILAW=immobilized low-activity waste; LAW=low-activity waste; LCF=latent cancer fatality; LLW=low-level radioactive waste; MLLW=mixed low-level radioactive waste; MREM/yr=millirem per year; NL=not listed; 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; SST=single-shell waste storage tank; TRU=transuranic.

3.3 Additional Evaluations

The construction and operation of the IX Column Storage Pad was not analyzed in the TC&WM EIS. The EIS did, however, include analyses of a similar facility. In Section E.1.2.3.4.5 of the Final TC&WM EIS, DOE evaluated the construction of a new dry-storage facility for cesium and strontium capsules in the 200 East Area. That analysis included an evaluation of the construction resources necessary to build an approximately 70,000-square-foot dry-storage facility. The IX Column Storage Pad for DFLAW would be similar to that dry-storage facility. It would be a cast-in-place, steel-reinforced concrete structure of approximately 190 feet by 180 feet [approximately 34,200 square feet] and would be located in a previously disturbed area that has been surveyed for biological and cultural resources. The IX Column Storage Pad would include a transport pathway, security fencing, and lighting.

The TC&WM EIS concluded that the impacts related to the dry-storage facility would be exceeded or bounded by the impacts from a cesium and strontium processing facility that was analyzed as part of the alternatives in the EIS (Section E.1.2.3.4.5). Given the smaller size of the IX Column Storage Pad, construction impacts would be less than those expected for construction of the dry-storage facility for cesium and strontium capsules. While the new IX Column Storage Pad would not replace the need for the dry-storage facility, one could conclude that the new storage pad would be similar in nature to a facility that was addressed in the EIS. These new construction impacts would be a negligible increase to those evaluated in the TC&WM EIS.

Operationally, the TC&WM EIS did not analyze the interim storage of IX columns loaded with radioactive cesium. As identified in Section 2.4 of this SA, the cesium IX columns stored on the IX Column Storage Pad would be self-shielded and would emit less than 1 MREM per hour of radiation at a distance of 30 centimeters. The columns would also be designed to passively dissipate heat produced by radioactive decay within the columns. The new facility would be classified as a "dangerous waste management unit" under the Hanford Facility RCRA Permit; it would be added to the permit through a modification issued by the State of Washington pursuant to its delegated RCRA authority. The dangerous waste management unit will include a closure plan which will be implemented, when treatment is complete, and the facility is no longer needed.

The environmental resource area screening process described in Section 3.2 (Table 3-1) identified three key areas related to the proposed implementation of the DFLAW approach, specifically the IX Column Storage Pad, for further evaluation: (1) Public and Occupational Health and Safety (Normal Operations), (2) Public and Occupational Health and Safety (Facility Accidents), and (3) Waste Management.

3.3.1 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, low-level radioactive waste [LLW], mixed LLW [MLLW], and transuranic waste) that would result from the operations of all facilities needed to support treatment of tank waste (see Tables 4-23 and 4-142 in Chapter 4, "Short-Term Environmental

Consequences," of the TC&WM EIS). This included both contact- and remote-handled waste canisters/packages. The cesium IX columns would represent a very small increase in the number of the canisters/packages that were analyzed in the TC&WM EIS. The cesium IX columns would be contact-handled with estimated dose rates of less than 1 MREM/hr at a distance of 30 centimeters (approximately 1 foot) and stored on the IX Column Storage Pad within a fenced area in the 200 East Area.

The closest member of the public (hypothetical maximally exposed individual [MEI]) would be more than 6.8 miles from the IX Column Storage Pad (TC&WM EIS, Section K.2.1.1.1.1). The TC&WM EIS provides that the maximum potential annual dose to the MEI as a result of normal WTP operations under Alternative 2B would be approximately 10 MREM (Table 4-23). There would be no atmospheric releases associated with normal DFLAW operations and, at this distance, the direct radiation dose from normal operations of the IX Column Storage Pad (estimated at 1 MREM/hr at a distance of 30 centimeters) would not be measurable. Therefore, there would be no potential for public exposure as a result of normal operations of the IX Column Storage Pad.

For the involved and noninvolved worker, DOE would continue to implement a radiation protection program to maintain doses as low as reasonably achievable for the workforce. As mentioned in Section 2.4 of this SA, the design of the self-shielded IX columns would result in a dose rate at a distance of 30 centimeters (approximately 1 foot) of less than 1 MREM/hr. Dose rate intensity decreases as a function of distance from the source. The ratio of dose rate intensity decreases by the square of the ratio of the increased distance. For instance, if the fence line is about 10 feet from the nearest IX column, the expected dose rate at the fence line from that column would be $1/100^{th}$ (1 percent) of the dose rate at 1 foot.

The average involved worker dose reported in the TC&WM EIS for Alternative 2B and Waste Management Alternative 2[14] is 160 to 200 MREM/year. This average dose represents the projected radiation exposure to all involved workers divided by the number of expected workers. Considering that there would be relatively few involved workers associated with the operation of the IX Column Storage Pad and that dose rates would be relatively low, the increase in the total radiation exposure for all involved workers would not be expected to increase the average involved worker dose beyond that reported in the TC&WM EIS. For noninvolved workers, as discussed above, the dose rate at the fence line of the IX Column Storage Pad would be below 0.01 MREM/hr; therefore, the area outside the fence of the IX Column Storage Pad would not be considered a radiation area in accordance with 10 CFR Part 835, "Occupational Radiation Protection." Based on this radiation level, there would be no significant change in the potential dose impacts to noninvolved workers estimated in the TC&WM EIS.

3.3.2 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 (see Tables 4-50 and 4-149 of the TC&WM EIS). The accidents analyzed included leaks, fires, and design-basis seismic events. The accident with the

[14] Cesium is the primary contributor to annual worker dose. Removing and segregating the cesium into the self-shielded IX columns would gradually reduce the radiation risks to personnel from continued operations and maintenance activities in the tank farms.

highest consequence and risk was a seismic-induced collapse and failure of the WTP. Under that bounding scenario, DOE estimated that the hypothetical MEI 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 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.

For this SA, DOE prepared a preliminary dose consequence analysis for the storage of cesium IX columns at the IX Column Storage Pad (Valentine and Beam 2018). The accidents analyzed included: (1) an IX column drop and spill event, (2) an IX column high-energy impact event (vehicular crash), and (3) a fire (unspecified source) involving all stored IX columns. The IX column drop and high-energy impact events were assumed to involve a single IX column and the analysis assumed that the columns were the larger IX columns at their maximum loading, 300,000 curies. Analysis of the fire event, assumed to involve all of the IX columns on the pad, assumed that there would be 120 columns loaded with an average 192,000 curies per column[15] (Valentine and Beam 2018). The design of the IX columns would ensure that the columns would not fail if subjected to a design-basis seismic event; therefore, a seismic event was not included in the spectrum of accidents considered.

Based on Valentine and Beam (2018), DOE estimates that the potential offsite MEI dose associated with a high-energy, vehicular impact event involving a single, maximally loaded IX column would be approximately 0.031 rem, which is less than 1 percent of the MEI dose estimated in the TC&WM EIS for the highest consequence and risk scenario. Consequently, the potential impacts of the maximum reasonably foreseeable accident associated with the Proposed Action in this SA are bounded by the analysis in the TC&WM EIS.

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

3.3.3 Waste Management

Section 4.1.14 of the TC&WM EIS presents the analysis of short-term environmental consequences to waste management associated with tank closure. The analysis includes the operation of all WTP facilities, including the Pretreatment, HLW, and LAW facilities. The analyzed operations of the Pretreatment Facility assumed that the cesium removed from the

[15] The assumption of 192,000 curies per column for 120 columns corresponds to approximately 23 million curies of cesium on the pad at the time of the event. Esparza (2018) includes the Best-Basis Inventory for the Hanford waste tanks for cesium-137 contained in supernatant, sludge, and saltcake. The inventory of cesium in the supernatant is reported as 17.9 million curies (see Section 3.3.3 of this SA). Therefore, the assumption that 23 million curies could be involved in an accident affecting all IX columns is inherently conservative.

supernatant waste stream would be transferred to the feed stream for the HLW Facility for vitrification. The DFLAW approach would require that the IX columns loaded with cesium removed from the supernatant waste stream be stored on the IX Column Storage Pad until the HLW Facility is ready for their treatment. After the WTP is fully operational, the IX media and cesium may be sent to the HLW Facility for vitrification in accordance with applicable laws and regulations and DOE decisions.

Under Alternative 2B, the TC&WM EIS also evaluated the continued storage and eventual retrieval and treatment of 1,971 radioactive cesium and strontium capsules (DOE 2012, Section E.1.2.3.4.1.). The analyzed treatment of the capsules would include extracting the cesium and strontium from the storage capsules and preparing a slurry waste stream, which would then be sent to the WTP HLW Facility for vitrification. This was assumed to occur during a separate campaign following the treatment of the HLW from the tanks. These capsules are currently stored in the Waste Encapsulation and Storage Facility but will be transferred to a new dry-storage facility in accordance with the amended ROD (83 FR 23270). According to the amended ROD, the capsules contain approximately 46 million curies of cesium.[16]

The loaded IX columns from DFLAW operations may also be treated in the HLW Facility during a separate campaign following the treatment of the HLW from the tanks. This approach does not represent a significant new waste stream, and the management and treatment of the cesium-loaded IX media would be similar to what was analyzed in the TC&WM EIS. After the IX columns were emptied during the vitrification of the cesium-loaded media, the emptied columns would be disposed of as MLLW in accordance with applicable laws and regulations and DOE decisions.

The cesium removal function of DFLAW would be similar to the cesium IX process analyzed for the Pretreatment Facility and would result in the generation of small quantities of radioactive waste. This waste would be considered secondary waste generated during the handling and processing of the tank waste and IX columns and would include contaminated filters, spent IX columns, and liquid effluents. Secondary waste minimization would include practices such as using metal high-efficiency particulate air filters that could be washed in place and reused. In addition, these functions would generate other waste (e.g., personal protective equipment and other incidental waste). Storage of the IX columns is an interim storage solution that would not result in significant additional impacts to waste management. Overall, the secondary waste generated as a result of DFLAW would represent an additional, but small, fraction of the waste streams presented in the TC&WM EIS (see Tables 4-86 and 4-155). Consequently, the potential waste management impacts associated with the Proposed Action in this SA are not significantly different from those analyzed in the TC&WM EIS.

[16] The amount of cesium-137 and strontium-90 to be transferred to the dry storage facility was estimated at 46 million curies (83 FR 23270). The TC&WM EIS evaluated an inventory of 68 million curies of cesium and strontium in the capsules. The supernatant in all 28 DSTs decayed to January 1, 2020, is estimated to contain 17.9 million curies of cesium-137. (Esparza 2018). Therefore, the maximum cesium that could be contained in all IX columns would be less than 17.9 million curies.

4 CUMULATIVE IMPACTS

This chapter presents an analysis of the potential cumulative impacts resulting from the Proposed Action evaluated in this SA. Council on Environmental Quality regulations at 40 CFR 1508.7 define cumulative impacts as "the incremental impacts of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time."

The TC&WM EIS presented the cumulative impacts analysis in Chapter 6, specifically identifying the past, present, and reasonably foreseeable future actions relative to that proposed action. This chapter of the SA evaluates the incremental impacts of the implementation of the DFLAW approach and those evaluated in the TC&WM EIS. The chapter also evaluates if there are any new past, present, or reasonably foreseeable future actions that were not considered in the TC&WM EIS that could contribute to cumulative impacts with the incremental impacts of DFLAW.

4.1 Incremental Impacts of DFLAW

As noted in Chapter 3 of this SA, the implementation of DFLAW has the potential for impacts in occupational and public health and safety (both under normal operations and facility accident conditions) and waste management. These potential impacts, however, were bounded by the impacts presented in the TC&WM EIS or did not present significant new circumstances or information relevant to environmental concerns.

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

As part of the analysis of cumulative impacts for this SA, DOE considered both the timing and the region of influence for each environmental resource area that could be affected by implementation of DFLAW. The timing considered for the implementation of DFLAW is a 10-year operational period starting no later than 2023. As DOE moves from construction of facilities to processing waste, additional testing is ongoing to demonstrate the treatment processes. Scaled down testing has already been completed. Additional tests are currently being done for filtration testing, measuring throughput, and testing bed volumes at laboratory facilities on the feed tank waste. Once the IX column storage pad is operational, there may be small amounts of spent IX resin from these demonstration projects that could be stored at other locations on site or may need be stored on the IX column storage pad. If any additional spent IX resin were going to be stored, it would remain within the limits described, in Valentine and Beam 2018. Because this additional storage would not increase the size of the storage pad and would be within the inventory limits established in Valentine and Beam (2018), there would be no additional, incremental impacts to the health and safety of workers or the public or to potential impacts of accidents or intentional destructive acts.

DOE did not identify any, past, present, or reasonably foreseeable additional future projects, beyond the demonstration testing phase, with potential impacts that would be cumulative with the incremental impacts of DFLAW that were not already identified in the Final TC&WM EIS.

Activities currently being done to support additional demonstration testing do not introduce additional public and occupational health and safety impacts beyond those analyzed in this SA.

5 DETERMINATION

DOE prepared this SA in accordance with 10 CFR 1021.314. Based on the analysis in this SA, DOE's DFLAW Proposed Action does not represent substantial changes to the proposal evaluated in the TC&WM EIS or significant new circumstances or information relevant to environmental concerns that would require preparation of a supplemental EIS. DOE has therefore determined that no further NEPA analysis is required.

Approved: January 17, 2019

Anne Marie White, Assistant Secretary for Environmental Management

6 REFERENCES

10 CFR Part 835. "Occupational Radiation Protection." *Energy*. U.S. Department of Energy.

10 CFR Part 1021. "National Environmental Policy Act Implementing Procedures." *Energy*. U.S. Department of Energy.

78 FR 75913, U.S. Department of Energy, 2013, "Final Tank Closure and Waste Management Environmental Impact Statement for the Hanford Site, Richland, Washington – Record of Decision," December 13.

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DOE (U.S. Department of Energy) 1996. DOE/EIS-0189. *Final Environmental Impact Statement for the Tank Waste Remediation System, Hanford Site, Richland, Washington*. DOE/EIS-0189. August.

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