Independent Assessment of Safety Basis Implementation at the Hanford Site Liquid Effluent Retention Facility

July 2025

U.S. DEPARTMENT of ENERGY | Office of Enterprise Assessments

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Acronyms

CFR	Code of Federal Regulations
CRAD	Criteria and Review Approach Document
DOE	U.S. Department of Energy
DSA	Documented Safety Analysis
EA	Office of Enterprise Assessments
ETF	Effluent Treatment Facility
HC	Hazard Category
HFO	Hanford Field Office
ITDC	Integrated Tank Disposition Contract
LERF	Liquid Effluent Retention Facility
OFI	Opportunity for Improvement
OOD	Operations Oversight Division
ORR	Operational Readiness Review
SAC	Specific Administrative Control
SMP	Safety Management Program
SR	Surveillance Requirement
TSR	Technical Safety Requirement
WRPS	Washington River Protection Solutions, LLC

INDEPENDENT ASSESSMENT OF SAFETY BASIS IMPLEMENTATION AT THE HANFORD SITE LIQUID EFFLUENT RETENTION FACILITY

Executive Summary

The U.S. Department of Energy (DOE) Office of Enterprise Assessments (EA) conducted an independent assessment of the effectiveness of safety basis implementation at the Hanford Site Liquid Effluent Retention Facility (LERF) during upgrade to a hazard category 3 (HC-3) nuclear facility. The assessment was performed in January and February 2025, at which time LERF was managed and operated for the DOE Hanford Field Office (HFO) by Washington River Protection Solutions, LLC (WRPS).* The assessment also evaluated the effectiveness of HFO oversight of WRPS's implementation of the new HC-3 safety basis.

EA identified the following strengths:

- WRPS's effective use of conduct of operations coaches has supported recent conduct of operations improvement actions.
- HFO Facility Representatives have been effective in identifying issues at the LERF and Effluent Treatment Facility during the interim phase of operations, prior to startup authorization approval for the LERF as an HC-3 nuclear facility.

EA also identified several weaknesses:

- Surveillance requirements to verify compliance with technical safety requirements are not required to be performed frequently enough to ensure continued compliance with required controls.
- Basin level instrument uncertainty was not accounted for in calculations and procedures.
- Operator rounds were not performed in accordance with procedures.
- Numerous equipment and procedure deficiencies were not being adequately addressed.
- HFO did not ensure that WRPS timely resolved identified problems during a two-year period since a readiness review, while LERF continued to operate with a mix of HC-3 and less than HC-3 controls

In summary, WRPS continues to implement actions to upgrade LERF to an HC-3 nuclear facility. However, safety basis controls and operational performance at LERF are not yet aligned with its operation as a hazardous nuclear facility. Until the concerns identified in this report are addressed or effective mitigations are put in place, safe operation of the facility will not be ensured.

*The tank waste operations contract, under which WRPS manages and operates LERF, was, at the time of the assessment, being transitioned to a new integrated tank disposition contract (ITDC). The ITDC was awarded to Hanford Tank Waste Operations & Closure, LLC, which received notice to proceed on contract transition on October 21, 2024, and assumed the ITDC on February 24, 2025.

INDEPENDENT ASSESSMENT OF SAFETY BASIS IMPLEMENTATION AT THE HANFORD SITE LIQUID EFFLUENT RETENTION FACILITY

1.0 INTRODUCTION

The U.S. Department of Energy (DOE) Office of Nuclear Safety and Environmental Assessments, within the independent Office of Enterprise Assessments (EA), conducted an assessment of the effectiveness of safety basis implementation at the Hanford Site Liquid Effluent Retention Facility (LERF), which was at the time of the assessment managed and operated by Washington River Protection Solutions, LLC (WRPS)[1] for the DOE Hanford Field Office (HFO). The assessment was conducted in January and February 2025.

LERF operations are integrated with Effluent Treatment Facility (ETF) operations, and include four basic process functions: receipt of various dilute liquid waste streams; interim storage and treatment of these streams; maintenance, inspection, and sampling; and transfer of basin content streams to the ETF for further treatment. The facility receives and stores dilute wastes and currently includes three operating basins (Basins 42, 43, and 44) and one new basin (Basin 41) that will become operational later in 2025. Each basin has a maximum permitted operating capacity of 7.8 million gallons and a total permitted operating capacity (with all four basins) of 31.2 million gallons. The waste stored in the LERF consists of aqueous solutions with a dilute mixture of organic and inorganic constituents, with the potential for associated solids, and a low overall radionuclide content.

The LERF was commissioned in 1994 as a low-hazard nuclear facility under a final safety analysis report. In 1997, the LERF was categorized as a less than hazard category 3 (<HC-3) nuclear facility, and an auditable safety analysis replaced the final safety analysis report. A documented safety analysis (DSA) developed per DOE-STD-1228-2019, *Preparation of Documented Safety Analysis for Hazard Category 3 DOE Nuclear Facilities*, and the applicable portions of DOE-STD-3009-2014, *Preparation of Nonreactor Nuclear Facility Documented Safety Analysis*, was approved and implemented in 2022, upgrading the LERF to an HC-3 nuclear facility. No additional safety significant controls were identified as necessary based on the hazards analysis used to develop the DSA; however, the hazards analysis identified safety management programs (SMPs) as an important part of the overall strategy for worker protection. Additionally, one specific administrative control (SAC) was identified to protect assumed initial conditions regarding facility hazards. The SAC and SMPs are implemented through the LERF technical safety requirements (TSRs).

In January 2023, HFO's predecessor organization[2] performed a Federal operational readiness review (ORR) in accordance with DOE Order 425.1D, *Verification of Readiness to Start Up or Restart Nuclear Facilities*, to review WRPS's readiness to begin operating the LERF as an HC-3 nuclear facility. The ORR identified two prestart findings that were required to be resolved before DOE would grant startup authorization as an HC-3 nuclear facility. One of these prestart findings, "Conduct of operations implementation is not sufficient for LERF Hazard Category 3 nuclear operations," had not yet been closed at the time of this assessment. The other, related to the identification of structures, systems, and

[1] The tank waste operations contract, under which WRPS managed and operated the LERF, was being transitioned to a new integrated tank disposition contract (ITDC) at the time of the assessment. The ITDC was awarded to Hanford Tank Waste Operations & Closure, LLC, which received notice to proceed on contract transition on October 21, 2024, and assumed the ITDC on February 24, 2025.

[2] HFO was formed on October 1, 2024, with the combination of the DOE Richland Operations Office and the Office of River Protection .

components needed to meet SAC requirements, was addressed by a DSA revision approved by HFO in November 2024, but was pending corrective action closure verification.

Consistent with the *Plan for the Independent Assessment of Safety Basis Implementation at the Hanford Site Liquid Effluent Retention Facility, January 2025*, this assessment evaluated the effectiveness of WRPS's implementation of LERF safety basis requirements. The assessment also evaluated the effectiveness of HFO's oversight of WRPS's safety basis implementation.

2.0 METHODOLOGY

The DOE independent oversight program is described in and governed by DOE Order 227.1A, *Independent Oversight Program*, which EA implements through a comprehensive set of internal protocols, operating practices, assessment guides, and process guides. This report uses the terms "best practices, deficiencies, findings, and opportunities for improvement (OFIs)" as defined in the order.

As identified in the assessment plan, this assessment considered requirements related to LERF safety basis controls, focusing on the adequacy of controls and implementation of TSRs, including the TSR-required SAC and SMPs. Criteria to guide this assessment were based on selected objectives and criteria from EA CRAD 31-35, Rev. 0, *Hazard Category 3 Nuclear Facility Documented Safety Analysis and Technical Safety Requirements*, focusing on the implementation of approved safety basis controls, including the SAC and TSRs. Additionally, the elements of SMPs selected for review were guided by criteria from EA CRAD 31-39, Rev. 0, *Review of Conduct of Operations*, and EA CRAD 30-06, Rev. 0, *Conduct of Maintenance*. EA also used elements of EA CRAD EA-30-07, Rev. 0, *Federal Line Management Oversight Processes*, to collect and analyze data on HFO oversight activities related to LERF safety basis implementation.

EA examined key documents, such as system descriptions, work packages, procedures, manuals, analyses, policies, and training and qualification records. EA also interviewed key personnel responsible for developing and executing the associated programs; observed operations shift activities; and walked down significant portions of selected LERF and ETF facilities, focusing on the implementation of TSR requirements. The members of the assessment team, the Quality Review Board, and the management responsible for this assessment are listed in appendix A.

There were no previous findings for follow-up addressed during this assessment.

3.0 RESULTS

3.1 Hazard Controls and Technical Safety Requirements

This portion of the assessment evaluated WRPS's implementation of the LERF safety basis hazard selection and controls, and TSRs and their derivation in accordance with DOE-STD-1228-2019.

The LERF safety basis generally addresses key hazards and controls. The LERF DSA (RPP-RPT-63029, *Liquid Effluent Retention Facility Documented Safety Analysis*) was developed using DOE-STD-1228-2019. Revision 1 of the DSA was approved by DOE Hanford in November 2024. Section 4.5.1.4 of the DSA describes hazards and two controls associated with waste streams accepted into LERF from other Hanford Site facilities (radiological and chemical properties and LERF basin storage volume). WRPS measures and verifies that unit-liter dose, unit sum of fractions, and the pH of waste streams are within specified limits to control inventory within HC-3 limits and maintain compatibility with material

properties of facility equipment. At maximum TSR-allowable concentrations, total inventory is controlled to below 85% of HC-2 threshold quantities. For each of the four LERF storage basins, the DSA-analyzed volume is 7.8 million gallons, which is the maximum permitted volume under state and Federal environmental permits (31.2 million gallons combined for the four basins). No TSR controls are established for the DSA-specified LERF basin volume limit; however, the DSA states that, even at basin overflow volumes, HC-3 limits would not be exceeded for radiological constituents. (See **OFI-WRPS-1**.)

Contrary to 10 CFR 830.122(f)(1), procedure ETF-60M-002, *Waste Transfers at LERF Basins*, which is used to control and monitor the basin influent, does not account for the up-to-one-foot instrument error of the basin level measuring instruments. (See **Deficiency D-WRPS-1**.) Not accounting for this instrument error could result in a LERF basin being filled with more than 500,000 gallons over the 7.8-million-gallon limit. After this issue was identified by EA, WRPS management entered issue number WRPS-AR-2025-0912 into the issues management system for corrective action.

The LERF TSRs (RPP-RPT-63028*, Liquid Effluent Retention Facility Technical Safety Requirements*) identify one SAC (SAC 5.8.1, *Waste Characteristic and Inventory Control)*, which states that it protects the assumed initial conditions used to estimate hazardous event scenario consequences by ensuring that unit-liter dose, unit sum of fractions, facility inventory, and pH are within the limits established in the LERF safety basis. Associated surveillance requirements (SRs) require initial and annual verification that the accepted waste streams and existing waste inventory remain in compliance with SAC limits. These verifications are performed in accordance with TFC-ENG-FACSUP-P-34, *New Waste Stream Acceptance at LERF/ETF*. Identification of any deviations from parameters between annual surveillances relies on controls implemented by the waste generators, not by LERF personnel required to implement the TSR. Further, in a briefing, WRPS engineering personnel stated that "currently active waste streams to LERF require more than annual sampling, either every six months or by batch/campaign," and that "select generators require sampling on every shipment due to concerns regarding meeting a specific limit or due to a lack of process knowledge." In general, more frequent sampling than required is operationally conservative. However, given that some waste streams were described to require more frequent sampling to ensure compliance with acceptance criteria based on known concerns, the documented basis for TSR SRs does not clearly describe why annual verification is sufficient, contrary to DOE-STD-3009-2014, section 5.5.X.2, and 10 CFR 830.205. (See **Deficiency D-WRPS-2**.) An excursion of a waste stream outside of acceptance criteria could result in LERF inventory exceeding analyzed safety basis assumptions.

Inventory control requirements of the SAC are managed using LERF Inventory and Nuclide Tracking System (LINTS) software. LINTS is identified as safety software and was appropriately developed through the WRPS software quality assurance program, as documented in RPP-RPT-62936, *LERF Inventory & Nuclide Tracking System Acceptance Test Report*.

Hazard Controls and Technical Safety Requirements Conclusions

The LERF safety basis generally addresses key hazards and controls. However, weaknesses were identified associated with controls for the LERF basin storage volume and adequacy of TSR SRs.

3.2 Safety Management Programs

This portion of the assessment evaluated WRPS's implementation of the SMPs for maintenance, operational safety (i.e., conduct of operations), and procedures to ensure the safe operation of the LERF.

Nuclear Maintenance Management Program

The conduct of maintenance program is adequately governed by TFC-PLN-029, *Nuclear Maintenance Management Program (NMMP)*. The NMMP appropriately addresses all the requirements of DOE Order 433.1B, *Maintenance Management Program for DOE Nuclear Facilities*. Individual elements of the 17 requirements of an NMMP are properly addressed and are further implemented through flowdown procedures. The maintenance organization is adequately staffed with supervisors and craftspeople and appropriately conducts preventive maintenance activities during the first three weeks of each month, leaving the last week to meet the corrective maintenance demand. During the assessment, no maintenance activities were available for observation at the LERF. All 17 elements of the NMMP are being appropriately assessed on a three-year cycle, assessing one third of the elements each year. The maintenance program manager identified maintenance instruction adequacy and adherence as issues that require continuous improvement.

Conduct of Operations Program

The conduct of operations program is adequately governed by TFC-PLN-05, *Conduct of Operations Implementation Plan*. TFC-PLN-05 adequately addresses the elements of DOE Order 422.1, *Conduct of Operations*. TFC-PLN-05 adequately meets the intent of the SMP as specified in the TSR document, RPP-RPT-63028, *LERF TSR*. Individual elements of the 18 requirements of a conduct of operations program are appropriately implemented by flowdown procedures. Notably, as described in interviews, WRPS is implementing an effort to enhance the use of conduct of operations coaches, in which six designated coaches will be required to provide specified minimum numbers of observations in designated categories every six months, and coaches will rotate among WRPS facilities. Coaches appropriately focus on technical procedure performance, administrative procedure adherence, and lockout/tagout. This new effort, if implemented as described, should support improvements in conduct of operations performance.

Control area activities are adequately specified in TFC-OPS-OPER-C-59, *Control Area and At-the-Controls Area Activities*. Observed control area activities at the ETF were appropriately conducted. Shift routines are adequately specified in TFC-OPS-OPER-C-08, *Shift Routines and Operating Practices*, and are further flowed down into TFC-OPS-OPER-C-60, *Surveillance Rounds*. TFC-OPS-OPER-C-13, *Technical Procedure Control and Use*, specifies an adequate process for procedure compliance. However, the following identified weaknesses were not reflective of disciplined and structured operations that support mission success and ensure worker, public, and environmental protection at an HC-3 nuclear facility:

- Contrary to DOE Order 422.1, attachment 2, section 2.h, and TFC-OPS-OPER-C-08, WRPS is not adequately monitoring and verifying known equipment deficiencies during the conduct of outside operator rounds and is not appropriately prioritizing repairs. (See **Deficiency D-WRPS-3**.) Ineffectively managed equipment deficiencies could result in the loss of control of equipment or possible exposure of workers to hazards. Specifically:
    - Eleven of 12 observed pump controllers exhibited extreme oxidation (rusted enclosure), and applied arc flash labels were illegible.
    - Housekeeping was generally poor, with debris, extension cords, and ladders in areas that they did not belong; several items were staged in an area clearly marked “keep clear.”
    - Interviewed operators explained that identified deficiencies communicated through a formal reporting system for operator rounds results were not being corrected in a timely manner.
    - Eighteen of 36 observed lights on pump controllers were not functioning.

- Contrary to DOE Order 422.1, attachment 2, section 2.p, and TFC-OPS-OPER-C-13, the procedure for observed operator rounds could not be followed as written. (See **Deficiency D-WRPS-4**.) Not establishing operator rounds procedures that are accurate, commensurate with expectations for use, and that can be performed could result in improper verification of equipment status. Specifically, during observed LERF operator rounds, the checklist in ETF-OR-DR-OOR, *ETF Outside Operator Daily Rounds*, required the operator to record the current reading (in amps) from pump number II-P43-4-1. The operator recorded a single measurement from a single digital display panel. However, the panel was labeled with a different equipment identification number (i.e., did not match the rounds checklist) and did not indicate units (e.g., amps, volts, resistance). The operator explained that the reading from this panel is the correct measurement based on historical performance.

Procedures Program

The technical procedures program is governed by TFC-OPS-OPER-C-13, which adequately addresses the requirements for technical procedures as specified by the SMP in the TSR document. TFC-OPS-OPER-C-13 appropriately addresses change control, procedure use, procedure use level, and procedure approval and review. Procedures program personnel are appropriately meeting with conduct of operations staff monthly to improve procedure accuracy. Interviewed conduct of operations personnel explained that they provide meaningful feedback during these monthly meetings to support improved procedure content and flow. However, contrary to DOE Order 422.1, attachment 2, section 2.p, and TFC-OPS-OPER-C-13, numerous reviewed WRPS procedures were not adequate. (See **Deficiency D-WRPS-5**.) Inadequate procedures could lead to the incorrect performance of operations, adversely affecting personnel safety or facility performance. The following are examples:

- TFC-PLN-32, *Tank Operations Contractor Safety Management Programs*, was superseded by TFC-ESHQ-Q-STD-01, *Assurance of Safety Management Programs*, but five implementing procedures still reference the superseded procedure.
- TFC-OPS-OPER-C-13 does not identify itself as implementing one of the SMPs specified in the TSR document.
- ETF-OR-DR-OOR is identified as a continuous-use procedure that was not used accordingly. Observed operators used electronic tablets, which did not accommodate step-by-step performance of the procedure.

Safety Management Programs Conclusions

WRPS has generally implemented the SMPs for maintenance, operational safety (i.e., conduct of operations), and procedures as specified by the TSR document. However, weaknesses were identified associated with the management of equipment deficiencies, following a procedure as written, and procedural adequacy, which were not reflective of disciplined and structured operations that support mission success and ensure worker, public, and environmental protection at an HC-3 nuclear facility.

3.3 Federal Oversight

This portion of the assessment evaluated the effectiveness of HFO's oversight of WRPS's upgrade of the LERF to an HC-3 nuclear facility.

HFO's predecessor organization signed and issued the DOE final ORR report (23-OOD-000378, *DOE Final Report Liquid Effluent Retention Facility Operational Readiness Review*) on January 31, 2023. This report identified two prestart findings: (1) F-OPS-01, which stated that conduct of operations was insufficient for LERF HC-3 nuclear operations, and (2) F-NS-01, which stated that SAC 5.8.1 did not identify structures,

systems, and components needed to fulfill the SAC safety function. Additionally, this report stated that the prestart findings must be satisfactorily resolved by HFO and WRPS prior to granting startup authorization approval for the LERF as an HC-3 nuclear facility, thus meeting the requirements of DOE Order 425.1D. The prestart findings were entered into WRPS's issues management system following issuance of the report. However, clear alignment on prioritization and timeliness were not documented between HFO and WRPS, and the two findings remain open. (See **OFI-HFO-1**.) As a contributing factor, the prestart findings were characterized by WRPS as "Level C" issues, described by TFC-CHARTER-76, *Action Request Screening Meeting*, as lower prioritized issues; HFO did not effectively encourage higher prioritization or more timely resolution.

HFO Operations Oversight Division (OOD) Facility Representatives have been effective in identifying issues at the LERF and ETF during this interim phase, prior to startup authorization approval for the LERF as an HC-3 nuclear facility. As demonstrated by three reviewed baseline assessments, OOD Facility Representatives have effectively identified issues in various functional assessment areas at the LERF and ETF, including fire protection, conduct of operations, and emergency preparedness.

HFO issued letter 24-TWO-0084 to WRPS on July 17, 2024, which stated that "due to the length of time since the conclusion of the LERF readiness review, DOE will perform enhanced oversight prior to authorization of restart as a HC-3 Facility." HFO and WRPS appropriately concluded that an additional, enhanced independent oversight assessment of the LERF and ETF was required prior to authorization to initiate operations as an HC-3 nuclear facility. WRPS tasked an independent team to conduct this activity in January 2025, and HFO implemented a shadow assessment team to provide parallel Federal oversight. The draft WRPS report for this enhanced assessment identified additional adverse conditions (issues) in conduct of operations, maintenance, and corrective action management; HFO's final report from the enhanced oversight assessment had not yet been issued at the conclusion of this assessment.

Federal Oversight Conclusions

HFO has provided generally effective oversight of WRPS's upgrade of the LERF to an HC-3 nuclear facility. However, HFO did not effectively encourage higher prioritization or more timely resolution of the two pre-start findings documented in the DOE final ORR report.

4.0 BEST PRACTICES

No best practices were identified during this assessment.

5.0 FINDINGS

No findings were identified during this assessment.

6.0 DEFICIENCIES

Deficiencies are inadequacies in the implementation of an applicable requirement or standard. Deficiencies that did not meet the criteria for findings are listed below, with the expectation from DOE Order 227.1A for site managers to apply their local issues management processes for resolution.

Washington River Protection Solutions, LLC

Deficiency D-WRPS-1: The WRPS procedure that is used to control and monitor basin influent does not account for the up-to-one-foot instrument error of the basin level measuring instruments. (10 CFR 830.122(f)(1))

Deficiency D-WRPS-2: The document basis for TSR SRs used to verify compliance with SAC 5.8.1 does not adequately describe why annual verification is sufficient to ensure that waste streams are controlled continuously within TSR limits. (DOE-STD-3009-2014, sec. 5.5.X.2, and 10 CFR 830.205)

Deficiency D-WRPS-3: WRPS is not adequately monitoring and verifying known equipment deficiencies during the conduct of outside operator rounds and is not appropriately prioritizing repairs. (DOE Order 422.1, att. 2, sec. 2.h; TFC-OPS-OPER-C-08)

Deficiency D-WRPS-4: The WRPS procedure for observed operator rounds could not be followed as written. (DOE Order 422.1, att. 2, sec. 2.p; TFC-OPS-OPER-C-13)

Deficiency D-WRPS-5: Numerous reviewed WRPS procedures were not adequate. (DOE Order 422.1, att. 2, sec. 2.p; TFC-OPS-OPER-C-13)

7.0 OPPORTUNITIES FOR IMPROVEMENT

EA identified the OFIs shown below to assist cognizant managers in improving programs and operations. While OFIs may identify potential solutions to findings and deficiencies identified in assessment reports, they may also address other conditions observed during the assessment process. These OFIs are offered only as recommendations for line management consideration; they do not require formal resolution by management through a corrective action process and are not intended to be prescriptive or mandatory. Rather, they are suggestions that may assist site management in implementing best practices or provide potential solutions to issues identified during the assessment.

Washington River Protection Solutions, LLC

OFI-WRPS-1: Consider adding a discussion of the maximum total volume in SAC bases to identify why a concentration limit adequately controls total inventory of material at risk.

Hanford Field Office

OFI-HFO-1: Consider providing additional guidance in internal HFO procedures and/or processes that discuss the implementation and closure of prestart findings (e.g., DOE-PRO-NSE-51879, *Nuclear Facility Startup and Restart*).

Appendix A
Supplemental Information

Dates of Assessment

January 13 to February 5, 2025

Office of Enterprise Assessments (EA) Management

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