# Safety System Management Assessment at the Savannah River Site Liquid Waste Concentration, Storage, and Transfer Facilities

**August 2019**

Office of Enterprise Assessments
U.S. Department of Energy

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## Acronyms

| | |
|---|---|
| CFR | Code of Federal Regulations |
| CGD | Commercial Grade Dedication |
| CM | Corrective Maintenance |
| CSE | Cognizant System Engineer |
| CSTF | Concentration, Storage, and Transfer Facilities |
| DOE | U.S. Department of Energy |
| DOE-SR | Savannah River Operations Office |
| DWPF | Defense Waste Processing Facility |
| EA | Office of Enterprise Assessments |
| EDWS | Electronic Document Workflow System |
| EOC | Extent of Condition |
| EPFM | Engineering Plant and Facilities Management System |
| FE | Facility Engineer |
| FY | Fiscal Year |
| HLLCP | High Liquid Level Conductivity Probe |
| LW | Liquid Waste |
| M&TE | Measuring and Test Equipment |
| NMMP-DD | Nuclear Maintenance Management Program Description Document |
| OFI | Opportunity for Improvement |
| ORPS | Occurrence Reporting and Processing System |
| PAAG | Performance Analysis Advisory Group |
| PCV | Pressure Control Valve |
| PdM | Predictive Maintenance |
| PM | Preventive Maintenance |
| PRV | Pressure Relief Valve |
| QA | Quality Assurance |
| RICP | Receipt Inspection Criteria Package |
| S/CI | Suspect/Counterfeit Item |
| SC | Safety Class |
| SHR | System Health Report |
| SRNS | Savannah River Nuclear Solutions, LLC |
| SRR | Savannah River Remediation, LLC |
| SRS | Savannah River Site |
| SS | Safety Significant |
| SSC | Structure, System, or Component |
| SSO | Safety System Oversight |
| STAR | Site Tracking, Analysis, and Reporting |
| TSR | Technical Safety Requirement |
| WDED | Waste Disposition Engineering Division |

# Safety System Management Assessment at the Savannah River Site Liquid Waste Concentration, Storage, and Transfer Facilities, May – June 2019

## Summary


**Scope**

This assessment evaluated safety system management at the Liquid Waste Concentration, Storage, and Transfer Facilities (CSTF). Savannah River Remediation, LLC (SRR) manages CSTF under a prime contract with the U.S. Department of Energy (DOE) Savannah River Operations Office. Systems assessed included the safety class waste tank high liquid level conductivity probes and alarms for the 43 waste storage tanks currently in service; the safety significant 242-16H evaporator tube bundle pressure control and relief system; and the safety significant 242-25H evaporator lance steam pressure control and relief system.

**Significant Results for Key Areas of Interest**

Safety System Management

Overall, SRR is effectively managing and implementing the programs and processes associated with safety system management. The engineering and configuration management processes are well-defined and provide adequate rigor and support for daily engineering activities. Technical products examined were of good quality, with the single exception of a calculation supporting a temporary modification. SRR has established a cognizant system engineer program that meets the requirements of DOE Order 420.1C, *Facility Safety,* and incorporates adequate training and qualification processes.

Operations processes are adequate, providing assurance that the examined systems will perform their intended functions when required. The CSTF maintenance program is effective and complies with DOE Order 433.1B, *Maintenance Management Program for DOE Nuclear Facilities*. The surveillance testing and calibration programs are well-structured and implemented, although the assessment team identified a few instances where information required to be documented in a TSR-related surveillance was missing or incomplete. Quality assurance, feedback, and improvement processes are also effective.

Feedback information is used regularly to focus attention on issues, and a multi-faceted self-assessment process is in place to drive performance improvement. The issues management system is used adequately to identify and correct problems, and to prevent recurrence.

Federal Oversight

The DOE Savannah River Operations Office has implemented an adequate safety system oversight program that ensures continued safety system operational performance, and effectively assesses CSTF safety systems.

Best Practices and Findings

A Best Practice was identified regarding the system health database tool for managing periodic system health reports. The tool is easy to navigate and effective in assembling high-level information for senior management.

No findings were identified during this assessment.

**Follow-up Actions**

No follow-up actions resulted from this assessment.

**Safety System Management Assessment at the Savannah River Site Liquid Waste Concentration, Storage, and Transfer Facilities**

## 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 safety system management at the Savannah River Site (SRS) Liquid Waste Concentration, Storage, and Transfer Facilities (CSTF). This assessment was conducted as part of an ongoing review of the management of safety systems at hazard category 1, 2, and 3 facilities across the DOE complex. The purpose of this effort is to evaluate processes for monitoring, maintaining, and operating safety systems to ensure their continued capability to reliably perform their intended safety functions.

The facilities within the CSTF complex are, in aggregate, considered a hazard category 2 facility that stores wastes generated at other DOE facilities across SRS. CSTF has the capability to perform volume reduction, where appropriate, and transfer waste between facilities for treatment and to other facilities, such as the Defense Waste Processing Facility (DWPF) for vitrification or the Saltstone Facility for disposition. DOE oversight of CSTF is the responsibility of the Office of Environmental Management's Savannah River Operations Office (DOE-SR). Savannah River Nuclear Solutions, LLC (SRNS) is the overall management and operating contractor for SRS, but Savannah River Remediation, LLC (SRR) manages CSTF under a separate prime contract covering liquid waste (LW) operations for DOE-SR. In most respects, SRR operates under the sitewide processes established by SRNS.

CSTF systems within the scope of this assessment included the safety class (SC) waste tank high liquid level conductivity probes (HLLCPs) and alarms for the 43 waste storage tanks currently in service; the safety significant (SS) 242-16H evaporator tube bundle pressure control and relief system; and the SS 242-25H evaporator lance steam pressure control and relief system. EA discussed and coordinated the scope of this assessment with the DOE-SR Waste Disposition Engineering Division Director and staff.

## 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 (OFIs)" as defined in DOE Order 227.1A.

As identified in the *Plan for the Office of Enterprise Assessments Assessment of Safety System Management at the Savannah River Site Liquid Waste Concentration, Storage, and Transfer Facilities, May-June 2019*, this assessment considered requirements related to engineering design and configuration management; system engineering; operations; maintenance, surveillance, and testing; quality assurance, feedback, and improvement; and Federal oversight. The assessment team further examined the flowdown of safety basis requirements into technical baseline documents and the application of appropriate technical requirements in the procurement process for component spares and replacement items.

The assessment team used Criteria and Review Approach Document 31-15, *Safety Systems Management Review*, Revision 0. Activities included examination of documents, such as system descriptions, health reports, work packages, procedures, engineering analyses/design change packages, and training and

qualification records. The assessment team also interviewed key personnel responsible for developing and executing the associated programs; observed Operations and Maintenance daily activities; and performed onsite inspections of accessible portions of the selected systems.

The members of the assessment team, the Quality Review Board, and management responsible for this assessment are listed in Appendix A.

EA has not conducted a recent assessment of the CSTF. Therefore, there were no items for follow-up during this assessment.

## 3.0 RESULTS

### 3.1 Engineering Design and Configuration Management

This section discusses the engineering processes and products applicable to the systems under review, evaluating them for technical adequacy and compliance with the documented safety analysis. Activities in this area also included examination of configuration management practices to ensure that safety systems continue to function as designed and as required by the safety analyses.

**Engineering Processes and Products**

The assessment team examined the engineering procedures for drawings, calculations, technical review, technical baseline identification, design change packages, design change forms, and modification travelers. The calculation and modification procedures are SRR-specific, and the rest are SRNS procedures in use throughout SRS. Most of the procedures had been reviewed at similar revision levels in previous assessments. No new issues resulted from the current review. These procedures reflect well-defined processes with rigorous design control. The calculation procedure clearly defines requirements for design inputs, technical justification of assumptions, and tracking of open items. The design change and modification traveler procedures establish a facility modification process that ensures changes are reviewed by all affected organizations, configuration management is maintained, and closure drives resolution of any open items and updating of affected documents.

CSTF has had several temporary modifications of safety-related equipment in place for multiple years. The temporary modification process that allowed initial approval of those modifications offered insufficient guidance/requirements for technical justification of the modifications. However, E7 2.06A, *LW Temporary Modification Control*, was revised in May 2019 to strengthen requirements in this area. Extensions approved since that revision implemented the new requirements and provide technically adequate bases for the modifications.

Several of the tank purge and ventilation systems have extensions added to the exhaust stacks, some of which also include an inline stack-mounted high efficiency particulate air (HEPA) filter box. These extensions were added under temporary modification packages, and some have since been made permanent. The temporary modification packages relied on supporting calculations to justify the continued natural phenomena hazard qualification for these safety class components (wind and seismic).

One such calculation, T-ESR-H-00005, *Evaluation of Temporary Extension for Tanks 38H and 40H P&V System Stack (Pipe) to Minimize Mercury Exposure to Workers*, contains inappropriate technical assumptions and procedural non-compliances that significantly affected the calculation results. Specifically, T-ESR-H-00005:

- Is a Type 2 calculation but does not comply with calculation procedure E7 2.31A, *LW Engineering Calculations*, requirements for functional classification, design inputs, and design verification. It also contains an open item on clamp qualification, although the procedure does not allow open items in Type 2 calculations.
- States that amplified horizontal seismic accelerations will not be considered "since this is a temporary mod and the temporary extension will be removed upon completion of any work requiring the extension." Temporary modifications of SC components must meet the same technical criteria as permanent modifications.
- Calculates a 400 pound vertical load on the supporting SC centrifugal fan housing but does not validate the fan's capability to take the load, relying on unsubstantiated engineering judgment.
- States that the stack support anchor bolts are "no good" for the analyzed 107 mph wind speed and "no good" for Performance Category 3 seismic loads. As a result, the temporary modifications did not meet seismic II/I criteria.

**Figure 1. Modified Ventilation Exhaust Stack**

When the assessors identified this issue, SRS took appropriate action by performing an immediate walkdown of the affected temporary modifications to determine whether the potential for seismic II/I interactions with other safety related structures, systems, or components (SSCs) might exist. As a result, SRS determined that such interactions could occur on two tanks. Item 2019-CTS-006074 was initiated in the Site Tracking, Analysis, and Reporting (STAR) system to document the concern and track corrective action. (See **Deficiency D-SRR-1**.)

In addition to the exhaust stack evaluation, the review of Engineering technical products encompassed 28 design changes, with 23 supporting calculations and 51 drawings, all of which were found to be technically adequate. Most of the design changes involved adjustments to the positioning of conductivity

**Figure 2. Liquid Level Conductivity Probe**

probe level instruments. The analytical operating limits for the tanks have sound technical bases, in accordance with American National Standards Institute/International Society of Automation (ANSI/ISA) Standard 67.04.01, that have been properly translated into design change packages for level setpoint changes and into documentation used by operating personnel.

**Configuration Management**

DOE-STD-1073-2016, *Configuration Management*, establishes five essential elements of a successful configuration management program. Those elements, addressed individually below, are technical baseline, design change control, work control, document control, and assessments. Individual elements are implemented at CSTF and other LW facilities through a combination of SRS sitewide processes and SRR-specific processes. SRR also uses G-ESR-H-00127, *Liquid Waste Disposition Project Configuration Management Implementation Plan*, to provide an overview of the program as applied to CSTF and other LW facilities, as well as specific guidance in such areas as legacy drawings that predate the configuration management program.

The technical baseline is established in accordance with upper tier procedure E7 1.05, *Technical Baseline Identification*, and SRR-specific procedure S4 ENG.15, *Technical Baseline for Liquid Waste*. These procedures adequately define requirements for identification, categorization, and maintenance of technical baseline documents, including limits to drive incorporation of changes: essential drawings must be revised within 30 days, and support drawings must be revised when there are 5 extant changes total. Updating of general support drawings is discretionary.

The design change control process is adequately defined and controlled by the design change form, design change package, and modifications traveler procedures noted previously.

Based on limited-scope system inspections, the assessment team found that the configurations of the selected safety systems were consistent with the as-built drawings and system alignment procedures. Overall, work processes adequately control maintenance of the selected safety systems so that system configuration is properly managed throughout the maintenance process.

Engineering documentation is maintained in the Engineering Plant and Facilities Management System (EPFM). Permanent records are kept in the Electronic Document Workflow System (EDWS), which is updated daily from EPFM. A previous independent oversight assessment at another SRR facility (*Assessment of Safety System Management at the Savannah River Site Defense Waste Processing Facility*, August 2017) identified an issue with a significant backlog of SRR documents waiting to be entered by SRNS into EDWS. That backlog has not yet been completely resolved; more than 2500 previously closed work packages remain to be entered. However, this is a known issue within SRR, which has applied additional resources to reduce the backlog from a peak of over 4000 in 2017. Newly generated work packages are being entered into EDWS in a timely manner.

SRR substantially upgraded its program for performing assessments of configuration management in 2018. In particular, G-ESR-H-00127 was revised to include construction, physical configuration, design, and performance assessments. Taken together, these revisions provide a comprehensive process that looks at all aspects of configuration management and ensures that the program is examined in its entirety

at least every three years. By comparison with previous independent oversight results, this upgrade reflects a substantial enhancement to the program.

**Engineering Design and Configuration Management Conclusions**

The engineering and configuration management processes in place at CSTF are well-defined, providing adequate rigor and support for daily engineering activities. The technical products that were examined were of good quality, with the single exception of the support calculation for a temporary modification that did not provide an adequate technical basis for continued operability of the affected components.

## 3.2 System Engineering

This section discusses the cognizant system engineer (CSE) program. DOE Order 420.1C, *Facility Safety*, requires that facility contractors at hazard category 1, 2, and 3 facilities implement a CSE program for all SC and SS systems and designated defense-in-depth systems to ensure that the systems will reliably perform as intended.

The CSE program at CSTF is defined in Procedure E7-1.10, *Engineering Program Roles, Responsibilities, Accountabilities and Authorities*, which adequately implements the relevant requirements of DOE Order 420.1C, Attachment 2, Chapter V, *Cognizant System Engineer Program*. The CSE program ensures that safety systems are controlled and maintained according to the requirements established in the safety basis. SRR has appropriately assigned individuals as CSEs to be directly responsible for each of the safety systems reviewed in this assessment. Among other duties, the CSE is the focal point for ensuring that system configuration is managed effectively, updating system documentation, and maintaining system reliability and operability. CSEs conduct frequent system walkdowns, maintain extensive field presence, assist with issue resolution, and analyze system data to meet system monitoring expectations and ensure adequate system performance.

Procedure S4-ENG.45, *Vital Safety System - System Design Descriptions and System Files*, provides both guidance and requirements for CSEs to maintain up-to-date documentation for their assigned systems. For the HLLCPs, the evaporator pressure control valves (PCVs), and the pressure relief valves (PRVs), the CSEs maintain system files that appropriately identify applicable requirements, explain why those requirements exist, and describe the features of the system design provided to meet those requirements. Combined with the system health reports (SHRs) discussed below, the system files communicate important system information to others, facilitate turnover to new engineers, and prevent the loss of system knowledge. An internal SRR assessment noted that the system files do not always contain the most recent references relevant to the systems. A corrective action, currently under way, was initiated in the STAR system to update the system file references with the most recent revisions.

**System Health Monitoring**

Procedure E7-3.04A, *LW SSC Performance Monitoring*, provides guidance for monitoring and evaluating performance data for safety systems to improve their reliability and availability through early detection of degradation. A facility-specific performance monitoring plan contains more specific requirements for CSTF systems. For each of the systems reviewed, the assessment team verified that a system-specific monitoring plan appropriately addresses the requirements of Procedure E7-3.04A and the facility-specific performance monitoring plan. CSEs develop and maintain SHRs for their systems, assigning color codes (stop-light colors) to each system that indicate the overall health of the system. For systems with yellow or red health colors (HLLCPs were yellow at the time of the assessment due to spurious alarms), E7-3.04A requires the CSE to develop monthly SHRs and develop a plan to return the system to green. Additionally, CSTF management holds monthly meetings to discuss these "path-to-green" plans as well

as other SHRs, and action items from these meetings are placed in the STAR system and tracked to completion. This approach is reasonable for ensuring that safety systems are managed adequately.

The periodic SHRs are generated using an online tool called the system health database. The assessment team found the system health database tool easy to navigate and effective for assembling high-level information for senior management to easily understand the status of the system. Use of this system is considered to be a **Best Practice**.

While the periodic SHRs are managed in the system health database, the annual SHRs are processed separately. The assessment team identified a number of issues in a sample of annual SHRs, including inconsistencies in content and layout, delays in completion, and inadequate highlighting of important information. (See **OFI-SRR-1**.)

**CSE Training and Qualifications**

The CSE training and qualification program is described in Procedure LWOTS000, *Engineering Technical Staff Training Program Description*, which meets the applicable requirements from DOE Orders 420.1C and 426.2. CSEs go through a rigorous qualification process that takes approximately 18-30 months to complete, depending on previous qualifications. The CSE training and qualification program uses a systematic approach to training and is designed to ensure that these personnel have the requisite knowledge, skills, and abilities to properly perform work in accordance with the safety basis. CSEs are required to take a combination of in-classroom and on-the-job training. Training topics appropriately cover engineering fundamentals, facility-specific processes, and system-specific content. A qualification board and the CSTF engineering manager provide final qualification approval. The CSE training records that were reviewed met the applicable requirements.

SRR has also established a continuing training program for CSEs, which is described in WCACAA00, *LWO Technical Staff Continuing Training Plan*. WCACAA00 requires CSEs to take periodic training classes to refresh their knowledge, skills, and abilities. WCACAA00 also requires any identified lack of training to be discussed with the CSTF engineering managers. While there are ample opportunities for CSEs to attend continuing training, the CSE continuing training program does not specify minimum training requirements, resulting in inconsistent levels of training across the organization. The CSE training coordinator stated that this is a known issue, and efforts are under way to ensure that all CSEs appropriately participate in the continuing training program.

**System Engineering Conclusions**

SRR has established a CSE program that meets the requirements of DOE Order 420.1C. CSEs conduct effective system health monitoring to ensure that the requisite design and safety functions will continue to be reliable. The CSE training and qualification program ensures that CSEs initially achieve the requisite knowledge, skills, and abilities. The annual SHR process and the CSE continuing training program could be strengthened to improve performance.

## 3.3 Operations

This section discusses the conduct of activities necessary to operate the identified systems, monitor their function and status, and identify problems when they arise. Typical Operations activities include periodic surveillances and functional checks, as well as responses to alarms.

**Conduct-of-Operations Program**

SRR has established a conduct-of-operations program that effectively implements the requirements of DOE Order 422.1, *Conduct of Operations*. SRS sitewide management policy 1-01 4.20, *Conduct of Operations*, defines the Standards/Requirements Identification Document as the implementation matrix required by DOE Order 422.1. For SRR, the applicable document is SRR-RP-2009-00558-09, *Standards/Requirements Identification Document Functional Area 09.0 Conduct of Operations*, which in turn invokes procedures from both Manual 2S, *Conduct of Operations*, and S4, *Liquid Waste Organization Administrative Procedures*. These procedures adequately flow down the DOE order requirements. However, the assessment team noted one inconsistency between implementing procedures. Manual 2S, Procedure 5.5, *Control of Equipment and System Status*, was recently revised to allow the use of seals as equivalent to locks for administrative control of equipment. This change has not yet been incorporated into Manual S4, Procedure OPS-SO-F-HTF.33, *F & H Tank Farm & ETP Administrative Control Lock Program*, even though this facility uses seals for this purpose. SRR appropriately initiated a procedure change request (PCR-2019-01926) to address this inconsistency.

CSTF is operated from three separate control rooms, located in buildings 241-18F, -2H, and -28H. The assessment team observed operations and reviewed operating logs in all three control rooms. Access to the control areas was adequately controlled in all these rooms. Operator aids were appropriately controlled in all control rooms, and no unapproved operator aids were noted elsewhere in the facility. Operating logs were appropriately maintained for key positions, and approved methods were used to correct errors or make late entries.

The assessment team observed several shift turnovers in each of the three control rooms. All turnovers were professional, thorough, and appropriately guided by a checklist. Operators appropriately articulated the status of the systems they were monitoring and described upcoming activities for the shift.

**Operator Training and Qualification**

The CSTF operator training program appropriately consists of a mix of classroom and on-the-job training; the specifics vary by position. The qualification requirements for all five Operations-qualified positions appropriately include a mix of classroom, simulator, and field training, and the training material adequately emphasizes the importance of safety systems for worker protection. The training requirements are satisfactory.

CSTF uses a computer-based tool, the Automated Qualification Matrix, to compose the watchbill for each shift. This system ensures that the watchstander is current with the required proficiency hours, and also updates the running total of proficiency hours. Control room operators routinely rotate between the three control rooms to maintain proficiency. The coupling of the watchbill roster and proficiency database was noted as a best practice in previous independent oversight assessments of SRS facilities.

Operations staff also receive continuing training on a variety of topics. In order to effectively train the entire crew, CSTF has instituted an innovative schedule that uses the Friday of the week that the crew is on the day shift as a dedicated training day. The assessment team observed the continuing training and found both the training and the examinations to adequately prepare the operators for future tasks. The continuing training was satisfactory.

**Procedure Development, Use, and Adherence**

Operations procedures for CSTF are developed, validated, issued, and revised in accordance with requirements from Manual 2S, Procedure 1.1A, *Conduct of Operations Liquid Waste Procedure*

*Administration*, and Manual S25, *Liquid Waste Operations Procedure Systems Administrative Procedures Manual*. Procedure writers appropriately engage subject matter experts to develop detailed procedures for equipment operation. Round sheets for monitoring equipment status are implemented as electronic rounds, and paper round sheets provide a backup when the electronic system is unavailable. The assessment team observed performance of rounds using the electronic round sheet and noted no issues.

The evaporator steam pressure control systems are not subject to operator intervention except during steam system startup and shutdown. Steam system pressures are recorded on appropriate operator rounds.

Each of the reviewed annunciator response procedures for the waste storage tank HLLCPs correctly listed the alarm setpoint, which corresponded with the value from N-ESR-G-00001, *High Level Waste Emergency Response Data and Waste Tank Data*. Operator actions included appropriate event responses. The annunciator response procedures were satisfactory.

The waste storage tank HLLCPs appropriately undergo a weekly functional check to satisfy surveillance requirement 4.8.4.1 from S-TSR-G-00001, *Technical Safety Requirements Savannah River Site Concentration, Storage, and Transfer Facilities*. This functional check is included with other control room tasks as part of the round sheet for the appropriate control room operator. The assessment team observed operators in each control room simulating the performance of the functional check and adequately explaining the expected indications. The simulated functional check was satisfactory.

**Operations Conclusions**

Overall, Operations activities are adequate to ensure that operators are informed of conditions, operate equipment properly, monitor system function and status, and identify problems when they arise. Operators are well trained and informed on the importance of the systems. CSTF uses a previously-identified best practice for automatically tracking operator proficiency hours based on watchstanding hours. The evaporator steam pressure control systems and waste storage tank HLLCPs are operated in a manner that ensures the systems will be able to perform their intended functions when required. An inconsistency noted between procedures regarding the use of seals for administrative control was appropriately addressed through an SRR-initiated procedure change request.

### 3.4 Maintenance, Surveillance, and Testing

Safety-related systems must be maintained in a manner that ensures that they will be capable of performing their safety functions when required. The facility maintenance program is established for this purpose, through a combination of procedurally controlled preventive maintenance (PM), corrective maintenance (CM), and predictive maintenance (PdM). Surveillance and testing of key components are performed periodically to ensure continued functionality in accordance with the technical safety requirements (TSRs) and specific administrative controls for the facility.

**Nuclear Maintenance Management Program**

Maintenance of safety-related SSCs in SRS nuclear facilities (including CSTF) is adequately addressed in the *Nuclear Maintenance Management Program Description Document* (NMMP-DD), as required by DOE Order 433.1B, *Maintenance Management Program for DOE Nuclear Facilities*. The NMMP-DD also complies with DOE Order 430.1B, *Real Property Asset Management*, as it relates to the maintenance of those assets. CSTF implements the NMMP-DD through the SRS sitewide procedures listed in the NMMP-DD. The NMMP-DD has been approved by DOE-SR, as required by DOE Order 433.1B.

The maintenance program is appropriately identified as a safety management program in TSR Section 5.7.2 and receives self-assessments on a three-year cycle. Each year, the facility maintenance management and staff perform self-assessments on multiple maintenance topics so that all areas of the maintenance program are assessed every three years. The assessment team reviewed the self-assessments performed during the last three years and found no issues.

The assessment team reviewed a sample of 243 completed maintenance work packages covering both CM and PM from a total of 2649 work packages performed during the last 2 years on SS/SC equipment. Isolated deficiencies were noted, including inconsistent use of placekeeping and unclear documentation of work history. Despite these minor exceptions, the maintenance work package documentation is thorough and in good order.

**Corrective, Preventive, and Predictive Maintenance**

SRR has implemented adequate CM and PM processes at CSTF for the HLLCPs and evaporator tube bundle and lance pressure control and relief valves (hereafter referred to as the selected safety systems), except as noted below. The assessment team observed PM activities involving fan bearing lubrication, periodic valve replacement, and type III waste tank ventilation system loop seals. PdM was also observed, including thermography and vibration analysis on fan bearings. The field work activities were properly performed in accordance with established work instructions. No issues were identified in work execution, except as noted below. The assessors also identified no issues in a sample of PdM work orders performed on CSTF SS/SC SSCs.

Maintenance processes, including provisions for CM and PM covering the selected safety systems, are addressed in SRS sitewide procedures and augmented by SRR-specific procedures. These procedures are consistent with the system SC/SS designations. The work control process adequately identifies the hazards, associated controls, and work steps for each activity (i.e., CM, PM, or PdM). However, there are weaknesses in the CSTF work planning and scheduling process.

SRR does not consistently implement schedule change control at CSTF in accordance with S4 OPS-14, *Liquid Waste Facilities Work Control Procedure*. The procedure requires schedule control with justifications and approvals for changes that occur beginning two weeks prior to the actual work week, which is referred to as the T-2 schedule. The current work week (called T-0) begins at 7 a.m. each Friday. The schedule for T-0 is locked in on Thursday afternoon. Although there is evidence of more consistent schedule control after the T-0 schedule is issued, many changes occur and jobs are added to the process without justification and approval between the T-2 schedule lock and the actual T-0 work week. SRR management revised an existing issue (2019-MFO-008299) to address this problem following discussions with the assessment team.

The PM program, as described in sitewide SRNS Manual 1Y, Procedure 5.02, *Preventive Maintenance Program*, requires PM activities to be scheduled and performed prior to the prescribed PM due date. PM grace periods (typically 25% of the PM interval) are routinely used as schedule relief. Following the 2017 EA assessment of vital safety systems at DWPF, SRR initiated a STAR item (2018-CTS-006330) to request a sitewide change to 1Y 5.02 to correct this weakness by requiring justification and approval before using the grace period. An update to the sitewide procedure is in process.

The selected safety systems were in good condition, with only a few SSCs out of service or in an alarm condition. However, the assessment team noted that an SS annulus conductivity probe that failed in February 2018 has not been repaired/replaced. Although the other annulus probe for that tank remains operable, the reliability of the annulus leak detection function is adversely affected since the probe has not been returned to operable status in a timely manner.

Several pre-job maintenance walkdowns of work sites, pre-job briefings, and work activities were observed during the assessment. Workers effectively integrated human performance error reduction tools into work performance. During pre-job briefings, supervisors and workers discussed specific human performance error reduction tools related to the job activity and subsequently implemented them as work proceeded. These tools included three-way communication, procedure placekeeping, and peer checks.

**Performance Metrics**

The SRR maintenance program uses three formal performance metrics to track maintenance performance: CM backlog, PM deferrals, and minor maintenance backlog. These metrics are presented monthly to SRR management. The CSTF maintenance manager also uses other informal performance measures to track maintenance performance. The assessment team noted that two of the three formal performance measures (CM backlog and PM deferrals) contain performance information relative to safety-related SSCs for which there are no goals. For example, the CM backlog metric shows both total CM backlog and CM backlog for SS/SC SSCs on the same chart. The chart has a performance goal only for the total CM backlog, with no goal for the more important SS/SC equipment backlog, so it is ineffective for identifying problems/trends requiring corrective action. The performance measure for PM deferrals has the same weakness. The metrics in use at CSTF (both formal and informal) are otherwise adequate to measure maintenance performance.

**Surveillance and Testing**

The documented safety analysis for CSTF identifies postulated events that credit HLLCPs for preventing explosive conditions from developing, thereby preventing overexposure to the maximally-exposed offsite individual. The evaporator tube bundle and lance steam PCVs and PRVs are credited as SS for the mitigation of an evaporator overpressure event or a seismic event.

The documented safety analysis requirements are properly flowed down to the TSRs and implementing procedures (see also Section 3.1, above). The assessment team reviewed 42 surveillance testing packages completed during the last two years, including calibrations of TSR equipment and functional tests. Most of the reviewed packages were properly completed and met established acceptance criteria. However, the assessment team identified instances where information required to be documented in a surveillance for a TSR related to a biennial Structural Integrity Inspection of PCVs and PRVs was missing or incomplete. Eight of the 12 reviewed past performances of the structural integrity program on PRVs and PCVs (performed to satisfy TSR 5.8.2.12) did not adequately and completely document the surveillance results. These omissions were also not identified during post-performance review. (See **Deficiency D-SRR-2**.)

Several daily operational TSR surveillance checks were observed. Operations and Maintenance personnel performing those surveillance activities were knowledgeable of the procedures and performed them properly. The assessment team also observed calibration of a TSR instrument associated with waste tank primary purge differential pressure, which was performed adequately.

**Instrumentation and Measuring and Test Equipment Calibration Program**

No SS/SC instrument calibrations were past due at the time of this assessment. Three measuring and test equipment (M&TE) storage areas are located throughout CSTF, managed by a single individual who coordinates/maintains M&TE calibrations. Manual 1Q, Procedure 12-1, *Control of Measuring and Test Equipment*, adequately defines the requirements and responsibilities for control of standards and M&TE used to support calibration of safety system instrumentation. The M&TE observed during the onsite portion of the assessment was properly calibrated and maintained. In addition, the assessment team reviewed a sample of M&TE calibration reports and found no issues.

### Training

SRR has implemented a training program for maintenance workers (i.e., electrical and instrumentation technicians, and maintenance mechanics). The training program consists of generic maintenance task training, site access training, and CSTF topical training, including safety basis training. The generic maintenance training provides base qualifications through the SRNS sitewide maintenance qualification process. The assessment team determined that the training program provides the knowledge, skills, and abilities to perform generic maintenance tasks (e.g., calibrating instruments, torqueing a flange). However, the program does not equip the mechanics and electrical/instrument technicians to perform specific work tasks on CSTF SSCs independently. During interviews, maintenance first-line supervisors and senior maintenance managers described their process for ensuring that the assigned workers are qualified to perform work on CSTF equipment, in which they rely on their own judgment that the assigned staff are fully qualified to perform CSTF maintenance tasks independently. This informal on-the-job training process is not documented or included in the qualification program for maintenance workers to ensure that it is consistently and objectively applied. (See **OFI-SRR-2**.)

SRR has implemented an adequate process to guard against suspect/counterfeit items (S/CIs). The CSEs and maintenance personnel receive initial and periodic training on identifying and dispositioning S/CIs found in the facilities, so that as work is performed and systems are walked down, they can identify and disposition any existing S/CI. The assessment team identified no issues in the records for the required S/CI training.

### Maintenance, Surveillance, and Testing Conclusions

Overall, the SRR maintenance program at CSTF complies with DOE Order 433.1B. SRR has addressed the requirements through the implementation of the sitewide NMMP-DD and its implementing documents. However, work prioritization and scheduling weaknesses contribute to a CM backlog and PM activities being completed past their due dates.

Observed work activities were performed in accordance with established controls, work hazards were properly identified and controlled, and maintenance workers exhibited good questioning attitudes and use of human performance error reduction tools. However, CM of an SS annulus conductivity probe has not been timely to restore the probe to operable status.

The surveillance testing and calibration program, in conjunction with the maintenance program, adequately maintains the SSCs in a condition that ensures that the TSRs are satisfied and that the safety systems will perform their intended functions when required. The M&TE maintenance and calibration program is well organized and effective. The observed surveillance and testing activities for CSTF were performed properly and adequately translate the TSRs into useable procedures and programs. However, inadequate documentation was noted in past performances of structural integrity program surveillances.

## 3.5 Quality Assurance, Feedback, and Improvement

This section discusses quality assurance (QA) aspects of the procurement process. An important aspect of QA as applied to operating facilities is the need to ensure that both new components and replacement items are designed, manufactured, and procured to sufficient quality standards and that they are capable of performing the required safety-related functions. This section further discusses measures implemented at CSTF to identify/resolve issues, assess performance, identify lessons learned, and promulgate the results to the facility staff in a manner that reduces the likelihood of recurrence.

**Procurement Documents and Records**

SRR effectively procures replacement components as commercial items subject to its commercial grade dedication (CGD) process, including use of receipt inspection criteria packages (RICPs) for critical characteristics. CGD procedure E7 3.46, *Replacement Item Evaluation/Commercial Grade Dedication [NQA-1 2008/2009A]*, adequately implements the requirements of 10 CFR 830.122, *Quality Assurance Criteria*, Criterion 7, *Performance/Procurement*. Eight sampled material service requests were appropriately used to acquire replacement parts for safety SSCs, were generally consistent with the functional classifications required by the technical baseline documents, and included appropriate CGD requirements to ensure that purchased replacement components will perform their intended safety functions. CSEs for the affected systems appropriately reviewed and approved procurement documents, which were compiled by qualified procurement engineering personnel. Interviews indicated that the CSEs for the HLLCP and PCV/PRV systems are knowledgeable of the SRNS/SRR procurement process, understand the applicable procedures, and effectively use database systems to access system data. Training records confirmed that the CSEs completed the appropriate SRR procurement training classes.

Records of seven installed components confirmed effective traceability of the original procurement documentation, including SC HLLCP relays and SS PCVs/PRVs. Records of five sampled safety-related procured components confirmed that SRR conducted appropriate requisite bench inspections, bench tests (if required), and in-service inspections/tests to verify each component's physical and functional technical baseline specifications and ensure that the items were fit for use.

**Critical Spare Parts Management**

SRR adequately acquires critical spare parts in accordance with an approved procedure, S4 MNT.06, *Spare Parts/Equipment Guidelines for LW,* to maintain onsite inventories based on an asset criticality ranking methodology. SRR has effectively implemented a database system (Puridiom) to generate material service requests for replacement of safety-related components using key parameters. Inspection of the SRR Tank Farm Material Access Center, auxiliary storage building 772H, and SRNS's N-Area receiving storage facilities confirmed the requisite Level 2 storage conditions (protection from temperature and humidity extremes) for eight sampled critical spare PCVs/PRVs, as well as an adequate N-Area designated QA hold area for a PRV that SRR properly marked while awaiting receipt of vendor information.

**Worker Feedback and Improvement**

SRR uses worker feedback effectively to improve subsequent work performance. An automated email containing any worker feedback on work performance is sent to the work order planners, requiring resolution and response to the feedback. Ten sampled recent emails to a lead planner demonstrated this communication. For example, mechanics noted several items in a work order that could improve tank filter element replacement, and the planner responded with a commitment to include the improvement suggestions in future work orders.

**Assessments**

SRR personnel routinely perform periodic self-assessments, independent corporate assessments, and functional area performance analyses of configuration management, maintenance, and operations processes that appropriately identify deficiencies. SRR conducts maintenance self-assessments on a three-year cycle as required by DOE Order 433.1B. Each year, the facility maintenance management and staff perform self-assessments on multiple maintenance topics so that SRR assesses all areas of the maintenance program every three years. The assessment team reviewed 22 maintenance self-assessments

performed during the last three years and found no issues. Additionally, two thorough engineering annual self-assessments addressed implementation verification of the 2017 safety basis update (fiscal year (FY) 2018) and conductivity probe system files (FY 2019). A 2017 integrated independent corporate evaluation team composed of SMEs from SRR, SRNS, AECOM, and Bechtel conducted a broad, performance-based assessment of the SRR Tanks Farms addressing fourteen functional areas including configuration management, maintenance, and conduct of operations. Documented assessment results in each report communicated an adequate basis for findings and opportunities for improvement.

Contractor assurance personnel also perform adequate independent evaluations of Occurrence Reporting and Processing System (ORPS) and non-ORPS event information on a periodic basis. Based on the results of these evaluations, they identify potential significant negative trends or areas that may need additional senior management attention. They also present the results to the Performance Analysis Advisory Group (PAAG), which evaluates the data and contractor assurance recommendations, and forwards recommendations to the Executive Safety and Quality Board for approval and action. For example, in the fourth-quarter FY 2018 ORPS performance analysis, one of the conclusions was that a large percentage of the deficiencies occur in three systems: HLLCPs, tank/transfer facility purge ventilation flow indicators, and DWPF gas chromatographs. At the request of the PAAG, the CSE presented an effective overview of the system health information for HLLCPs to the PAAG in January 2019, noting improvements in screening of conductivity probes for salt buildup and pre-emptive replacement of junction boxes and internal components to reduce HLLCP reportable failures.

**Corrective Actions**

SRR uses the STAR system effectively to document and resolve issues. For the 16 samples reviewed specific to CSTF, SRR effectively analyzed identified deficiencies, developed appropriate corrective actions, ensured proper corrective action closure/verification, and adequately performed extent-of-condition (EOC) reviews and effectiveness reviews as appropriate. For example, causal analysis of the issue *Conductivity Probe Inoperable in Tank 32* determined that low voltage junction boxes and conduit attachments were not designed to prevent moisture intrusion, resulting in the corrosion of wire crimps, a path to ground, and an alarm signal. An EOC review found more evidence of this corrosion issue in other junction boxes. The CSE submitted a procedure change request to implement a maintenance worker's suggestion to use heat shrink tubing instead of crimps. The required effectiveness review is pending.

In another example, salt buildup on the HLLCP in Tank 47 caused an HLLCP alarm. The resulting corrective actions included an EOC review that included camera inspections of two other tanks. As a result of the EOC review, Engineering and Facility Management personnel developed new screening criteria for HLLCP inspections. These criteria are being used effectively in the work order database system to plan PM at six-month intervals, including video camera inspections to determine whether the probe needs to be flushed. An effectiveness review of the inspection/screening process is in progress.

**Quality Assurance, Feedback, and Improvement Conclusions**

Overall, SRR adequately procures replacement components following its CGD/RICP and procurement processes. Both SRR's and SRNS's receipt inspections verify the conformance of components to the procurement document requirements and adequately tag components to ensure their traceability. Sampled components are adequately stored and controlled in the SRR Material Access Center and SRNS N-Area storage facilities.

The CSTF management team demonstrates adequate involvement in monthly performance monitoring, issues management/corrective action resolutions, and worker feedback on field performance. Feedback information is used regularly to focus attention on issues and drive performance improvement. SRR

performs adequate periodic self-assessments and corporate assessments of engineering, configuration management, maintenance, and operations processes, and has appropriately identified deficiencies. The STAR system is used effectively for tracking problems and deficiencies identified in corrective action reports.

### 3.6 Federal Oversight

The objective of this portion of the assessment was to verify that DOE-SR has established and implemented an effective oversight program that ensures continued safety system operational performance.

The Safety System Oversight (SSO) Program at DOE-SR is implemented by Procedure SRIP 421.2, *Safety System Oversight*, which adequately implements the requirements of DOE Order 426.1A, *Federal Technical Capability Program*, Appendix C, *Safety System Oversight, Duties, Responsibilities, Knowledge, Skills, and Abilities*. Under the DOE-SR Assistant Manager for Waste Disposition, the Waste Disposition Engineering Division (WDED) is responsible for carrying out the SSO role. WDED uses a Facility Engineer (FE) model that combines the SSO function with the Nuclear Safety Specialist function, which enables staff to have a broad overview of safety system performance. However, the two individuals assigned the FE role for CSTF spend most of their time on safety basis document reviews and thus cannot fully oversee safety system management. This dual role is an issue that is being addressed within the DOE-SR organization.

Overall, the CSTF FEs are very knowledgeable of the safety systems and the current system status. DOE-SR has established a detailed assessment schedule for CSTF, in accordance with Procedure SRM 226.1.1F, *Integrated Performance Assurance Manual (IPAM)*, which includes independent assessments of safety system performance, equipment configuration, material condition of assigned systems, and safety management programs. The FEs routinely participate in system health review meetings, conduct system walkdowns, and perform program/document reviews, such as corrective actions, maintenance, surveillance, and design change packages. Additionally, DOE-SR management regularly observes activities in the field, the results of which are documented in STAR.

DOE-SR has established an SSO qualification program that meets the requirements of DOE Order 426.1A, Appendix C, ensuring that SSO personnel obtain the requisite knowledge, skills, and abilities to ensure that safety systems will perform as required by the safety basis and other applicable requirements. The SSO qualification program is guided by Procedure SRM 300.1.1B, *Technical Qualification Program*, and appropriately uses a tailored set of competencies that enables SSO personnel to acquire the necessary basic technical knowledge about their assigned safety systems. Additionally, DOE-SR has established an FE and SSO Council for the purpose of continuously improving the DOE-SR oversight programs. The Council enables SSO personnel to learn about issues of common interest across the site related to SSO functions.

**Federal Oversight Conclusions**

Overall, DOE-SR is meeting the requirements of DOE Order 426.1A, Appendix C, and has implemented an SSO program that is adequate, but challenged by the exigencies of the dual role described above. DOE-SR actively and effectively conducts assessments of CSTF safety systems, the results of which are appropriately documented. The DOE-SR SSO qualification program ensures that SSO personnel are capable of carrying out their assigned duties.

## 4.0 BEST PRACTICES

Best practices are safety-related practices, techniques, processes, or program attributes observed during an assessment that may merit consideration by other DOE and contractor organizations for implementation. One best practice was identified as part of this assessment.

- The system health database tool for managing periodic SHRs is easy to navigate and effective for assembling high-level information for senior management to easily understand the status of the system.

## 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.

All deficiencies apply to SRR.

**Deficiency D-SRR-1**: Contrary to the requirements of E7 2.31A, *LW Engineering Calculations*, SRR issued calculation T-ESR-H-00005 with procedural non-compliances and non-conservative assumptions that invalidate the calculation conclusions. This calculation was used to support temporary modifications to several SC purge and ventilation exhaust stacks. (STAR item 2019-CTS-006074)

**Deficiency D-SRR-2**: Contrary to structural integrity program procedure SW11.6-SVP-45, Revision 8, Section 4.17, SRR issued structural integrity surveillance documentation with required information missing in 8 of 12 examples reviewed. The internal post-performance review did not identify these omissions. (STAR item 2019-CTS-007278)

## 7.0 OPPORTUNITIES FOR IMPROVEMENT

The assessment team identified two OFIs 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.

All OFIs apply to SRR.

**OFI-SRR-1:** Consider integrating the annual SHR process into the system health database tool.

**OFI-SRR-2:** Consider enhancing the maintenance qualification program for mechanics and electrical/instrumentation technicians to include task qualifications specific to CSTF maintenance activities to ensure that they are qualified to perform their assigned tasks independently.

## Appendix A
## Supplemental Information

**Dates of Assessment**

Onsite Assessment: May – June 2019

**Office of Enterprise Assessments (EA) Management**

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April G. Stephenson, Deputy Director, Office of Enterprise Assessments
Thomas R. Staker, Director, Office of Environment, Safety and Health Assessments
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