

Implementing a Low Activity Waste Direct Feed Capability in the Hanford Waste Treatment Plant – 17277

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ABSTRACT

The original design of the Waste Treatment and Immobilization Plant (WTP) requires that all waste be processed through the Pretreatment (PT) Facility in order to separate the low-activity waste and high-level waste streams. The U.S. Department of Energy (DOE) has developed a sequenced approach to completing the WTP Project, beginning with feeding some liquid waste directly to the Low-Activity Waste (LAW) Facility, bypassing the PT Facility. Sending low-activity waste from the tank farms to the LAW Facility is referred to as direct-feed LAW (DFLAW). Using this approach, low-activity waste will be pretreated in a Low-Activity Waste Pretreatment System (LAWPS) for cesium and solids separation to meet LAW Facility safety basis requirements and produce an acceptable low-activity waste product. The waste feed will then be transferred to the LAW Facility where it will be immobilized in glass, poured into stainless steel containers, and then transported by truck to the Integrated Disposal Facility, a mixed waste burial ground located in the Hanford 200-East Area.

The primary driver for the DFLAW approach is to enable commissioning of the LAW Facility for low-activity waste processing prior to the completion and availability of the PT and High-Level Waste (HLW) facilities. As such, the functions intended to be provided to the LAW Facility by the PT Facility and the common functionality with the HLW Facility must be refined and modified to enable DFLAW operations. The DFLAW approach will provide necessary systems and facilities to replace these enabling PT Facility functions until the PT Facility is completed and commissioned. For example, liquid effluents from the LAW Facility, primarily melter offgas condensate, will be processed in a new effluent management facility (EMF) within the WTP footprint rather than sending the effluent back to the PT Facility for processing.

During DFLAW operations approximately 3 785 m³ (1 million gallons) of double-shell tank (DST) waste will be delivered to WTP for treatment each year of operation, and nominally produce 21 metric tons of immobilized low-activity waste glass per day. The resultant freed space in the DSTs will support safe tank farm operation and staging of additional waste for treatment.

In December 2016, DOE executed a contract modification and approved an incremental change to the project's performance baseline to complete the WTP facilities needed to allow direct feed of low-activity waste to the LAW Facility. The revised performance baseline supports completion and cold commissioning of the WTP facilities needed for DFLAW operations no later than August 2023. The design of modifications to WTP facilities needed to enable DFLAW operations is more than 60 percent complete. DOE approved the preliminary safety basis for DFLAW modifications to WTP based on the 30 percent design package in early 2016. Early

construction work for DFLAW modifications to WTP began in mid-2015. Long-lead procurement actions for some of the more complex equipment needed for LAW Facility effluent treatment were initiated in early 2016.

INTRODUCTION

WTP is designed to process Hanford tank waste during a roughly 40-year period. The current design requires waste to be processed through the PT Facility, where it will be separated into a low-activity waste stream to be vitrified in the LAW Facility, and a high-level waste stream to be vitrified in the HLW Facility. The Analytical Laboratory (LAB) and Balance of Facilities (BOF) support these vitrification activities.

In September 2013, DOE introduced a strategy to begin treating waste in the Hanford tank farms with the LAW Facility by providing pretreated feed independent of the PT Facility. This operation is referred to as DFLAW. Using this approach, low-activity waste will be pretreated by a LAWPS in the Hanford tank farms for cesium and solids separation to meet LAW Facility safety basis requirements and produce an acceptable low-activity waste product. The waste feed will then be transferred to the LAW Facility where it will be immobilized in glass, poured into stainless steel containers, and then transported by truck to the Integrated Disposal Facility, a mixed waste burial ground located in the Hanford 200-East Area.

Implementing DFLAW will enable commissioning of the LAW Facility for low-activity waste processing prior to the completion and availability of the PT and HLW facilities. As such, the functions intended to be provided to the LAW Facility by the PT Facility and the common functionality with the HLW Facility must be refined and modified to enable DFLAW functionality. The DFLAW approach will provide necessary systems and facilities to replace these enabling PT Facility functions until the PT Facility is completed and commissioned.

Initiating operations in the LAW Facility before the PT and HLW facilities will reduce programmatic risks and will provide attendant benefits:

- Begins production of low-activity waste glass sooner by processing waste in the LAW Facility while technical issues in the PT and HLW facilities are being resolved
- Demonstrates hot operations of ultra-filtration and ion-exchange technology in the LAWPS prior to implementation in the PT Facility
- Draws down waste inventory in DSTs, making space available to transfer waste from single-shell tanks
- Reduces risk to WTP's production facilities by validating startup and commissioning procedures in the LAW processing facility before applying them the more complex facilities
- Provides early confirmation of the low-activity waste glass performance models in an actual production environment

- Creates a valuable alternate pathway for liquid waste treatment that will be available during planned PT Facility maintenance or outages, ensuring continuity of operations.

DISCUSSION

Direct-Feed Low-Activity Waste Description

The overall DFLAW concept is to transfer pretreated waste from the tank farms through existing and modified waste transfer piping directly to the LAW Facility, bypassing the PT Facility. The DFLAW operation will deliver about 3 785 m³ (1 million gallons) of DST waste for treatment each year of operation, and nominally produce 21 metric tons of glass per day, using two LAW Facility melters, with the necessary support from BOF and LAB.

A new EMF within the WTP site footprint will store, treat, and route the LAW Facility liquid secondary waste streams. Additional WTP modifications include installation of underground waste feed and effluent piping; utility isolations to operate the subset of BOF functions needed during DFLAW operations; modifications to the maintenance shop and warehouse to support operations; final grade and road modifications; and fencing to segregate the operating LAW Facility, BOF, and LAB from the PT and HLW facilities while HLW and PT facilities are still under construction. The integrated DFLAW capability is illustrated on Figure 1.

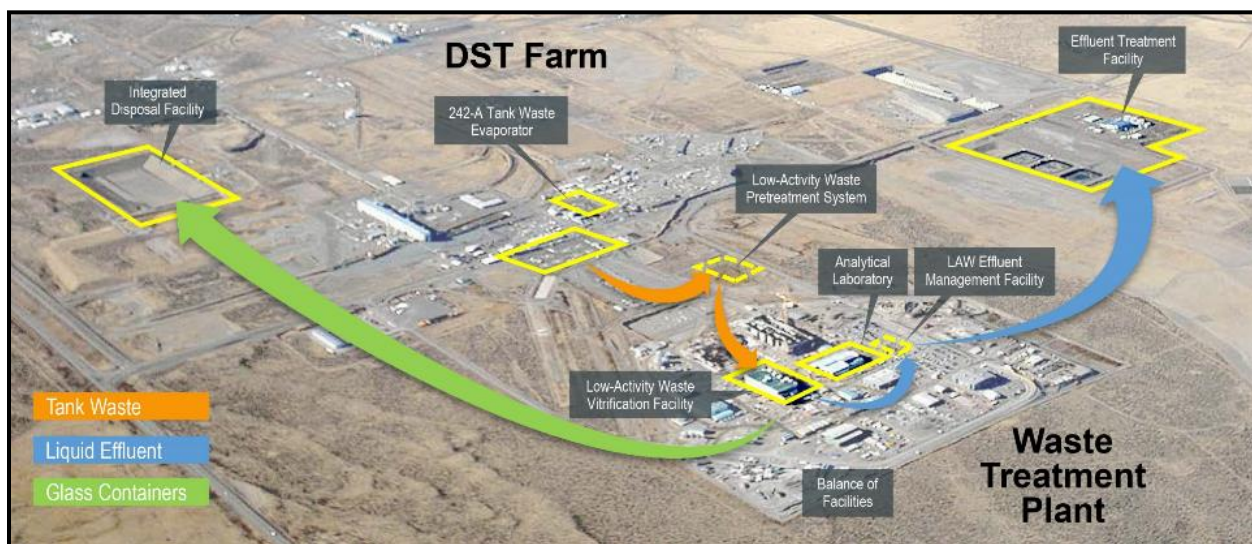


Fig. 1. Integrated Direct-Feed Low-Activity Waste Conceptual Flow Diagram.

Effluent Management Facility

Under full WTP operation, effluent from the LAW Facility would be returned to the PT Facility for further processing and/or transfer to the Hanford Liquid Effluent Retention Facility/Effluent Treatment Facility. Additionally, all secondary waste and effluent lines from WTP facilities and the feed lines from the tank farms would slope to the PT Facility. The PT Facility would also handle all flush water from the tank farms feed lines to WTP.

A new EMF in WTP will replace the secondary waste management functions provided by the PT Facility until such time the PT Facility is operational. The EMF will receive and process secondary waste streams from the LAW Facility submerged bed scrubber, wet electrostatic precipitator, plant wash systems, and caustic scrubber. The design for the facility includes an evaporator and other components to process, sample, and condition various effluent streams from the LAW Facility, route the conditioned waste streams to the Liquid Effluent Retention Facility/Effluent Treatment Facility, recycle waste back into the incoming LAW Facility waste feed, and/or return effluent back to the tank farms. A plan view of the EMF is shown on Figure 2.

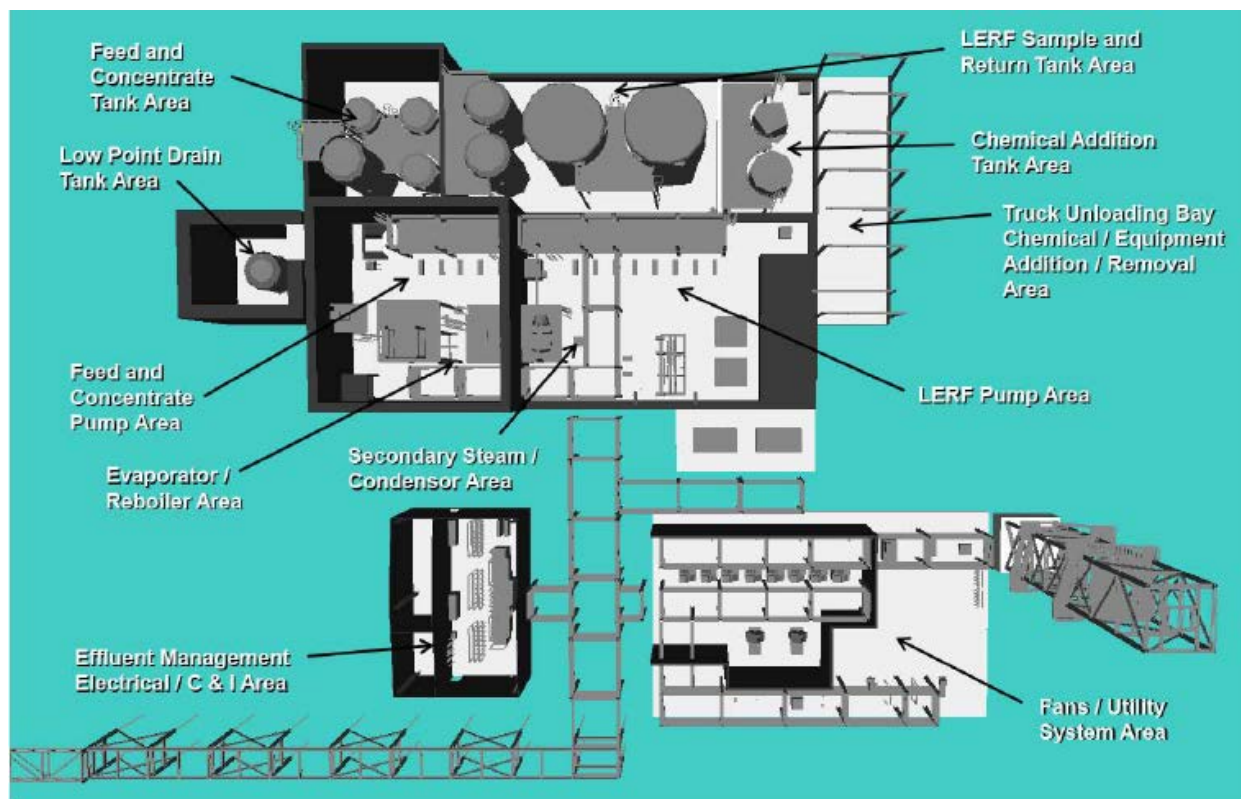


Fig. 2. Plan View – Effluent Management Facility.

Current Status

In March 2016, a federal judge amended the Hanford Consent Decree¹ completion milestones for WTP that align with DOE's plans for completing the WTP facilities in sequence. The Amended Consent decree requires completion of LAW Facility hot commissioning no later than December 31, 2023. Although the Amended Consent Decree does not specifically require DOE to implement a DFLAW capability, the court-ordered date for completing the LAW Facility can only be achieved with DFLAW.

Having established milestones for completing the WTP facilities has enabled DOE to formally implement its plans for completing the WTP facilities in sequence, starting with the LAW Facility. The contract modification for completing DFLAW design modifications in the WTP was approved in June 2015. The WTP contractor began the first BOF modifications and preconstruction activities to implement DFLAW modifications in July 2015. In December 2016, DOE executed a contract modification and approved an incremental change to the project's performance baseline to complete the WTP facilities needed to process direct feed of low-activity waste to the LAW Facility. The contract modification and revised performance baseline will support completion of hot commissioning of the LAW Facility to support the court-ordered completion milestone in December 2023.

CONCLUSIONS

In alignment with the DOE's strategy to start the Hanford tank waste treatment mission in phases, the DOE Office of River Protection and the WTP contractor have initiated the design and early construction activities necessary to incorporate a capability to process low-activity waste feed directly from the Hanford tank farms, bypassing the PT Facility. The DFLAW approach to starting the Hanford tank waste treatment mission accelerates treatment of low-activity waste and reduces future risk on a number of levels, both at WTP and in the tank farms. The benefits of initiating operations with DFLAW include beginning production of low-activity waste glass while technical decisions on the PT and HLW facilities are being resolved, demonstrating filtration and ion-exchange technology in the LAWPS prior to implementation in the PT Facility, drawing down waste inventory in DSTs, and reducing commissioning and startup risk to WTP's more complex production facilities.

ACKNOWLEDGEMENTS

Bechtel National, Inc., contributed to this paper by providing conceptual design concepts and all graphical representations of design concepts utilized herein. Bechtel National, Inc., is the prime contractor and the design authority for the Waste Treatment and Immobilization Plant Project for the U.S. Department of Energy under contract DE-AC27-01RV14136.

¹ State of Washington v. United States Department of Energy, case 2:08-cv-05085-RMP, March 11, 2016.