Independent Assessment of Safety System Management at the Hanford Site Tank Farms

December 2023

Office of Enterprise Assessments
U.S. Department of Energy

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Acronyms

CFR	Code of Federal Regulations
CGD	Commercial Grade Dedication
CRAD	Criteria and Review Approach Document
CSE	Cognizant System Engineer
DOE	U.S. Department of Energy
DSA	Documented Safety Analysis
DST	Double-shell Tank
EA	Office of Enterprise Assessments
FR	Facility Representative
KPI	Key Performance Indicator
LCO	Limiting Condition for Operation
M&TE	Measuring and Test Equipment
NQA	Nuclear Quality Assurance
OJT	On-the-job Training
ORP	Office of River Protection
PAC	Protective Action Criteria
PM	Preventive Maintenance
QA	Quality Assurance
QAP	Quality Assurance Plan
SDD	System Design Description
SIL	Safety Integrity Level
SIS	Safety Instrumented System
SRED	Safety Requirements Evaluation Document
SS	Safety Significant
SSCs	Structures, Systems, and Components
SSM	Safety System Management
SSO	Safety System Oversight
SST	Single-shell Tank
TBD	To Be Determined
TF	Hanford Site Tank Farms
TSR	Technical Safety Requirement
WRPS	Washington River Protection Solutions

INDEPENDENT ASSESSMENT OF SAFETY SYSTEM MANAGEMENT AT THE HANFORD SITE TANK FARMS

Executive Summary

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 independent assessment of safety system management (SSM) at the Hanford Site Tank Farms (TF) from August through October 2023. Washington River Protection Solutions (WRPS) manages the TF under the direction and oversight of the DOE Office of River Protection (ORP). This assessment was performed within the broader context of targeted SSM assessments at selected high risk (i.e., hazard category 1 and 2) nuclear facilities across the DOE complex. The purpose of the assessment was to evaluate whether selected active safety structures, systems, and components were appropriately developed as technical safety requirements and are operated and maintained in a manner to ensure that they can reliably perform their intended function of protecting workers and the public from analyzed hazards.

EA identified the following strengths:

- The TF technical baseline is comprehensively identified and documented.
- Safety requirements evaluation documents provide a comprehensive compilation of requirements.
- Cognizant systems engineers demonstrate strong ownership of their safety systems.
- Operations engineer classroom training videos are available online, as an option, for staff interested in learning about TF operations and for self-education.

EA also identified several weaknesses, as summarized below:

- The surveillance requirements in the technical safety requirements document do not include the documented safety analysis required replacement intervals for the limited service-life safety significant components of the double-shell tank ventilation systems, waste transfer system freeze protection system, and double-shell tank annulus high-level alarm.
- An unjustified assumption regarding nonconservative radiological consequences, and potentially inadequate controls to protect the co-located worker, was made in the documented safety analysis related to the single-shell tank partial dome collapse accident analysis.
- Engineering procedures governing the issuance of calculations, engineering change notices, modification travelers and drawings do not establish a formal process for tracking and ensuring closure of assumptions requiring verification (e.g., items to be determined/holds).
- Multiple ventilation system design descriptions remain active, yet they have not been updated since 2018 or earlier and contain outdated/inaccurate technical information not representative of the current configuration.
- ORP oversight of contractor performance does not include independent assessments of the cognizant system engineer program or the operability of associated TF safety systems.

In summary, WRPS has established a generally adequate SSM program that effectively ensures operability of safety systems and complies with applicable DOE requirements. Although EA identified weaknesses associated with technical safety requirements and engineering programs necessary for SSM implementation, no imminent safety concerns were identified. Resolution of the issues identified in this assessment will support a more robust safety basis and strengthen the engineering program.

INDEPENDENT ASSESSMENT OF SAFETY SYSTEM MANAGEMENT AT THE HANFORD SITE TANK FARMS

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), assessed the effectiveness of safety system management (SSM) at the Hanford Site Tank Farms (TF). This assessment was performed within the broader context of SSM assessments at selected high risk (i.e., hazard category 1 and 2) nuclear facilities across the DOE complex. This assessment was conducted in accordance with the *Plan for the Independent Assessment of Safety System Management Across the DOE Complex Fiscal Year 2024*. The onsite portion of the assessment was conducted from October 16 to 26, 2023.

The primary purpose of this assessment was to evaluate whether selected active safety system controls were appropriately developed into technical safety requirements (TSRs) and are operated and maintained in a manner that ensures the structures, systems, and components (SSCs) can reliably perform the intended function of protecting workers and the public from analyzed hazards. Programs within the scope of this assessment that support safety system operability and reliability are safety basis, surveillance and testing, engineering design, cognizant system engineer (CSE), configuration management, operations, quality assurance (QA), feedback and improvement, and Federal oversight. The assessment focused on the effectiveness of the DOE and contractor line management in managing and implementing safety system requirements.

Washington River Protection Solutions (WRPS) manages the TF under the direction and oversight of the DOE Office of River Protection (ORP). The TF, a hazard category 2 nuclear facility, stores over 50 million gallons of high-level radioactive waste underground in 149 single-shell tanks (SSTs) and 28 double-shell tanks (DSTs). Currently the waste from 19 SSTs and 1 DST has been retrieved. Major TF operations in the scope of this assessment include waste transfers, characterization, and chemical adjustments to ensure tank integrity. TF waste will be stored until the Hanford Site 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 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" as defined in the order.

As identified in the assessment plan, this assessment considered requirements from EA Criteria and Review Approach Document (CRAD) 30-11, *Safety Systems Management Review*, and CRAD EA-30-07, *Federal Line Management Oversight Processes*, in assessing the adequacy of select programs related to SSM at the TF. The assessment was performed based on a sampling of data and is not intended to represent a full programmatic assessment of SSM.

Based on high curie content and other waste characteristics, EA selected 4 DSTs (AZ-101, AP-102, AN-106, and AW-101) and evaluated active, safety significant (SS) SSCs associated with 3 of the 11 TSR limiting conditions for operation (LCOs) in the TF TSR document:

- TSR LCO 3.1, *Double-Shell Tank Primary Tank Ventilation Systems*
- TSR LCO 3.10, *Waste Transfer System Freeze Protection (Automation)*
- TSR LCO 3.11, *Double-Shell Tank Annulus High-Level Alarm (Automation)*.

EA also evaluated the documentation of structural integrity of SSTs and safety basis accident analysis to determine whether designation of the SSTs as general service equipment is appropriate.

EA used a written comment and response process to address salient issues identified before the onsite portion of the review. Follow-on discussions were conducted with ORP and WRPS personnel to clarify and resolve comments.

EA examined the development of select controls as TSRs based on the hazard and accident analyses, and the implementation of safety basis requirements into technical baseline documents. EA examined key documents such as the documented safety analysis (DSA), the TSR and surveillance and testing records, selected program plans, system design documents, procedures, engineering analyses, and training and qualification records. EA interviewed personnel responsible for developing and executing the assessed programs, observed daily activities related to operations and surveillance, and performed onsite inspections of accessible portions of the selected systems. EA also conducted interviews and reviewed oversight records to determine whether the Federal oversight program ensures that safety systems reliably meet their safety functions. The members of the assessment team, the Quality Review Board, and the management responsible for this assessment are listed in appendix A.

EA conducted a previous assessment of SSM at the TF in 2016, as documented in EA report *Office of Enterprise Assessments Targeted Assessment of the Double Shell Tank Ventilation Systems at the Hanford Site Tank Farms, September 2016*. This current EA assessment examined the completion and effectiveness of corrective actions for the findings described in the previous assessment. Results of the corrective action assessments are included in section 3.10 of this report.

3.0 RESULTS

3.1 Safety Basis

This portion of the assessment evaluated the approved TF safety basis for the selected safety SSCs to determine whether their functional classification is appropriate and whether subsequent development of functional requirements, performance criteria, and associated TSRs meet the requirements of DOE-STD-3009-94, *Preparation Guide for U.S. Department of Energy Nonreactor Nuclear Facility Documented Safety Analyses*.

Control Derivation and Description

The DST primary tank ventilation system is credited for facility worker protection by preventing a flammable gas deflagration in a DST. The ventilation system maintains the concentration of flammable gases in the tank headspace below the lower flammability limit for steady-state flammable gas generation and induced gas release events potentially caused by water additions, chemical additions, or waste transfers between tanks. The DST annulus high-level alarm system is credited to protect the facility worker from a flammable gas deflagration in a DST annulus caused by flammable gas accumulated from waste leaked from the primary tank into the annulus. The waste transfer freeze protection safety instrumented system (SIS) provides co-located and facility worker protection by preventing a loss of the safety function provided by piping (confinement) and isolation valves (limit leakage) due to freezing during waste transfers for the TF.

The DSA, chapter 4, appropriately provides detailed descriptions of each evaluated system, including the safety function, system description, functional requirements, and performance criteria. The system descriptions include discussions of the SS system components (e.g., piping, sensors, switches, transmitters, annunciators) and explain how the subsystem components relate to the system functional requirements. Additionally, the non-safety components necessary for system performance are adequately identified, as well as the basis for the acceptability (e.g., failsafe) of these general service components. The DSA adequately describes the performance criteria necessary for these systems to meet their functional requirements. The capability of the SSCs to perform their safety functions is evaluated in safety requirements evaluation documents (SREDs) and safety integrity level (SIL) calculations. The SREDs and SIL calculations provide complete identification of the system components, key safety attributes, interfaces with general service SSCs, failure modes and effects analyses, and the functional and performance requirements necessary for the system to perform its safety function. Compliance with safety requirements is demonstrated by identifying the key design attributes that satisfy the specific requirement along with the appropriate verification documents.

Three system evaluations in the DSA and associated SREDs and SIL calculations identify SS components that require replacement prior to the end of their manufacturer-specified service lives to ensure that failure rate assumptions are maintained. Contrary to 10 CFR 830.205, *Technical safety requirements*, section (a)(1), these components and the associated replacement intervals are not included in the TSR surveillances for LCOs 3.1, 3.10, and 3.11. (See **Deficiency D-WRPS-1**.) Allowing components to exceed their service lives could result in degraded system reliability. TSRs must include the minimum set of surveillance requirements to ensure necessary operability and quality of safety SSCs.

Safety Control Classification

The TF DSA appropriately classifies the DST primary tank ventilation, waste transfer system freeze protection, and DST annulus high-level alarm as SS. Each accident is appropriately analyzed for potential consequences to the public by comparing the calculated radiation dose to the Evaluation Guideline of 25 rem specified in DOE-STD-3009-94. In accordance with the methodology described in the DSA, SS controls are designated for accidents with radiological consequences that exceed 100 rem or chemical consequences that exceed protective action criteria (PAC)-3 to the co-located worker, exceed PAC-2 to the public, or are judged to result in prompt death, serious injury, or significant radiological or chemical exposure to the facility worker. The radiological consequences of the TF accident analyses do not challenge the Evaluation Guideline. SS controls are appropriately identified to protect the co-located and facility workers.

Technical Safety Requirements Development

The information provided in the TF DSA chapter 5 is sufficient to derive the TSR LCOs for each of the evaluated systems. The performance criteria developed for the SSCs are adequate to ensure that the required safety functions will be provided and are appropriately reflected in the corresponding TSR operability requirements and surveillance requirements. The TSR document bases appendix provides the linkage to the DSA and adequately describes the reasons for the operating limits and surveillance requirements.

Single-shell Tank Integrity

The review of the structural integrity analysis confirmed that SSTs have sufficient structural integrity to prevent failure under anticipated operational and seismic loading. However, the SSTs can fail due to an excessive concentrated load or load drop on the dome structure; this is analyzed as the bounding release accident in the DSA. In the reviewed accident analysis, the concentrated load is assumed to shear through

the dome, with the displaced portion of the dome, the soil directly above it, and the load dropping into the tank and impacting the waste, resulting in a release from the tank headspace to the atmosphere through the failed tank dome. This scenario was evaluated in a DSA-referenced document RPP-12444, *Technical Basis for the Tank Failure Due to Excessive Loads Representative Accident*. The analysis concluded that the 8-foot soil depth (covering the tank) falling into the tank would scavenge 90% of the lofted, respirable material, resulting in radiological consequences of 32 rem for the co-located worker. However, contrary to DOE-STD-3009-94, section 3.4, this assumption is unjustified and there is no control protecting the assumed soil depth. (See **Deficiency D-WRPS-2**.) Without this assumption, the radiological consequences would increase by a factor of 10, resulting in co-located consequences of 320 rem, requiring SS controls. As discussed in RPP-12444, the offsite radiological consequence would remain below 5 rem, even if no material was assumed to be scavenged. Although there are no SS controls, the implemented defense-in-depth dome loading program provides some level of protection by limiting vehicle access to the TF.

Safety Basis Conclusions

In general, the safety basis for the selected systems is appropriately established and implemented. The systems are adequately described and appropriately evaluated in the DSA and supporting documents to ensure that they will provide their required safety functions. Except for the lack of TSR surveillance requirements for the limited-life components, the TSRs are appropriately derived from the DSA and identify the operating conditions, required actions, completion times, and surveillances. A deficiency was also identified associated with the use of an unjustified assumption in the analysis of the SST dome collapse accident.

3.2 Surveillance and Testing

This portion of the assessment evaluated TF surveillance and testing processes related to the selected LCOs for the four tanks of interest (AZ-101, AP-102, AN-106, and AW-101) to determine compliance with the TSR document.

Safety system TSR surveillance and testing procedures and their implementation are adequate to ensure that the safety SSCs can accomplish their safety functions. The reviewed surveillance procedures appropriately cite applicable TSR requirements; identify system and test conditions; provide calibration requirements; and include clear performance steps. The procedures were appropriately developed, reviewed, and approved. WRPS effectively schedules, tracks, and documents surveillances to ensure compliance with the TSR-required frequencies, considering allowable extensions. A review of available records demonstrated that no surveillances have been missed for the reviewed LCOs and associated surveillance requirements.

Review of performed surveillances generally demonstrated that SISs are appropriately calibrated. The work records appropriately record calibration information and specify the accuracy required for the tests. Observations and interviews confirmed that surveillances are appropriately performed and documented. Prior to this assessment in 2023 WRPS identified two calibrations that were performed incorrectly; appropriate corrective actions were taken upon discovery.

Measuring and test equipment (M&TE) is appropriately stored and maintained in four tool cribs at the TF. Observed M&TE was properly labeled with current calibration stickers. Reviewed calibration records for M&TE were adequate. TF M&TE calibration is conducted off site and was not evaluated as part of this assessment.

Surveillance and Testing Conclusions

WRPS adequately performs required surveillances, including testing and calibration, to maintain safety SSCs in a condition that ensures that the TSRs are satisfied. The surveillance and testing procedures are effective. The observed surveillance and testing activities for TF were performed properly and adequately implement the TSR surveillance requirements for the reviewed LCOs.

3.3 Engineering Design

This portion of the assessment evaluated WRPS's engineering procedures and the design of selected systems, including technical baseline documents, design calculations, drawings, and change control documents, for technical adequacy and compliance with 10 CFR 830.122, *Quality assurance criteria*, and appropriate consensus standards (including American Society of Mechanical Engineers Nuclear Quality Assurance (NQA)-1-2008, *Quality Assurance Requirements for Nuclear Facility Applications*, with the NQA-1a-2009 addenda [hereafter referred to as NQA-1]).

Procedures

WRPS engineering procedures adequately establish controlled processes for design development and documentation. Those processes include identification of technical baseline documents essential to establish and ensure compliance with DSA and TSR requirements. Design authority responsibility for the technical adequacy of issued documents is well defined. TFC-ENG-DESIGN-C-52, *Technical Reviews*, appropriately establishes design verification requirements for safety-related engineering products, supported by procedures TFC-ENG-DESIGN-P-54, *Checking of Engineering Documents*, and TFC-ENG-DESIGN-P-17, *Design Verification*, that individually implement the checking and design verification processes.

Procedure TFC-ENG-DESIGN-C-10, *Engineering Calculations*, contains adequate guidance for aspects of the calculation development process, including provision for documenting unverified assumptions (identified as TBDs [to be determined] or holds). The procedure states in attachment A that "any assumptions that require later verification must be tracked for resolution;" however, it does not include provisions for tracking those TBDs/holds to closure. Contrary to TFC-PLN-02, *Quality Assurance Program Description*, paragraphs 3.7.7 and 3.7.8 (which implements 10 CFR 830.122 criterion 6(5) by requiring that unverified portions of a design be identified and controlled, and that verification shall be completed prior to relying upon the SSC to perform its function), the procedures for engineering change control, modification travelers, and technical document control contain no guidance establishing processes to track TBDs/holds to closure. (See **Deficiency D-WRPS-3**.) Closure of these open items is essential for adequate maintenance of design control and the technical baseline.

Technical Baseline Documents

The types and categories of documents that, in aggregate, define the technical baseline for the TF are appropriately and comprehensively identified in TFC-ENG-STD-46, *Technical Baseline Management*. Review of a sampling of technical baseline documents (e.g., SREDs, calculations) for the selected systems determined that they are well-developed and maintained. However, contrary to DOE Order 420.1C, *Facility Safety*, attachment 2, chapter V, which requires that all safety-related SSCs and important defense-in-depth system design documents must be identified and kept current, four reviewed system design descriptions (SDDs) for DST ventilation systems contain outdated information, which is inconsistent with current information in other technical baseline documents. (See **Deficiency D-WRPS-4**.) Allowing these SDDs to remain active in their current state could result in dissemination of inaccurate information and technical baseline.

Calculations

The process for development and issuance of engineering calculations is adequately controlled by TFC-ENG-DESIGN-C-10, with the exception noted above in Deficiency D-WRPS-3. A sampling of 29 supporting calculations for the selected systems was reviewed and identified to be technically adequate. Checking and design verification were adequately implemented and documented.

Drawings

Processes for creating, updating, and issuing engineering drawings are adequately defined in TFC-ENG-DESIGN-C-09, *Engineering Drawings*. Drawings are categorized as essential, support, or reference drawings. Essential drawings are defined as those depicting active SSCs required to support emergency response actions, including those showing electrical or fluid system isolation boundaries. Essential drawings are appropriately required to be updated within 30 days following completion of a modification, while support drawings may take 60-90 days, and reference drawings (e.g., vendor drawings, historical drawings) are not updated without specific approval. The drawing update process established in TFC-ENG-DESIGN-C-09 in conjunction with the design change process discussed in the following paragraphs is adequately structured to ensure that engineering drawings reflect the as-built condition of the facility and are updated in a timely manner. Metrics (i.e., key performance indicators [KPIs]) that track drawing status by using a three-month rolling average demonstrate that essential drawings are generally updated within three weeks of availability.

Change Control Documents

Except as noted above in Deficiency D-WRPS-3, the engineering change control process is adequately established in TFC-ENG-DESIGN-C-06, *Engineering Change Control*, and TFC-ENG-DESIGN-C-56, *Modification Traveler*, and their associated supporting guidance documents. Implementation of change control in accordance with these procedures was confirmed through review of engineering change notices and modification travelers issued for the selected systems over the last two years, as well as a sampling of change documents from prior years. The reviewed documents clearly identify design inputs and affected documents.

Engineering Design Conclusions

Reviewed engineering processes provide an adequate framework for the accomplishment of technical design. Reviewed engineering products were technically adequate, providing an acceptable basis for the design of the subject systems in a manner compliant with DSA requirements. However, deficiencies were identified due to a lack of a defined process for tracking and closing TBDs/holds in engineering output documents, and the continued availability of outdated SDDs.

3.4 Cognizant System Engineer Program

This portion of the assessment evaluated the WRPS CSE program to determine whether it meets the requirements of DOE Order 420.1C.

The WRPS CSE program is adequately described in TFC-ENG-FACSUP-P-01, *TOC System Engineer Program*. CSEs are qualified as design authorities per TFC-PLN-136, *Engineering Design Program*, and TFC-PLN-03, *Engineering Management Plan*, which effectively ensures that they can support all design activities associated with their systems. CSEs are appropriately assigned to the three selected SS SSCs.

The CSEs demonstrate strong ownership of their assigned systems and are the focal point for system documentation with lead roles in the procurement and replacement of spare parts, preventive and corrective maintenance, and configuration management. They actively support system operation. CSEs rely on remote monitoring of the inaccessible portions of the systems (e.g., confined spaces), and both remote monitoring and direct observations of the accessible portions of the systems. System assessment walkdowns performed by CSEs and documented in the reviewed system notebooks appropriately identified physical or documentation discrepancies and their resolutions.

System Notebooks

CSEs develop and maintain system notebooks as required by TFC-ENG-FACSUP-D-01.2, *System Notebook Preparation*. Reviewed electronic notebooks appropriately contain technical baseline information including SREDs, design requirements compliance matrix, safety equipment compliance documentation, performance monitoring metrics, required spare parts, emergent issues, and other technical information. These system notebooks have been appropriately assessed every two years by engineering management to ensure that they are being adequately maintained.

System Health Reports

TFC-FACSUP-D-01.1, *System Engineering Performance Monitoring and Health Reporting*, requires formal assessments to measure system health for active safety systems every year. Reviewed system health reports for the selected systems from calendar years 2019 to 2023 comprehensively discussed system health and operability, availability, performance monitoring and system walkdowns, maintenance, configuration control, design changes, spare parts and obsolescence, and long-range issues and recommendations. These reports are an effective tool for the CSEs to manage and communicate system health and identify proactive measures to ensure reliable system performance.

CSE Training and Qualification

CSEs for the selected systems are effectively trained and qualified, as documented in reviewed training records. They are qualified as engineering technical staff and design authorities.

Cognizant System Engineer Program Conclusions

The CSE program is well implemented and CSEs are effectively managing their systems. The system health reports are comprehensive and provide thorough summaries of current system health. System notebooks are comprehensive and appropriately maintained. The CSEs are effectively trained and qualified.

3.5 Configuration Management

This portion of the assessment evaluated the WRPS configuration management program based on the requirements of DOE-STD-1073-2003, *Configuration Management.*

Initial construction of the TF began in 1943, and modifications to the SSCs continue to this day. The technical baseline has been reconstituted, is adequate, and is maintained current using formal change control. The WRPS configuration management program is contained in TFC-PLN-23, *Configuration Management Plan*, in accordance with DOE-STD-1073-2003. Based on interviews and document reviews, the CSEs adequately maintain configuration control during design, construction, and operation. The selected systems for this review have been recently upgraded due to issues with aging and technical obsolescence.

Engineering procedures effectively require the use of process hazard analyses for development of the SREDs, which identify the design system requirements and performance criteria. The modification traveler ensures that design changes to an existing system configuration are accurate, the constructed system meets the design performance criteria (as demonstrated with post-maintenance testing), and design changes are reviewed under the unreviewed safety question process prior to implementation. Work control is managed by TFC-OPS-MAINT-C-01, *Tank Operations Contractor Work Control*, which adequately controls the modification process to ensure that field modifications are implemented as designed and are tested prior to operation.

Reviewed annual management assessments of design requirements, work control, change control, and document control were adequately performed in accordance with the configuration management plan.

Configuration Management Conclusions

The WRPS configuration management program ensures that the physical configuration is consistent with the issued technical baseline and design changes.

3.6 Operations

This portion of the assessment evaluated operations at the TF, including operating practices, procedures, and operator training, to determine compliance with DOE Order 422.1, *Conduct of Operations.*

Operating Practices

WRPS has appropriate processes in place to ensure that shift operators are alert, informed of conditions, and operate equipment properly. Reviewed "round sheets" and daily reports, and observed control room operations, turnover, and a shift briefing were adequate. During one observed shift briefing, the shift manager reviewed the daily report and provided operating personnel the status of TF current conditions. The daily report format appropriately includes such topics as LCO actions, TSR-related issues, stop work actions, ventilation system status, and out-of-service equipment.

Observations were determined adequate for simulated rounds of central control room panel annunciator checks, a tabletop review of a waste transfer using the automated freeze protection system, and a tabletop review of a retrieval activity. WRPS management and operating personnel responsible for TF TSR implementation and compliance were knowledgeable and experienced as demonstrated by interview responses and observations.

Operating Procedures

WRPS has appropriate processes in place to ensure that procedures are accurate, understandable, and provide for safe and effective operations at the TF. Reviewed TSR-related procedures for the selected systems including response to alarms at annunciator panels, response to tank ventilation upset, round sheets, and waste transfer procedures were adequate. Technical operating procedures incorporate the necessary actions for conducting operations within the TSRs; alarm response procedures appropriately provide actions to respond to situations when operating conditions have the potential to exceed safe boundary conditions. Procedures appropriately contain independent verification steps to ensure TSR compliance.

Operator Training

Operator training and qualification appropriately include classroom training and on-the-job training (OJT) for LCO requirements. Classroom training appropriately includes general safety basis concepts, DSA/TSR format and structure, and TF LCO and system-related requirements credited for accident

prevention or mitigation. Reviewed OJT qualification cards appropriately document performance of TSR-related tasks by the operators. Interviews and observations of operations demonstrated that operators are knowledgeable of their assigned tasks.

Of note, operating engineer classroom training videos are available on the WRPS training website for the education of interested personnel. These videos cover a broad range of TF operations and are available outside of formal training courses.

Operations Conclusions

The WRPS processes adequately meet the requirements of DOE Order 422.1 to ensure that shift operators are alert, informed of conditions, and can operate equipment properly. Technical operating procedures, alarm response procedures, and waste transfer procedures are adequately developed and implemented. Operator training incorporates the necessary elements for achieving safe and effective TF operations.

3.7 Quality Assurance

This portion of the assessment evaluated WRPS's approved QA program and its implementation for training and qualification of QA personnel. Additionally, the assessment evaluated procurement verification to ensure that new components and replacement items are manufactured and procured to design specifications and can perform required safety-related functions, as required by DOE Order 414.1D, *Quality Assurance*.

Quality Assurance Program

The WRPS DOE-approved quality assurance plan (QAP) meets the QA criteria specified in DOE Order 414.1D. The QA manager is responsible for implementing, assessing, maintaining, and improving the QAP as documented in TFC-PLN-02 and TFC-PLN-50, *Quality Implementation Plan and Graded Approach*. The QAP describes an adequate graded approach, applying increased quality control of work and equipment associated with SS SSCs. The QAP adequately implements NQA-1. WRPS reviews the QAP annually, updates it as needed, and obtains appropriate DOE approvals. The QAP appropriately provides for the flowdown of DOE QA requirements to sub-tier contractors, vendors, and suppliers to ensure their compliance with requirements.

Training and Qualification of QA Personnel

The WRPS training and qualification program for QA personnel effectively satisfies the training requirements of NQA-1. The reviewed training records for interviewed QA technicians were adequate. The QA manager is knowledgeable of his responsibilities for performing QA field inspections, procurement reviews, receipt inspections, and storage facility inspections.

Procurement Verification

WRPS has an effective commercial grade dedication (CGD) process implemented through procedure TFC-ENG-DESIGN-C-15, *Commercial Grade Dedication*. Compliance with this procedure is appropriately achieved through a coordinated effort between the engineering design, procurement engineering, and QA engineering departments. This CGD process provides reasonable assurance that SS SSCs not available from qualified suppliers can perform their intended safety function. Six reviewed CGD packages for equipment used on the DST exhaust air flow monitoring and the TF freeze protection SISs identified appropriate critical characteristics, attributes, and acceptance criteria for the SS function of these components. The CGD packages contained sufficient QA documentation to trace the quality pedigree to

the manufacturer. Verification of a CGD QA inspection plan is effectively implemented via a two-step process: (1) Initial receipt inspection is conducted by a Hanford Site central contractor's QA inspector, and (2) WRPS QA technicians perform the final inspection verifying CGD critical characteristics. Observed QA technicians demonstrated use of proper procurement acceptance criteria and the required tagging system to provide assurance that received items were properly inspected. Three representative SS components acquired through CGD were properly tagged and stored in requisite environmental storage conditions, as specified on inventory records, in an observed storage facility.

Quality Assurance Conclusions

The WRPS QA program effectively implements the requirements of NQA-1 in the areas evaluated. QA personnel are adequately trained and qualified. CGD plans are appropriately developed for procuring safety-related components from non-qualified suppliers. Sampled procurement documents are consistent with WRPS procurement controls.

3.8 Feedback and Improvement

This portion of the assessment evaluated WRPS feedback and improvement processes including assessments, issues management processes, and performance measures to determine compliance with DOE Order 226.1B, *Implementation of Department of Energy Oversight Policy.*

WRPS implements the contractor requirements of DOE Order 226.1B in TFC-PLN-83, *Assurance System Program Description*.[1]

Assessments

WRPS effectively implements a broad range of independent, management-directed, and management observation programs to evaluate compliance with contractual requirements and adequacy of work performance. Reviewed independent assessments and audits demonstrated appropriate performance evaluations of work processes for engineering, operations, and maintenance requirements of selected SS SSCs. Management-directed assessments appropriately provide a process to identify and evaluate the safety management programs, systems, and processes that affect performance; the assessments also identify areas for improvement. Reviewed assessments demonstrated appropriate evaluations of work performance, change management, and personnel qualification and training. The management observation program requires direct management oversight at the activity level. Reviewed management observation program assessments appropriately documented field observations of safety system component upgrades, work orders, and functional tests for LCO 3.1 and LCO 3.10.

Issues Management Processes

TFC-ESHQ_C-C-01, *Problem Evaluation Request*, appropriately implements WRPS corrective action process requirements and responsibilities for the timely identification and evaluation of conditions adverse to (in part) quality, safety, and operability using the integrated Contractor Assurance System (iCAS) software. ORP has access to iCAS. Reviewed condition reports demonstrate that the issues were appropriately identified, and corrective actions were assigned as applicable. Causal analysis to support the corrective action process is adequately described in TFC-ESHQ-Q-ADM-C-16, *Apparent Cause*

[1]EA report *Independent Assessment of the Washington River Protection Solutions Management of Safety Issues at Hanford - December 2021* identified two findings and eleven deficiencies associated with the full programmatic assessment of WRPS issues management. The conclusions in this report are based on a focused scope, limited sample (see section 2.0) of newer data, and different criteria.

Analysis. One apparent cause analysis demonstrated adequate review of the identified condition to determine apparent cause and prescribe corrective actions.

Feedback and Improvement Processes

TFC-OPS-OPER-C-28, *Operating Experience/Lessons Learned*, is an effective process for implementing and managing the WRPS Operating Experience/Lessons Learned Program. Reviewed worker feedback reports, lessons learned reports, and additional training sessions for human performance issues demonstrate appropriate focus on preventing the recurrence of safety and reliability issues and sharing good work practices among DOE sites.

Performance Measures

TFC-PRJ-PC-C-11, *Performance Indicator Program*, and TFC-ESHQ-Q_C-C-06, *Trend Analysis Process*, provide appropriate methods for developing, documenting, analyzing, presenting monthly KPIs, reporting analysis results and trends, and identifying the need for corrective or improvement actions. Reviewed mission-level KPI metric reports covering a 16-month period and engineering KPI metric reports covering a 12-month period adequately demonstrate performance measurement processes that communicate issues and performance trends monthly to WRPS and ORP senior management.

Feedback and Improvement Conclusions

WRPS adequately implements an assurance system that provides feedback and improvement processes to address safety system issues. Reviewed documents demonstrate appropriate evaluation of work processes and performance, appropriate corrective actions to address adverse conditions of SS SSCs, and adequate communication of issues and performance trends.

3.9 Federal Oversight

This portion of the assessment evaluated the effectiveness of ORP oversight of TF operations, with a specific emphasis on oversight activities related to the selected safety systems.

The ORP safety system oversight (SSO) and Facility Representative (FR) programs are effectively implemented consistent with established procedures. ORP personnel responsible for oversight are adequately trained and qualified. The FRs are qualified to a TF-specific qualification standard. The SSO qualification standard is DOE-STD-8000-2021, *Safety System Oversight Functional Area Qualification Standard*. SSO personnel are responsible for overseeing assigned safety systems to ensure that they will perform as required, while FRs are responsible for monitoring the safety performance of nuclear facilities and daily operational status.

In general, SSO personnel adequately conduct a variety of oversight activities. These activities include monitoring the performance of the contractor's CSE program, reviewing safety basis amendments and LCO recovery plans, reviewing system health and status reports, and evaluating the implementation of corrective actions. However, contrary to DOE Order 226.1B, section 4.b.(1) and DOE Order 420.1C, section 4.c, ORP oversight of contractor performance does not include independent assessments of the CSE program or the operability of associated TF safety systems. (See **Deficiency D-ORP-1**.) A lack of formal oversight by ORP could result in contractor issues associated with the CSE program and TF safety system operability not being identified, and ultimately safety system degradation.

Federal Oversight Conclusions

Overall, ORP implements an adequate SSO program. The ORP qualification program ensures that SSO personnel can perform their assigned duties. Except for the lack of independent assessments of the CSE program or operability of associated TF safety systems, the oversight by the ORP FRs and SSOs is effective and appropriately documented.

3.10 Follow-up on Previous EA Findings

This portion of the assessment examined the completion and effectiveness of corrective actions for two findings and six deficiencies documented in EA report *Office of Enterprise Assessments Targeted Assessment of the Double Shell Tank Ventilation Systems at the Hanford Site Tank Farms, September 2016*.

WRPS adequately initiated and closed corrective actions for both findings. Specifically:

- Finding-WRPS-01 of the 2016 report stated that, contrary to DOE Order 433.1B, *Maintenance Management Program for DOE Nuclear Facilities*, the WRPS preventive maintenance (PM) program was not maintaining safety SSCs in accordance with the DOE-approved nuclear maintenance management program; specifically, PMs were not required to be performed on or before the established due date and were not being performed at the required frequency. Reviewed corrective actions demonstrated that WRPS adequately conducted a causal analysis, resulting in the elimination of grace periods for safety SSC PMs, requiring Level 2 Operations Manager approval for proposed extensions, and briefing of maintenance staff on procedure changes. Overall, reviewed KPIs show a downward trend for delinquent PMs over fiscal years 2022 and 2023.
- Finding-WRPS-02 of the 2016 report stated that, contrary to the requirements of DOE Order 426.2, *Personnel Selection, Training, Qualification, and Certification Requirements for DOE Nuclear Facilities*, nuclear chemical operator training was not ensuring that operators achieved and maintained adequate knowledge and skills. Reviewed corrective actions demonstrated that WRPS adequately conducted a causal analysis, resulting in revisions to operator continuing training; revised base operator and shift training program objectives, and revised student manual to contain safety basis related components; revised learning objectives and learning materials for qualification packages; and required remedial training for all operators to maintain qualification. All operators were required to complete continuing training programs prior to being requalified.

In addition, reviewed closed corrective actions for all six deficiencies adequately addressed and corrected the issues.

Follow-up on Previous EA Findings Conclusions

WRPS adequately addressed and corrected the two findings and six deficiencies documented in the 2016 EA 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

Deficiency D-WRPS-1: The TSR surveillance requirements do not include the DSA-required replacement intervals for the limited service-life SS components of the DST ventilation systems, waste transfer system freeze protection, and DST annulus high-level alarm (automation). (10 CFR 830.205(a)(1))

Deficiency D-WRPS-2: An unjustified assumption in the DSA SST partial dome collapse accident analysis results in nonconservative radiological consequences, and potentially inadequate controls to protect the co-located worker. (DOE-STD-3009-94, sec. 3.4)

Deficiency D-WRPS-3: WRPS's engineering procedures governing the issuance of calculations, engineering change notices, modification travelers, and drawings do not establish a formal process for tracking and ensuring the closure of assumptions requiring verification (e.g., TBDs/holds). (10 CFR 830.122, criterion 6(5))

Deficiency D-WRPS-4: Multiple WRPS ventilation SDDs remain active, yet they have not been updated since 2018 or earlier and contain outdated/inaccurate technical information not representative of the current configuration. (DOE Order 420.1C, att. 2, ch. V)

DOE Office of River Protection

Deficiency D-ORP-1: DOE ORP oversight of contractor performance does not include independent assessments of the CSE program or the operability of associated TF safety systems. (DOE Order 226.1B, sec. 4.b.(1)) (DOE Order 420.1C, sec. 4.c.)

7.0 OPPORTUNITIES FOR IMPROVEMENT

No opportunities for improvement were identified during this assessment.

Appendix A
Supplemental Information

Dates of Assessment

Onsite Assessment: October 16-26, 2023

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
Thomas E. Sowinski, Director, Office of Nuclear Safety and Environmental Assessments
Kimberly G. Nelson, Director, Office of Worker Safety and Health Assessments
Jack E. Winston, Director, Office of Emergency Management Assessments
Brent L. Jones, Director, Office of Nuclear Engineering and Safety Basis Assessments

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