Independent Assessment of Specific Administrative Controls at the Hanford Site Tank Farms and 242-A Evaporator Facility

December 2021

Office of Enterprise Assessments
U.S. Department of Energy

Table of Contents

Acronyms

AC	Administrative Control
CRAD	Criteria and Review Approach Document
DOE	U.S. Department of Energy
DSA	Documented Safety Analysis
DST	Double-Shell Tank
EA	Office of Enterprise Assessments
LCO	Limiting Condition for Operation
ORP	Office of River Protection
SAC	Specific Administrative Control
SS	Safety Significant
SSC	Structures, Systems, and Components
SST	Single-Shelled Tank
TF	Tank Farms
TSR	Technical Safety Requirement
WRPS	Washington River Protection Solutions

INDEPENDENT ASSESSMENT OF SPECIFIC ADMINISTRATIVE CONTROLS AT THE HANFORD SITE TANK FARMS AND 242-A EVAPORATOR FACILITY

Executive Summary

The U.S. Department of Energy (DOE) Office of Enterprise Assessments (EA) conducted an independent assessment of the development and implementation of specific administrative controls (SACs) at the Hanford Site Tank Farms and 242-A Evaporator Facility from July to September 2021. This assessment was performed within the broader context of ongoing assessments of the derivation and implementation of SACs across the DOE complex. The assessment focused on the approach to meeting SAC requirements in DOE-STD-3009-94, Change Notice 3, *Preparation Guide for U.S. Department of Energy Nonreactor Nuclear Facility Documented Safety Analyses.*

EA identified the following strengths based on the sample of evaluated controls:

- SACs, as developed in Chapter 4 of the documented safety analyses, are adequately captured in the technical safety requirements (TSRs) in either limiting condition for operation or directive action format.
- SAC implementing procedures include appropriate performance criteria for implementation.
- Training/qualification on SACs is sufficient and appropriately tailored for operations, engineering, and supervisory personnel.

EA also identified three deficiencies as summarized below:

- Key elements of one administrative control (AC) and portions of the key elements of two other ACs are inappropriately categorized and implemented as ACs rather than SACs as defined by DOE-STD-3009-94.
- In three instances, the SAC descriptions do not adequately explain how the SAC meets its safety function or justify the use of a SAC over an SSC as required by DOE-STD-3009-94.
- The triennial TSR implementation assessments performed by the contractor did not include performance-based verification that the implementing procedures include rigorous, risk informed, and credible self-assessment activities for potentially high consequence activities to ensure that SAC safety functions are met as required by DOE O 226.1B.

In summary, identification, development, and implementation of SACs at the Hanford Site Tank Farms and 242-A Evaporator Facility generally meet the requirements of DOE-STD-3009-94. Although EA identified deficiencies associated with both SAC development and implementation, the SACs and administrative controls are sufficiently captured in implementing documents controlling the hazards. Resolution of the deficiencies identified in this assessment will ensure a robust and reliable control set for long-term operations.

INDEPENDENT ASSESSMENT OF SPECIFIC ADMINISTRATIVE CONTROLS AT THE HANFORD SITE TANK FARMS AND 242-A EVAPORATOR FACILITY

1.0 INTRODUCTION

The U.S. Department of Energy (DOE) Office of Nuclear Engineering and Safety Basis Assessments, within the independent Office of Enterprise Assessments (EA), conducted an assessment of the derivation and implementation of specific administrative controls (SACs) at the Hanford Site Tank Farms (TF) and 242-A Evaporator Facility. This assessment, conducted from July through September 2021, was performed within the broader context of ongoing assessments of the derivation and implementation of SACs across the DOE complex at select high risk (i.e., hazard category 1 and 2) facilities. The purpose of these assessments is to evaluate the effectiveness of both the contractor and field office programs in developing, implementing, and maintaining SACs.

This assessment was conducted in accordance with the *Plan for the Specific Administrative Control Implementation Assessment across the DOE Complex, July 2021 – March 2022*. The assessment focused on the line management approach to meeting SAC requirements in DOE-STD-3009-94, Change Notice 3, *Preparation Guide for U.S. Department of Energy Nonreactor Nuclear Facility Documented Safety Analyses*. This assessment evaluated the most significant SACs based on the hazard and accident analyses; SACs that use structures, systems, and components (SSCs) for their implementation; or SACs that may have been established instead of a safety SSC.

Washington River Protection Solutions (WRPS) manages the TF and 242-A Evaporator Facility under the direction and oversight of the DOE Office of River Protection (ORP). The TF store over 50 million gallons of high-level radioactive waste underground in 149 single-shell tanks (SSTs) and 28 double-shell tanks (DSTs). Major TF operations include waste transfers, characterization, and chemical adjustments to ensure tank integrity, with an overall mission goal of timely closure of SSTs. The 242-A Evaporator Facility supports the TF mission by reducing DST waste volumes. TF waste will be stored until the Hanford Waste Treatment and Immobilization Plant is commissioned to vitrify the waste for final disposal.

2.0 METHODOLOGY

The DOE independent oversight program is described in and governed by DOE Order 227.1A, *Independent Oversight Program*, which is implemented 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" as defined in the order.

As identified in the approved plan, this assessment considered requirements from EA Criteria and Review Approach Document (CRAD) 34-02, *Specific Administrative Controls Criteria Review and Approach Document*, and CRAD 30-02, *Conduct of Operations Controls Criteria Review and Approach Document*. The assessment was conducted in two parts. The first part of the assessment was conducted remotely and focused on SAC identification and development. EA reviewed documented safety analyses (DSAs), technical safety requirement (TSR) documents, hazard analyses, and relevant reference and implementing documents to determine whether SAC identification and development meet the requirements of DOE-STD-3009-94 and the expectations provided in DOE-STD-1186-2004. DOE-STD-1186-2004 clarifies the requirements and provides guidance for the development and implementation of SACs. DOE-STD-1186-2004 is cited as a requirement in the Hanford Site Tank Farms and 242-A Evaporator Facility DSAs. Due to travel constraints associated with coronavirus disease 2019 conditions at the

Hanford Site, the second part of the assessment was also conducted remotely and focused on formalization of select SAC requirements in procedures and implementation of SAC maintenance expectations of DOE-STD-1186-2004 (e.g., periodic assessments of SAC effectiveness required by DOE O 226.1B, *Implementation of Department of Energy Oversight Policy*). This activity involved interviews with ORP and contractor personnel, including nuclear safety managers, engineering managers, facility managers, operations personnel, and subject matter experts; table-top discussions of SAC implementing procedures; and further review of implementing documents.

EA used a written comment and response process with WRPS to address issues identified during its review. Follow-on discussions among EA, ORP, and WRPS were conducted to clarify and resolve issues.

Due to a recent assessment, the safety basis for the Tank-Side Cesium Removal System is not within this assessment scope. There were no previous items for follow-up addressed during this assessment.

3.0 RESULTS

3.1 SAC Identification and Development

The objective of the review of the hazard and accident analyses in the DSAs was to determine whether SACs are appropriately identified as hazard controls in accordance with DOE-STD-3009-94. Based on the highest potential consequences, EA evaluated all seven TF SACs for prevention of flammable gas explosions and two of six SACs from the waste transfer leak accident control suite. Additionally, EA assessed two SACs from the 242-A Evaporator Facility DSA used in preventing flammable gas explosions. Based on accident consequences, all SACs are categorized as safety significant (SS).

EA also evaluated a sample (six of twelve) of non-SAC administrative controls (ACs) from both DSAs to determine whether they were properly categorized as ACs rather than SACs (i.e., ACs cannot be specifically credited to prevent or mitigate a hazard or an accident scenario and do not provide a safety function that would be SS if the function were provided by an SSC).

In most cases, SACs are appropriately identified based on the control selection in the hazard and accident analyses to prevent or mitigate an accident scenario. However, as described below, the key elements of one AC and portions of the key elements of two other ACs are inappropriately categorized and implemented as ACs rather than SACs as defined by DOE-STD-3009-94. (See **Deficiency-WRPS-1**.)

- 242-A Evaporator AC 5.9.2, *Ignition Controls*, performs analyses of ignition control requirements which directly support SAC 5.8.1, *Flammable Gas Controls for Waste Transfer Piping, Waste Slurry Transfer Piping, and C-A-1 Vessel Drain (Dump) Piping*. WRPS responses to EA comments indicate that portions of AC 5.9.2 (directive action-type statements) will be added to SAC 5.8.1.
- 242-A Evaporator AC 5.10.2, *Emergency Response Actions Following Facility Fires*, performs the same safety function as the SS C-A-1 Vessel Flammable Gas Control System, and should have been categorized as a SAC. This issue will be resolved by a pending design change to the vessel flammable gas control system and the associated safety basis amendment prior to resumption of evaporator operations.
- Tank Farm AC 5.9.4, *Waste Characteristics Controls*, protects important initial conditions (i.e., waste characteristic assumptions) used to estimate accident consequences and develop controls to prevent deflagrations due to flammable gas release events. WRPS responses to EA comments indicate that directive action statements, and the requirements of AC 5.9.4 that fulfill the stated safety function, will be converted into a new SAC.

Requirements from the identified ACs above are sufficiently captured in implementing documents that currently control the hazards. However, the ACs are not subjected to the more stringent development, implementation, and verification requirements of a SAC. Using an AC rather than a SAC can result in a less robust and reliable hazard control for long-term operations.

SAC safety functions are adequately derived in the hazard and accident analyses, and the functional requirements developed in the SAC evaluations in the DSAs generally demonstrate that the safety function can be met. The SAC descriptions and evaluations generally meet the requirements of DOE-STD-3009-94. The descriptions contain sufficient detail for an understanding of the SAC's safety function and its relationship to the facility safety analysis. In most cases, sufficient detail is provided to ensure that the SAC can be effectively implemented. The SACs identify SSCs required to support SAC performance (e.g., temperature monitors, isolation valves) and appropriately classify them as SS.

However, as detailed below, three SAC descriptions do not adequately explain how the SAC meets its safety function or justify the use of a SAC over an SSC as required by DOE-STD-3009-94, section 4.5.X. (See **Deficiency-WRPS-2**.) Incomplete descriptions of the SAC safety function and functional requirements and the subsequent evaluation of their sufficiency can lead to inadequate development or implementation of the safety control.

- The 242-A Evaporator SAC 5.8.1 and supporting AC key element AC 5.9.2 are selected instead of identifying and developing safety SSCs for ignition controls. There is inadequate justification provided for this control selection as required by DOE-STD-3009-94, section 4.5.X.2. WRPS responses to EA comments indicate that additional justification for selection of a SAC instead of an SSC will be provided in the SAC description.
- TF SAC 4.5.1 (Limiting Condition for Operation [LCO] 3.7), *DST 241-AY-102 Flammable Gas Monitoring Control*, is incomplete. The DSA asserts in numerous places (including in sections 3.3.2.4.1.4.1 and 4.4.10) that DST 241-AY-102, which has a failed primary tank, will not receive additional waste, chemical additions, or large water additions. DST 241-AY-102 tank waste has been retrieved to the extent practical. However, the engineered or operational controls implemented to ensure that this assumption remains valid are not presented in the SAC description or evaluation. DOE STD-3009-94, section 4.5.X.2, requires that "descriptions for each SAC must be complete enough to indicate suitability of safety analysis inputs and assumptions." WRPS responses to EA comments indicate that the description detailing isolation of DST 241-AY-102 in the DSA will be revised.
- TF SAC 4.5.4 (LCO 3.5), *Double-Shelled Tank 241-AY-102 Annulus Flammable Gas Control*, relies upon the configuration of a supporting SSC (tank annulus flammable gas sampler) that is not adequately protected to ensure that the SAC functional requirement is met as required by DOE-STD-3009-94, section 4.5.X.4. The sampler length must be sufficient to extend into the annulus to obtain a representative sample, and the volume of the sampler assembly (a function of the length and inside diameter) must be known to calculate the purge time before a valid representative sample can be extracted. The SAC evaluation is incomplete as it does not protect the sampler configuration to ensure that a representative sample is obtained. WRPS responses to EA comments indicate that configuration management requirements will be added to the SAC description.

SAC Identification and Development Conclusions

SACs are adequately identified based on the control selection in the hazard and accident analyses to prevent or mitigate an accident scenario except for three instances where ACs are being used instead of SACs. SAC safety functions are appropriately derived in the hazard and accident analyses, and the functional requirements developed in the SAC evaluations in the DSAs generally demonstrate that the

safety function can be met. Most SAC descriptions and evaluations are sufficiently detailed to support effective implementation except for three instances where the level of detail in the SAC descriptions did not meet the requirements of DOE-STD-3009-94, section 4.5.X.

3.2 SAC Implementation

The objective of this portion of the assessment was to determine whether the TF and 242-A Evaporator Facility SACs are implemented and maintained in accordance with DOE-STD-1186.

The TF and 242-A Evaporator Facility SACs, as developed in Chapter 4 of the DSAs, are adequately captured in the TSRs in either LCO or directive action format as prescribed by DOE-STD-3009-94. SAC implementing procedures include appropriate specifications for implementation, such as qualification requirements of personnel, steps involved, verification of identified limits, frequency of verification, requirements for independent verifications, interfaces with measuring equipment, and the required accuracy of the equipment. EA reviewed eight procedures related to SAC implementation, including two revisions of a waste transfer procedure, one procedure on valve manipulation and verification, and five procedures addressing field measurement of flammable gas concentrations. EA also reviewed an operating procedure for abnormal events relating to flammable gas increase. The implementing procedures were generally adequate, incorporating independent verification for critical valve manipulations, and specifying appropriate calibration and operational checking of field instruments.

However, EA identified errors in two procedures that could impact performance. Procedure TF-OPS-IHT-001, *IHT Flammable Gas Surveillances on Double Shell Tanks*, referenced an incorrect step, and procedure TF-OPS-IHT-030, *IHT Flammable Gas Surveillances on Double Shell Tank Annulus*, listed an incorrect sampling location. In both cases, during discussions with operators and supervisors, they understood the appropriate corrective action for response to steps that could not be performed as written. WRPS initiated prompt, effective action resulting in revisions to correct the procedures.

Several SACs require engineering evaluations to determine control details. EA reviewed the engineering evaluations performed for the development of procedure TO-260-461, *Over-Ground Transfer From 241-AX-103 to 241-AZ-102 and Sluicing of Tank 241-AX-103*, to ensure that the SAC requirements were satisfied. The engineering evaluations addressed SAC requirements, and the controls identified in the evaluations are accurately captured in the implementing waste transfer procedure. Additionally, EA discussed the isolation of DST 241-AY-102 (see section 3.1 of this report) with several WRPS engineers. WRPS provided engineering documents that addressed aspects of the tank isolation. Although the documentation provided for EA review was not sufficient to independently confirm that isolation is complete, WRPS stated that process liquid flow paths into the tank are plugged or disconnected. WRPS committed to expand the DSA description of DST 241-AY-102 isolation.

Readiness to perform the transfer from SST 241-AX-103 to DST 241-AZ-102 was demonstrated in *Operational Readiness Checklist, 241-AX-103 Waste Retrieval System* (AX103WRS-ORC-086). Per TFC-PLN-16, *Readiness and Turnover Program Plan*, an operational readiness checklist is adequate to demonstrate readiness. The checklist was compiled and performed per TFC-PRJ-PM-06, *Operational Readiness Checklist*. The level of detail apparent through walkdowns, inspection evidence, and affidavits was adequate to demonstrate readiness, and EA identified no issues with SAC implementation.

EA evaluated the training and qualification, and periodic re-training and re-qualification, of WRPS personnel responsible for SAC implementation and compliance activities to determine whether the training is sufficient to ensure SAC effectiveness. Training effectiveness was evaluated through discussions with operations, engineering, and nuclear safety management and staff personnel, and review of training and qualification records for these positions. The EA review of qualification cards, on-the-job

training cards, study guides, and SAC implementing procedures confirmed that SAC training is sufficient and appropriately tailored for operations, engineering, and supervisory personnel. WRPS management and staff personnel responsible for SAC implementation and compliance were found to be highly knowledgeable and experienced during the discussions.

EA evaluated Federal oversight of SAC implementation, which is primarily performed by Facility Representatives. The evaluation included reviewing operational awareness assessments and interviewing ORP Operations Oversight Division and Nuclear Safety Division personnel. SAC implementation assessment activities are not pre-planned or pre-scheduled. Instead, SAC oversight is performed as part of oversight activities for scheduled TF activities, such as waste transfers, or as a result of emergent issues identified during routine operational awareness assessments. Because many SACs would apply to any tank transfer activity and issues with SAC implementation (e.g., TSR recovery plans) would be identified during routine operational awareness activities, this SAC oversight approach is effective. Although ORP safety system oversight personnel are assigned responsibility for safety SSCs, there is no equivalent requirement to provide the same oversight for SACs and AC key elements.

EA reviewed the most recent three-year cycle of triennial TSR implementation assessments performed by WRPS. The triennial assessments focused on whether SAC requirements are included in implementing procedures but did not include performance-based verification that the procedures ensure that SAC safety functions are met as required by DOE O 226.1B, Attachment 1, section 2.b.(2). (See **Deficiency-WRPS-3**.) Although WRPS performs independent verifications of SAC implementation with sufficient frequency, assessments primarily involved review of implementing procedures and review of TSR non-compliances identified in the Problem Evaluation Report database to verify continued implementation. DOE O 226.1B, Attachment 1, section 2.b.(2) requires that the contractor assurance system include rigorous, risk informed, and credible self-assessment activities for potentially high consequence activities. The expectations for performance-based demonstrations are included in the WRPS assessment program plan (TFC-PLN-10, *Assessment Program Plan,* section 2.4) and DOE guidance for conducting SAC implementation verification reviews (DOE Guide 423.1-1B, *Implementation Guide for Use in Developing Technical Safety Requirements,* section 4.2.2). WRPS triennial assessments did not review products resulting from SAC actions, such as engineering evaluations or valve isolations, and no field activities were observed or simulated.

SAC Implementation Conclusions

The evaluated TF and 242-A Evaporator Facility SACs, as developed in Chapter 4 of the DSAs, are adequately captured in the TSRs in either LCO or directive action format as prescribed by DOE-STD-3009-94. SAC implementing procedures include appropriate performance criteria for implementation. Training on SACs is sufficient and appropriately tailored for operations, engineering, and supervisory personnel. Federal oversight is sufficient to ensure SAC implementation. However, periodic independent verification of SAC implementation by WRPS does not meet the requirement of DOE O 226.1B for performance-based evaluations.

4.0 BEST PRACTICES

There were no best practices identified as part of this assessment.

5.0 FINDINGS

There were no findings identified as part of 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

Deficiency-WRPS-1: WRPS inappropriately categorized and implemented the key elements of one AC and portions of the key elements of two other ACs as ACs rather than SACs. (DOE-STD-3009-94, definitions)

Deficiency-WRPS-2: WRPS did not ensure that all SAC descriptions adequately explain how the SAC meets its safety function or justify the use of a SAC over an SSC. (DOE-STD-3009-94, section 4.5.X)

Deficiency-WRPS-3: WRPS's triennial TSR implementation assessments did not include performance-based verification that implementing procedures ensure that SAC safety functions are met. (DOE O 226.1B, Attachment 1, section 2.b.(2))

7.0 OPPORTUNITIES FOR IMPROVEMENT

There were no OFIs identified as part of this assessment.

8.0 ITEMS FOR FOLLOW-UP

EA will follow up on the DSA revisions committed to by WRPS Nuclear Safety (discussed in section 3.1 of this report) in the next annual DSA update. EA may also observe SAC activities when ORP is able to support an onsite assessment.

Appendix A
Supplemental Information

Dates of Assessment

July to September 2021

Office of Enterprise Assessments (EA) Management

John E. Dupuy, Director, Office of Enterprise Assessments
William F. West, Deputy Director, Office of Enterprise Assessments
Kevin G. Kilp, Director, Office of Environment, Safety and Health Assessments
David A. Young, Deputy Director, Office of Environment, Safety and Health Assessments
Kevin M. Witt, Director, Office of Nuclear Safety and Environmental Assessments
Charles C. Kreager, Director, Office of Worker Safety and Health Assessments
Jack E. Winston, Director, Office of Emergency Management Assessments
Joseph J. Waring, Director, Office of Nuclear Engineering and Safety Basis Assessments

Quality Review Board

William F. West
Joseph Lewis
David A. Young
Michael A. Kilpatrick – Advisor to the Quality Review Board

EA Site Lead for Hanford Site Tank Farms

Eric A. Ruesch

EA Assessors

James O. Low – Lead
Kevin E. Bartling
Katherine S. Lehew
Charles J. March
David J. Odland
Robert J. Poche
Thomas L. Spatz
Gregory D. Teese
Robert W. Young