Independent Assessment of Safety System Management at the Savannah River Site Defense Waste Processing Facility

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Office of Enterprise Assessments
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Acronyms

BLEVE	Boiling Liquid Expanding Vapor Explosion
CFR	Code of Federal Regulations
CGD	Commercial Grade Dedication
CM	Configuration Management
CRAD	Criteria and Review Approach Document
CSE	Cognizant System Engineer
DOE	U.S. Department of Energy
DOE-SR	DOE Savannah River Operations Office
DSA	Documented Safety Analysis
DWPF	Defense Waste Processing Facility
EA	Office of Enterprise Assessments
LCO	Limiting Condition for Operation
NMMP	Nuclear Maintenance Management Program
NQA	Nuclear Quality Assurance
NSS	Nuclear Safety Specialist
OFI	Opportunity for Improvement
PHSSR	Packaging, Handling, Shipping, Storage, and Receiving
PM	Preventive Maintenance
QA	Quality Assurance
QAMP	Quality Assurance Management Plan
SC	Safety Class
SDD	System Design Description
SHR	System Health Report
SRIP	Savannah River Implementing Procedure
SRMC	Savannah River Mission Completion, LLC
SRS	Savannah River Site
SS	Safety Significant
SSCs	Structures, Systems, and Components
SSM	Safety System Management
SSO	Safety System Oversight
TSR	Technical Safety Requirement
USQ	Unreviewed Safety Question
VSS	Vital Safety System

INDEPENDENT ASSESSMENT OF SAFETY SYSTEM MANAGEMENT AT THE SAVANNAH RIVER SITE DEFENSE WASTE PROCESSING FACILITY

Executive Summary

The U.S. Department of Energy (DOE) Office of Enterprise Assessments (EA) conducted an independent assessment of safety system management (SSM) at the Savannah River Site Defense Waste Processing Facility from March to May 2024. Savannah River Mission Completion, LLC (SRMC) manages the Defense Waste Processing Facility under the direction and oversight of the DOE Savannah River Operations Office (DOE-SR). This assessment was performed within the broader context of targeted SSM assessments at selected high hazard (i.e., hazard category 1 and 2) nuclear facilities across the DOE complex. The purpose of the assessment was to evaluate whether the selected safety systems (i.e., safety class melter off-gas flammability control and the safety significant standby electrical power system) were appropriately functionally classified and are operated and maintained in a manner to ensure that they can reliably perform their intended safety function of protecting workers and the public from analyzed hazards. This assessment also evaluated the effectiveness of applicable DOE-SR oversight processes.

EA identified the following strengths:

- SRMC engineering processes are effectively implemented.
- SRMC implements an effective plan for applying a graded approach to quality assurance requirements.
- The SRMC engineering and nuclear safety organizations responded proactively to address an emergent concern raised during the EA assessment regarding the unevaluated potential for a boiling liquid expanding vapor explosion.
- DOE-SR has enlisted a senior subject matter expert to help qualify recently hired engineers.

EA also identified several weaknesses, including two findings, as summarized below:

- SRMC issues management processes do not ensure appropriate classification, analysis, and resolution of issues. (Finding)
- DOE-SR does not ensure that each safety system receives adequate oversight from qualified safety system oversight personnel. (Finding)
- SRMC did not identify or evaluate the hazard created by a potential liquid nitrogen boiling liquid expanding vapor explosion in the documented safety analysis and supporting hazard analysis.
- SRMC did not consider all hazards associated with a temporary system modification that could affect the potential for a melter off-gas system explosion in an unreviewed safety question evaluation.
- SRMC operations practices allow some operations to be performed without using reviewed and approved written technical procedures.
- SRMC does not store all procured parts and equipment in accordance with their packaging, handling, shipping, storage, and receiving procedure such that materials are not always protected from damage.
- The SRMC cognizant system engineer program allows designation of unqualified personnel to fill the position for up to a year while qualifying.
- DOE-SR has not developed an SSO-specific staffing plan to inform and support priority recruitment and hiring of SSO personnel.

In summary, SRMC has established a generally adequate SSM program that ensures the operability of the evaluated safety systems and is compliant with applicable DOE requirements. The evaluated safety systems are appropriately classified and are being adequately managed. Nevertheless, EA identified specific program weaknesses associated with documented safety analysis development and several programs supporting SSM implementation, as well as weaknesses associated with DOE-SR oversight. Resolution of the issues identified in this assessment will support a more robust safety basis and strengthen the reliability of safety systems.

INDEPENDENT ASSESSMENT OF SAFETY SYSTEM MANAGEMENT AT THE SAVANNAH RIVER SITE DEFENSE WASTE PROCESSING FACILITY

1.0 INTRODUCTION

The U.S. Department of Energy (DOE) Office of Nuclear Engineering and Safety Basis Assessments, within the independent Office of Enterprise Assessments (EA), assessed the effectiveness of safety system management (SSM) at the Savannah River Site (SRS) Defense Waste Processing Facility (DWPF). This assessment was performed within the broader context of SSM assessments at selected high hazard (i.e., hazard category 1 and 2) nuclear facilities across the DOE complex in accordance with the *Plan for the Independent Assessment of Safety System Management Across the DOE Complex Fiscal Year 2024*. The assessment was conducted from March to May 2024.

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

Savannah River Mission Completion, LLC (SRMC) manages DWPF under the direction and oversight of the DOE Savannah River Operations Office (DOE-SR). DWPF, a hazard category 2 nuclear facility located in S-Area at the SRS, vitrifies high-level radioactive liquid waste produced by chemical separation processes. The liquid waste is currently stored in tanks in F- and H-Areas at SRS.

2.0 METHODOLOGY

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

As identified in the assessment plan, this assessment considered requirements from criteria and review approach document (CRAD) EA CRAD 30-11, Revision 1, *Safety Systems Management Review*, in assessing the adequacy of selected programs related to SSM at DWPF. The assessment was conducted using a sampling of data and is not intended to represent a full programmatic assessment of all SSM-relevant programs.

EA selected one safety class (SC) system and one safety significant (SS) system associated with the following TSR limiting conditions for operation (LCOs):

- TSR LCO 3.3.1, *Melter Off-gas Flammability Control* - SC
- TSR LCO 3.9.1, *Standby Electrical Power* - SS.

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 DOE-SR and SRMC personnel to clarify and resolve comments. Additional issues were identified during the onsite portion of the assessment.

EA examined the development of the selected controls as TSRs based on the hazard and accident analyses, and the implementation of safety basis requirements into technical baseline documents. Key documents were reviewed, including the documented safety analysis (DSA), the TSR document, TSR surveillance records, selected program plans, system design documents, procedures, and training and qualification records. EA interviewed personnel responsible for developing and executing the assessed programs; observed activities related to operations and surveillance; participated in detailed discussions of procedures and process implementation; and performed walkdowns of accessible areas of the selected systems and material storage areas. EA also conducted interviews and reviewed oversight records to determine whether the Federal oversight program ensures adequate operability of associated safety systems. The members of the assessment team, the Quality Review Board, and the management responsible for the assessment are listed in appendix A.

A previous independent assessment of SSM at DWPF was conducted in 2017, as documented in the EA report *Office of Enterprise Assessments Assessment of Safety System Management at the Savannah River Site Defense Waste Processing Facility, September 2017*. The 2017 independent assessment covered the same safety systems and SSM programs as this assessment and identified no findings; therefore, there were no items for follow-up addressed during this assessment.

3.0 RESULTS

3.1 Safety Basis

This portion of the assessment evaluated the DWPF safety basis, including control derivation and description, safety control functional classification, and TSR development for the SC melter off-gas flammability control and the SS standby electrical power system to determine whether they can fulfill their required safety functions under operating and accident conditions, and to ensure compliance with DOE-STD-3009-94, *Preparation Guide for U.S. Department of Energy Nonreactor Nuclear Facility Documented Safety Analyses*.

Control Derivation and Description

The DWPF SC melter off-gas flammability control is appropriately credited for protection of the public and workers from radiological consequences due to a flammable gas explosion in the off-gas system. The off-gas flammability instrumentation provides an indication and control of total melter air pressure and total melter air flow that ensure a flammable mixture is not formed in the off-gas system. Interlocks shut down the melter feed if the total melter air flow or steam pressure to the melter film coolers is low.

The DWPF SS standby electrical power system is appropriately identified as a support system to maintain Zone 1 exhaust ventilation following a loss of offsite power. The SS standby electrical power system, which is powered by two diesel generators, provides sufficient power for exhaust fan operation when offsite power is lost.

The facility is designed and constructed to meet design basis natural phenomena loads in accordance with DOE-STD-1020-94, *Natural Phenomena Hazards Design and Evaluation Criteria for DOE Facilities*. The SC components required for the melter off-gas flammability control appropriately meet

performance category 3 natural phenomena criteria and the SS standby electrical power system appropriately meets performance category 2 criteria.

The DSA, chapter 4, appropriately provides the safety function, system description, and functional requirements for the SC melter off-gas flammability control and the SS standby electrical power system. The system descriptions include a discussion of system components and operability requirements. Although chapter 4 of the DSA does not provide performance criteria and associated evaluations, which is inconsistent with the expectations of DOE-STD-3009-94, section 4.3.X.4, the necessary information to derive the TSR controls and justify their adequacy can be found in DSA, chapter 11, and the TSR bases.

Safety Control Functional Classification

The SC melter off-gas flammability control is appropriately functionally classified in the accident analysis. Unmitigated radiological consequences from off-gas explosions exceed the Evaluation Guideline of 25 rem specified in DOE-STD-3009-94; therefore, the melter off-gas flammability control is identified as SC to prevent these events. The SS standby electrical power system is appropriately functionally classified as a support system for the SS Zone 1 ventilation system. The Zone 1 ventilation system is credited with mitigating events with radiological consequences that exceed 100 rem to the collocated worker.

Technical Safety Requirement Development

The information provided in chapter 11 of the DSA and the TSR bases is sufficient to derive the TSR LCOs for each of the evaluated systems. The TSR operability and surveillance requirements developed for the SC melter off-gas flammability control and the SS standby electrical power system are adequate to ensure that the required safety functions will be provided. The TSR bases adequately describe the reasons for the operating limits and surveillance requirements.

Liquid Nitrogen Storage Tanks

During this assessment, a review of a causal analysis of a leak in the SC liquid nitrogen purge system identified that the liquid nitrogen tanks had not been evaluated in the hazard analysis. There are seven liquid nitrogen storage tanks in the vicinity of DWPF (six SC and one SS) that have not been identified or evaluated as hazards, based on the potential for a boiling liquid expanding vapor explosion (BLEVE). A BLEVE is a highly energetic event associated with liquid gas containers that can cause damage spanning a wide radius. A lack of hazard identification and evaluation could result in unanalyzed vulnerabilities to safety systems (such as the facility structure in this case) and an inadequate set of controls. Upon discovery of the unanalyzed hazard, SRMC management appropriately committed to following their potential inadequacy of the safety analysis (PISA) process to evaluate any resultant potential inadequacies of their DSA. Completion of the PISA and ORPS reporting processes, should result in adequate resolution of the issue.

Safety Basis Conclusions

The safety basis for the SC melter off-gas flammability control and the SS standby electrical power system is appropriately developed, and the safety functions and functional requirements are adequately provided. The melter off-gas flammability control and the standby electrical power system are appropriately classified as SC and SS, respectively. The TSRs are properly developed. The facility is designed and constructed to meet the required design basis natural phenomena loads. However, the DSA hazards and accident analyses do not address a BLEVE hazard from the liquid nitrogen tanks.

3.2 Technical Safety Requirement Surveillance

This portion of the assessment evaluated the DWPF TSR surveillance processes for the SC melter off-gas flammability control and the SS standby electrical power system to determine compliance with the TSR document.

The TSR surveillance procedures and their implementation are adequate to ensure that the SC melter off-gas flammability control and the SS standby electrical power system can accomplish their safety functions. The surveillance procedures appropriately identify system and test conditions and include clear performance steps. The procedures were appropriately developed, reviewed, and approved. SRMC schedules, tracks, and documents surveillances effectively to ensure compliance with the TSR-required frequencies, taking into account allowable extensions of surveillance requirements (i.e., TSR-defined grace periods).

Available records for the past four years show that surveillances on the SC melter off-gas flammability control have been adequately performed on time for the reviewed LCOs, except for one case that SRMC identified as a TSR violation by SRMC. Observed surveillances for the diesel generators and interviews with operations personnel confirmed that surveillances are appropriately performed and documented.

Training for operators performing TSR surveillances is addressed in section 3.7 below.

Technical Safety Requirement Surveillance Conclusions

SRMC's surveillance procedures are effective, and the performance of required surveillances is adequately documented to ensure the operability of the SC melter off-gas flammability control and the SS standby electrical power system.

3.3 Engineering Design Process

This portion of the assessment evaluated the DWPF engineering design process for the SC melter off-gas flammability control and the SS standby electrical power system to determine whether they incorporate applicable safety basis requirements and comply with 10 CFR 830.122, *Quality assurance criteria*, and appropriate consensus standards, including American Society of Mechanical Engineers Nuclear Quality Assurance (NQA)-1-2008/2009a, *Quality Assurance Requirements for Nuclear Facility Applications* (NQA-1).

SRMC has appropriately implemented conduct of engineering procedures at DWPF that meet the requirements of 10 CFR 830.122, criterion 6, for design performance. These procedures provide an adequate process for developing and controlling engineering design criteria, performing calculations, and developing drawings for the SC melter off-gas flammability control equipment and the SS standby electrical power system.

Reviewed engineering calculations and drawings were complete and appropriately signed by independent checkers. Design inputs and standards were adequately identified and are sufficient to allow qualified individuals to understand the design requirements. The SRMC engineering organization performed adequate independent design verifications for reviewed calculations and drawings to ensure that engineering products are technically accurate and complete.

An unreviewed safety question (USQ) process has been adequately established and implemented as required by 10 CFR 830.203, *Unreviewed safety question process*, and is being appropriately applied within the design change process. All reviewed USQ screens, and two of three USQ evaluations demonstrated adequate review of proposed changes to the SC melter off-gas flammability control and SS

standby electrical power system. However, contrary to 10 CFR 830.203(a), 10 CFR 830.3(a), and the SRS Facility Safety Document Manual 11Q, procedure 1.05, *Nuclear Facility Unreviewed Safety*, section 5.6.1 step 7, temporary air compressors were installed in an outdoor area to supply purge air to the melter plenum without considering the potential for flammable gases near the compressors (e.g., from a vehicle fuel spill) in USQ evaluation TRP-WD-2023-00190. System purging with quality supply air is required to keep the melter off-gas below flammability limits. (See **Deficiency D-SRMC-1**.) Missing hazard identification and evaluation associated with design changes could result in exceeding the limits assumed in the accident analysis.

Engineering Design Process Conclusions

Engineering procedures provide adequate processes for performing calculations, developing drawings, and managing design changes. The reviewed calculations and drawings were appropriately signed by independent engineers and incorporated applicable requirements from the facility safety design basis and consensus standards. The USQ process is adequately implemented; however, one USQ evaluation did not consider the possibility of flammable gas being introduced into the melter off-gas system due to a temporary system modification.

3.4 Cognizant System Engineer Program

This portion of the assessment evaluated the implementation of the CSE program to determine its effectiveness in ensuring that the SC melter off-gas flammability control and the SS standby electrical power system can reliably perform as intended, and to determine compliance with DOE Order 420.1C, *Facility Safety*.

SRMC has adequately established and implemented procedures that define the CSE program for DWPF. The CSE program meets the requirements of DOE Order 420.1C for the SC melter off-gas flammability control and the SS standby electrical power system. A qualified CSE is assigned to each reviewed system in accordance with DOE Order 420.1C. At the time of this assessment, there were no qualified backup CSEs for the SC melter off-gas flammability control and the SS standby electrical power system. DOE-SR also identified this issue in a 2023 assessment of the CSE program. The SRMC CSE program allows the designation of an engineer qualified as design authority to perform the responsibilities of the CSE for up to a year while qualifying. (See **OFI-SRMC-1**.) Lack of backup CSEs presents a vulnerability to operations and maintenance support of safety systems. The DWPF Deputy Engineering Manager indicated during interviews that he is actively recruiting personnel to fill the open backup positions and to provide depth for these functions.

Reviewed qualification cards for CSEs assigned to the SC melter off-gas flammability control and the SS standby electrical power system demonstrate adequate training and qualifications. The CSE training program adequately includes an overview of engineering procedures and system-specific design and safety requirements. Reviewed continuing training documents appropriately demonstrated a review of DSA and TSR updates required to maintain system design requirements for the selected systems.

Interviews and walkdowns with CSEs demonstrated adequate knowledge of the reliability, operational readiness, and required configurations of their assigned systems. Reviewed annual system health reports (SHRs) demonstrated appropriate CSE review of SSC configurations, system reliability, system maintainability, system availability, CM, system design description (SDD) revisions, master equipment list changes and trending of system failures, and SSC aging/degradation. CSEs work closely with the operations and maintenance organizations to troubleshoot equipment issues.

SEs appropriately monitor the physical configuration of their assigned systems using walkdowns and system health assessments to validate the adequacy of CM and change control processes, and to ensure that affected documents are properly updated when impacted by implemented modifications. System walkdowns are documented in SHRs and appropriately identify physical or documentation discrepancies and their resolutions.

Cognizant System Engineer Program Conclusions

The CSE program is appropriately implemented and CSEs are effectively managing their systems. The SHRs are comprehensive and provide thorough summaries of the current system health. The CSEs are adequately trained and qualified. However, the lack of qualified backup CSEs could result in inadequate support of SSM.

3.5 Configuration Management

This portion of the assessment evaluated CM processes, technical baseline documents, change control, work control, document control, and assessments to ensure that changes are properly controlled in accordance with DOE Order 420.1C and DOE-STD-1073-2016, *Configuration Management*, such that the SC melter off-gas flammability control and the SS standby electrical power system continue to meet their safety functions.

Configuration Management Processes

SRMC has established and implemented adequate CM processes to maintain consistency between requirements, engineering documents, operations implementing procedures, and physical configuration, which ensure that the SC melter off-gas flammability control and the SS standby electrical power system can reliably perform their intended safety functions. The DWPF CM implementation plan adequately addresses system requirements and performance criteria identified in the DSA and TSRs. The CM processes meet the requirements of DOE Order 420.1C and DOE-STD-1073-2016.

Technical Baseline Documents

Reviewed technical baseline documents for the SC melter off-gas flammability control and the SS standby electrical power system (SDDs, drawings, calculations, and the master equipment list) were adequately identified, developed, approved, and kept current to support facility safety basis development and implementation. Technical baseline documents are appropriately tracked and monitored in site-wide databases.

Change Control

Design change forms, design change packages, and modification travelers adequately implement a change control process that ensures proper engineering design review and approval of proposed changes and the identification of all affected documents. Reviewed design change forms, design change packages, and a modification traveler demonstrate that design changes received proper engineering review and approval. Affected documents (including implementing documents) were appropriately updated or are being tracked to maintain adequate change control.

Work Control

Work control activities are adequately identified, planned, approved, performed, and reviewed. Reviewed work packages demonstrated adequate control of field modifications that were implemented as designed

and tested as required. However, minor administrative errors were identified (e.g., missing signatures and signature dates on two of three reviewed temporary modification installation work packages).

Document Control

Document control is appropriately implemented for reviewed design change forms, design change packages, temporary modification packages, work packages, design drawings, and calculations. The latest versions of the technical baseline documents and amendments are contained in a document control system.

Assessments

CSEs appropriately perform annual system assessments using SHRs to demonstrate a review of SSC configurations, CM issues, SDD updates/revisions, and master equipment list changes. Reviewed CM assessments were appropriately conducted in the last two years, focusing on CM implementation.

Configuration Management Conclusions

SRMC implements an adequate CM program that meets the requirements of DOE Order 420.1C and DOE-STD-1073-2016. Reviewed technical baseline documents for the SC melter off-gas flammability control components and the SS standby electrical power systems were consistent with design requirements. CSEs are appropriately performing annual assessments of CM for the reviewed systems.

3.6 Maintenance

This portion of the assessment evaluated the DWPF maintenance program and processes, and control of maintenance, repairs, and modifications to determine whether maintenance of the SC melter off-gas flammability control components and the SS standby electrical power system is properly planned, scheduled, and performed in accordance with DOE Order 433.1B, *Maintenance Management Program for DOE Nuclear Facilities*, to ensure that those items can perform their intended safety functions.

Maintenance Program

The DOE-SR-approved sitewide nuclear maintenance management program (NMMP) and the DWPF maintenance program provide adequate requirements for the safe conduct of maintenance for the SC melter off-gas flammability control components and the SS standby electrical power system to ensure that they can reliably perform their intended safety functions. SRNS-IM-2021-00080, *Nuclear Maintenance Management Program (NMMP) Description Document*, adequately addresses all 17 elements of DOE Order 433.1B.

Maintenance Processes

The SRMC maintenance processes for the SC melter off-gas flammability control components and the SS standby electrical power system are adequate to conduct maintenance and manage the backlog consistent with their functional classifications. The DWPF maintenance organization adequately coordinates maintenance planning and scheduling with facility management and uses a graded approach to prioritize the maintenance of safety SSCs. Prioritization of preventive maintenance (PM) and corrective maintenance work requests considers impacts on the site mission, safety, property, and environment, placing a high priority on safety-related emergent work.

SRMC appropriately performs PM and corrective maintenance on the SC melter off-gas flammability control components and the SS standby electrical power system to ensure reliable operation and uses key

performance indicators to monitor maintenance backlog. However, based on DWPF maintenance metrics, trending data, and performance reports for the period from March 2023 to February 2024, SRMC self-identified that its overall maintenance program needs improvement. Key performance indicator scores are below management expectations at DWPF for deferred PM and corrective maintenance backlog. SRMC management is actively working toward the improvement of the maintenance program, focusing on reducing the backlog of deferred PMs, improving task readiness, and scheduling PMs for completion within optimum performance windows.

Control of Maintenance, Repairs, and Modifications

The SRMC maintenance process is adequate for planning, scheduling, controlling, and overseeing maintenance; it appropriately implements approved modifications, PM, corrective maintenance, and QA hold points. The reviewed maintenance and modification work packages for the SC melter off-gas flammability control components and the SS standby electrical power system included adequate formal controls to ensure system operability. Interviews with maintenance managers and reviewed completed work packages demonstrated adequate performance, control, and documentation of maintenance. The reviewed completed work packages demonstrated consistent adherence to maintenance program requirements, including appropriately documented pre-job and post-job briefings; measurement equipment calibrations; work steps in sequence; proper use of QA hold-point inspections; post-maintenance testing acceptance criteria; and review of test results by quality control personnel for return to operability. These work packages adequately supported the safe and complete execution of work and were effectively planned and well-coordinated with facility management.

Maintenance Conclusions

The DWPF maintenance program is adequate for conducting maintenance for the SC melter off-gas flammability control components and the SS standby electrical power system. Maintenance is properly planned, scheduled, and performed to ensure that the reviewed systems can reliably perform their intended safety functions. SRMC has adequate formal controls for maintenance and modifications for the reviewed systems. However, SRMC is not adequately managing the backlog of DWPF maintenance but is actively working toward improvement.

3.7 Operations

This portion of the assessment evaluated DWPF operating practices, procedures, and operator training to determine whether DWPF operations are conducted in a manner that ensures that the SC melter off-gas flammability control and the SS standby electrical power system can perform their intended safety functions.

Operating Practices and Procedures

The DOE-SR-approved standards/requirements identification document (S/RID) appropriately provides a crosswalk between DOE Order 422.1, *Conduct of Operations*, site-level procedures, and DWPF procedures. DWPF administrative and operating procedures are adequate to ensure that shift operators can operate equipment properly. Procedures for administering shift orders, identifying systems requiring independent verification, log keeping, and controlling equipment and system status are appropriately formalized in the SRS Conduct of Operations Manual 2S, and in DWPF administrative procedures. The reviewed logs, shift turnover checklists, building and facility status control, and TSR surveillances were adequate.

Observations, procedure discussions, walkdowns of status control, TSR surveillances, and daily rounds demonstrated adequate performance and operator knowledge of the SC melter off-gas flammability control and the SS standby electrical power system. DWPF management and operating personnel responsible for TSR implementation and compliance were knowledgeable and experienced, as demonstrated by interviews and observations.

During a recent formal assessment, SRMC identified several weaknesses in conduct of operations program implementation including multiple round sheet errors and not performing TSR surveillances within the required frequency. Formal corrective action plans were appropriately developed to address the issues. SRMC monitors progress on the corrective actions weekly; corrective actions are scheduled to be completed by September 2024. SRMC's progress in completing the corrective actions should lead to improved conduct of operations at DWPF.

As part of the conduct of operations corrective action plan, SRMC initiated a deliberate operations improvement program that requires additional management oversight for performance of routine actions. Through deliberate operations processes, SRMC identified that operators are using workarounds for some operations (i.e., performing some operations without strict adherence to written procedures). Contrary to DOE Order 422.1, attachment 2, section 1.p(1), SRMC management is allowing the use of workarounds (work outside of approved procedures) to continue while investigating the extent of condition and revising procedures to eliminate the need for workarounds. (See **Deficiency D-SRMC-2**.) Operations outside of approved procedures can result in facility accidents, equipment damage, and is a potential hazard to worker safety. Management acceptance of this practice undermines disciplined operations and reinforces the behavior of creating workarounds to address procedures that need to be revised.

During walkdowns of the diesel generator system, the assessment team noted several temporary identification tags with an initiation date of 2017. Markings on some of the tags were illegible and the tags were worn from aging. The equipment labeling procedure contains requirements for applying temporary labeling, but there is no requirement for replacement with permanent labeling. (See **OFI-SRMC-2**.)

Operator Training

DWPF operator qualifications appropriately include classroom training and performance demonstrations for applicable LCO requirements. Classroom training appropriately includes safety basis fundamentals and TSR training. DWPF operators are provided with system-specific training. The operator qualification cards document the completion of required training activities. Personnel interviews, review of procedures, walkthroughs, and observation of a shift turnover demonstrated that operators are knowledgeable of their assigned tasks.

SRMC tracks operator qualification in the SRS learning management system. A learning management system module is used to develop operator watch bills. A review of the process for developing shift watch bills performed with the DWPF training manager confirmed that qualified personnel can be appropriately assigned to the watch bill.

Operations Conclusions

Operations at DWPF are conducted in a manner that ensures the operability of the SC melter off-gas flammability control and the SS standby electrical power system. The reviewed operating procedures for TSR surveillances and daily facility rounds were adequately developed and implemented. Operator training is sufficient to achieve safe and effective DWPF operations. However, SRMC practices allow

some operations to be performed without using approved technical procedures. Further, SRMC is pursuing corrective actions to address previously identified conduct of operations program weaknesses.

3.8 Quality Assurance

This portion of the assessment evaluated the SRMC QA program and procurement verification to determine whether they are implemented in a manner that ensures that the SC melter off-gas flammability control and the SS standby electrical power system components will conform to required standards and perform as designed, consistent with DOE Order 414.1D, *Quality Assurance*.

Quality Assurance Program Implementation

Activities that may affect the safety of DWPF are appropriately conducted in accordance with a Quality Assurance Management Plan (QAMP) that meets the QA criteria specified in DOE Order 414.1D and adequately implements NQA-1. The QAMP describes a graded approach that applies increased quality control of work and equipment associated with SC and SS SSCs. SRS plan G-QP-G-00002, *SRNS Management and Operations Graded Approach Plan*, provides an effective mechanism for implementing the graded approach. SRMC reviews the QAMP annually, updates it as needed, and obtains appropriate DOE-SR approvals. The QAMP appropriately requires the flowdown of DOE QA requirements to suppliers. As demonstrated by a review of selected training records, QA personnel are appropriately trained and qualified, as required by NQA-1.

Procurement Verification

Requirements are appropriately established for procurement and verification of items and services in accordance with DOE Order 414.1D. DWPF SC and SS SSCs are appropriately procured using qualified suppliers, and when qualified suppliers are not available, commercial grade dedication (CGD) processes are appropriately used to qualify equipment. SC and SS SSCs are procured with the highest level of controls and processes as procurement level 1 or 2 as appropriate. Procedures in the SRS QA Manual 1Q provide appropriate methods for evaluating and qualifying suppliers. The SRS QA organization maintains the site's qualified suppliers list. When an approved supplier is not available, CGD is appropriately used to ensure purchased components can function as required. Critical characteristics and appropriate methods for verification are identified in the CGD package. Personnel performing the CGD activities are appropriately trained and qualified.

Documents reviewed, as well as interviews with receipt inspection management and receipt inspectors, demonstrated that the procurement process is well defined and appropriately implemented. Manual 1Q Procedure 13-1, *Packaging, Handling, Shipping, Storage and Receiving* (PHSSR), appropriately requires that materials are received and stored in a manner that ensures damage prevention or deterioration, and the ability to maintain their procurement level. However, contrary to the requirements of NQA-1, part 2, subpart 2.2, sections 302, 601, 602, and DOE Order 414.1D, attachment 2, criterion 5, equipment is not always stored in accordance with PHSSR requirements. (See **Deficiency D-SRMC-3**.) Examples include:

- Areas where items with specific storage requirements were stowed were not appropriately designated as storage areas.
- Items with specific PHSSR classification levels were stored in areas designated at a lower classification level.
- Designated storage areas did not comply with the PHSSR-defined requirements for that classification level.

- Items were stored with less than the required level of protection (e.g., protection from the introduction of foreign material and surface damage).

As a result, these items with PHSSR classification levels could lose the integrity associated with the original purchase specifications.

The reviewed purchase orders for SC melter off-gas flammability control and the SS standby electrical power system components contained appropriate technical specifications based on the functional requirements of the procured components. SRMC appropriately reviewed the CGD purchase orders before they were released to a supplier to ensure that critical QA requirements were included in the procurement package.

Quality Assurance Conclusions

The SRMC QAMP adequately implements the requirements of NQA-1. Approved suppliers for procurement level 1 and 2 components are appropriately evaluated and listed on a qualified suppliers list. CGD is appropriately used to dedicate safety-related components when approved suppliers are not available. The sampled procurement documents are generally consistent with established SRMC procurement controls. However, storage of procured items does not meet all requirements of the PHSRR procedure.

3.9 Feedback and Improvement

This portion of the assessment evaluated SRMC's feedback and improvement processes, including issues management processes and performance assurance, to determine whether they comply with DOE Order 414.1D.

Issues Management Processes

SRMC Contractor Assurance System Manual 22Q Procedure CAP-1, *Corrective Action Program*, sets forth generally adequate processes to identify the causes of issues, correct the issues, and identify actions to prevent recurrence. Additionally, SRMC procedure CA-1A, *LWO Causal Analysis,* provides generally adequate supplemental guidance for performing causal analysis. Issues affecting quality, safety, and operability are appropriately managed and tracked in the commitment tracking system module of the Site Tracking, Analysis, and Reporting data base, an electronic issues management tool. However, contrary to the requirements of NQA-1, part 1, requirement 16, and DOE Order 414.1D, attachment 2, criterion 3, certain elements of the issues management process do not ensure appropriate classification, analysis, and resolution of issues. (See **Finding F-SRMC-1**.) Without effective issues management processes, significant causal factors could be missed, and the likelihood of event recurrence increases. The following are identified issues that contributed to this observation:

- Procedure CA-1A does not clearly identify criteria or the logic to be used in the determination of a significant condition adverse to quality.
- Apparent cause analysis corrective actions are not procedurally required in CA-1A to preclude the recurrence of issues for significant issues adverse to quality. Instead, CA-1A only requires that they "would (or should) decrease the likelihood" of recurrence.
- Although 22Q CAP-1 allows an apparent cause analysis for significant issues adverse to quality, CA-1A allows an engineering evaluation in lieu of this analysis for equipment failures.
- There is no procedure for the development of an engineering evaluation. As such, there is no established process for corrective action development and review and approval of evaluation results.

- Not all staff tasked with determining the cause of events are required to be trained or maintain proficiency as causal analysts.

Performance Assurance

SRMC assesses and evaluates organizational performance to ensure that applicable requirements and standards for environment, safety, and health, including QA and integrated safety management are met. SRMC assessment programs are risk-informed and formally documented. SRMC appropriately identifies assessments with consideration of risk. Assessments are adequately scheduled and performed in accordance with an integrated assessment plan. SRMC effectively uses a senior management Performance Analysis Advisory Group that meets quarterly to oversee overall organization performance and identify areas needing additional focus.

Feedback and Improvement Conclusions

SRMC has established a generally effective program to assess organizational performance. Conditions adverse to quality, safety, and operability are generally adequately managed and tracked. Assurance systems are in place to provide appropriate feedback and improvement processes that address safety system performance. The issues management processes for identifying causes of issues and corrective actions to address those issues and prevent recurrence are generally adequate; however, those processes do not ensure appropriate classification, analysis, and resolution of issues.

3.10 Federal Oversight

This portion of the assessment evaluated DOE-SR oversight to determine whether DOE-SR effectively ensures that the SC melter off-gas flammability control and the SS standby electrical power system reliably perform their safety functions.

The DOE-SR safety system oversight (SSO) program is consistent with DOE Order 420.1C. SSO personnel are responsible for overseeing assigned safety systems to ensure that the systems will perform as required. The SSO program is adequately established in Savannah River Implementing Procedure (SRIP) 421.2, *Safety System Oversight*.

Consistent with SRIP 421.2, DOE-SR implements a facility engineer model at DWPF to perform SSO and nuclear safety specialist (NSS) oversight. DWPF has 16 active SC and SS systems and only one qualified facility engineer to cover both the NSS and SSO functions. The second facility engineer assigned to DWPF is one of five new hires and is not yet qualified. Given the high workload of DSA changes and number/complexity of safety systems, staffing is not adequate to effectively complete the NSS and SSO functions at DWPF. Contrary to DOE Order 426.1B, *Department of Energy Federal Technical Capabilities*, section 4.c.(2), DOE-SR does not have an SSO-specific staffing plan to inform and support priority recruitment and hiring of SSO personnel. (See **Deficiency D-DOE-SR-1**.) Inadequate planning of resources can lead to gaps in key positions and non-compliances with DOE orders.

DOE-SR has not established a minimum assessment periodicity for the list of the DWPF safety systems identified as needing periodic SSO reviews as recommended in DOE Guide 226.1-2A, *Federal Line Management Oversight of Department of Energy Nuclear Facilities*. Specifically, DOE Guide 226.1-2A recommends a minimum assessment periodicity of three years for SC systems and five years for SS systems. The reviewed list of systems requiring SSO at DWPF shows that the periodicity between vital safety system (VSS) (i.e., active SC and SS systems) assessments exceeds the recommended guidelines. (See **OFI-DOE-SR-1**.)

SRIP 421.2 requires SSOs to conduct VSS assessments according to an annual assessment plan. The reviewed assessment plans were generally effective in identifying assessments for the next fiscal year but did not provide adequate detail on the specific system or program area scheduled for review. (See **OFI-DOE-SR-2**.) The reviewed VSS assessments were effective in identifying issues that improved nuclear safety. The DOE-SR Performance Assurance Division appropriately conducts programmatic assessments in various areas, including the CSE program. In addition to these formal efforts, the cognizant DWPF SSO specialists produce periodic operational awareness reports covering DWPF SSC operability, as well as aspects of the DWPF CSE program. However, contrary to DOE Order 420.1C, section 4.c, DOE-SR did not provide adequate oversight of the operability of safety systems under the purview of the CSE program. (See **Finding F-DOE-SR-1**.) Specifically:

- There are no records showing that a VSS assessment at DWPF has ever been conducted on the melter off-gas system components; one is scheduled for 2026.
- Two VSS assessments at DWPF scheduled for 2022 and one for 2023 were not completed as scheduled.

Not performing required oversight assessments could preclude early identification of issues that may adversely affect the ability of VSSs to perform their intended safety function. Additionally, the DOE-SR Performance Assurance Division self-identified that contrary to the requirement in DOE Order 433.1B, DOE-SR did not conduct a program assessment of the NMMP in the last three years.

In addition to SSO specialists, Facility Representatives conduct daily oversight of VSSs. Three reviewed operational awareness activities of the diesel generator system conducted between 2021 and 2024 demonstrate that Facility Representatives are maintaining adequate operational awareness of safety systems status.

Reviewed training and qualification records for one current and two previous DWPF SSOs demonstrate that DOE-SR is meeting SSO training and qualification requirements specified in SRIP 421.2 and DOE-STD-8000-2021, *Safety System Oversight and Functional Area Qualification Standard*. DOE-SR has enlisted a senior subject matter expert exclusively to help qualify recently hired engineers.

Federal Oversight Conclusions

Overall, the SSO program is adequately defined for the DWPF safety systems; however, it is not effectively implemented. DOE-SR cannot effectively perform all required assessments with a single qualified facility engineer to cover SSO and NSS responsibilities. There is no minimum assessment periodicity established for conducting VSS oversight. DOE-SR did not complete scheduled VSS assessments in 2022 and 2023 as specified in the assessment plans.

4.0 BEST PRACTICES

No best practices were identified during this assessment.

5.0 FINDINGS

Findings are deficiencies that warrant a high level of attention from management. If left uncorrected, findings could adversely affect the DOE mission, the environment, the safety or health of workers and the public, or national security. DOE line management and/or contractor organizations must develop and implement corrective action plans for findings. Cognizant DOE managers must use site- and

program-specific issues management processes and systems developed in accordance with DOE Order 226.1, *Implementation of Department of Energy Oversight Policy*, to manage the corrective actions and track them to completion.

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Finding F-SRMC-1: SRMC issues management processes do not ensure appropriate classification, analysis, and resolution of issues. (NQA-1, part 1, req. 16, and DOE Order 414.1D, att. 2, criterion 3)

DOE Savannah River Operations Office

Finding F-DOE-SR-1: DOE-SR does not ensure that each safety system receives adequate oversight from qualified SSO personnel. (DOE Order 420.1C, sec. 4.c, and SRIP 421.2, sec. 6.3.2)

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.

Savannah River Mission Completion, LLC

Deficiency D-SRMC-1: An SRMC unreviewed safety question evaluation did not adequately evaluate whether a temporary system modification could result in the possibility of a new accident or malfunction involving the SC melter off-gas flammability control. (10 CFR 830.203(a), 10 CFR 830.3(a), and Manual 11Q, procedure 1.05, sec. 5.6.1, step 7)

Deficiency D-SRMC-2: SRMC operations practices allow some operations to be performed without using reviewed and approved written technical procedures. (DOE Order 422.1, att. 2, sec. 1.p)

Deficiency D-SRMC-3: SRMC does not store all procured parts and equipment in accordance with their PHSSR procedure such that materials are not always protected from damage or deterioration. (NQA-1, part 2, subpart 2.2, secs. 302, 601, and 602; and DOE Order 414.1D, att. 2, criterion 5)

DOE Savannah River Operations Office

Deficiency D-DOE-SR-1: DOE-SR does not have an SSO-specific staffing plan to inform and support priority recruitment and hiring of SSO personnel. (DOE Order 426.1B, sec. 4.c.(2))

7.0 OPPORTUNITIES FOR IMPROVEMENT

EA identified the OFIs shown below to assist cognizant managers in improving programs and operations. While OFIs may identify potential solutions to findings and deficiencies identified in assessment reports, they may also address other conditions observed during the assessment process. These OFIs are offered only as a recommendation 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.

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OFI-SRMC-1: Consider alternative methods for providing adequate qualified backup CSEs (e.g., CSE cross training, CSE training of lead engineers) to ensure continuous CSE coverage of safety systems.

OFI-SRMC-2: Consider revising the facility equipment and labeling procedure to require temporary labeling tags to be replaced by permanent equipment labels within a specified time frame.

DOE Savannah River Operations Office

OFI-DOE-SR-1: Consider establishing a minimum assessment periodicity for the list of DWPF safety systems identified as needing periodic SSO reviews, as recommended in DOE Guide 226.1-2A.

OFI-DOE-SR-2: Consider revising the annual assessment plan to provide details on the specific systems or program areas scheduled for review.

8.0 ITEMS FOR FOLLOW-UP

Based on the results and observations of this assessment, EA will conduct a follow up at DWPF on the following topics:

- Safety basis development, maintenance, and implementation
- Procedure compliance.

Appendix A
Supplemental Information

Dates of Assessment

March 6 to May 14, 2024

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

Quality Review Board

William F. West, Advisor
Kevin G. Kilp, Chair
Christopher E. McFearin
Thomas C. Messer
William A. Eckroade

EA Site Lead for Savannah River Site

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