Independent Assessment of Specific Administrative Controls at the Savannah River Site H-Canyon

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Office of Enterprise Assessments
U.S. Department of Energy

Table of Contents

Acronyms

AC	Administrative Control
DOE	U.S. Department of Energy
DOE-SR	DOE Savannah River Operations Office
DSA	Documented Safety Analysis
EA	Office of Enterprise Assessments
OF-H	Outside Facilities H-Area
OFI	Opportunity for Improvement
PVV	Process Vessel Vent
SAC	Specific Administrative Control
SC	Safety Class
SRNS	Savannah River Nuclear Solutions, LLC
SS	Safety Significant
SSCs	Structures, Systems, and Components
TSR	Technical Safety Requirement

INDEPENDENT ASSESSMENT OF SPECIFIC ADMINISTRATIVE CONTROLS AT THE SAVANNAH RIVER SITE H-CANYON

Executive Summary

The U.S. Department of Energy (DOE) Office of Enterprise Assessments (EA) conducted an independent assessment of the identification, development, and implementation of specific administrative controls (SACs) at the Savannah River Site H-Canyon and Outside Facilities H-Area from December 2022 to March 2023. This assessment was performed within the broader context of ongoing assessments of the development and implementation of SACs across the DOE complex. The assessment focused on the approach to meeting SAC requirements in DOE-STD-3009-94, Change Notice 3, *Preparation Guide for U.S. Department of Energy Nonreactor Nuclear Facility Documented Safety Analyses*.

EA identified the following strength:

- The H-Canyon documented safety analysis (DSA) follows the hierarchy of controls and appropriately credits safety structures, systems, or components (SSCs) prior to identifying SACs.

EA identified one finding and three deficiencies in meeting the requirements of DOE-STD-3009-94, as summarized below:

- Attributes of seven programmatic administrative controls with credited safety significant or safety class functions are not identified as SACs. (Finding)
- For six SACs, the DSA, chapter 4, SAC description, functional requirements, and/or evaluation do not contain sufficient information to justify that the SAC can meet its safety function.
- For five SACs, Savannah River Nuclear Solutions, LLC did not identify all support SSCs, functionally classify or provide functional requirements, or include a justification for not functionally classifying the SSCs as safety significant or safety class.
- The implementation of the safety class *Radiological Material Inventory Control* SAC does not meet the requirements of 10 CFR 830, *Nuclear Safety Management*.

In summary, the identification, development, and implementation of SACs for the H-Canyon generally meet the requirements of DOE-STD-3009-94. However, EA identified seven programmatic administrative controls specifically credited for risk reduction in the hazard analysis; programmatic administrative controls are not developed or implemented as rigorously as SACs and therefore cannot ensure the risk reduction identified in the hazard analysis. Although EA identified issues associated with SAC development and implementation, no imminent safety concerns were identified. The SACs and implementing documents are sufficient for controlling the analyzed hazards. Resolution of the issues identified in this assessment will support a more robust and reliable control set.

INDEPENDENT ASSESSMENT OF SPECIFIC ADMINISTRATIVE CONTROLS AT THE SAVANNAH RIVER SITE H-CANYON

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 identification, development, and implementation of specific administrative controls (SACs) at the Savannah River Site H-Canyon and Outside Facilities H-Area (OF-H) from December 2022 to March 2023. This assessment was performed within the broader context of ongoing assessments of the development and implementation of SACs at selected high risk (i.e., hazard category 1 and 2) nuclear facilities across the DOE complex. The purpose of these assessments is to evaluate the effectiveness of both the contractor and field office in developing, implementing, and maintaining SACs.

This assessment was conducted in accordance with the *CY* [Calendar Year] *2023 Plan for the Independent Assessment of Specific Administrative Control Implementation Across the DOE Complex*. The assessment focused on the line management approach to meeting SAC requirements in DOE-STD-3009-94, Change Notice 3, *Preparation Guide for U.S. Department of Energy Nonreactor Nuclear Facility Documented Safety Analyses*.

Savannah River Nuclear Solutions, LLC (SRNS) manages H-Canyon and the OF-H under the direction and oversight of the DOE Savannah River Operations Office (DOE-SR). The H-Canyon and OF-H chemical separations facilities were constructed in the mid-1950s to process irradiated reactor targets. The H-Canyon processes consist of chemical dissolution, feed clarification, solvent extraction, and batch evaporation (as well as other supporting processes). The OF-H facilities consist of support processes such as acid recovery, low-level waste evaporation, uranium storage, and solvent washing.

During the early 2000s, H-Canyon began processing uranium and plutonium scrap materials to recover the enriched uranium and dispose of the dissolved plutonium. H-Canyon missions have included blending down highly enriched uranium with natural uranium for shipment to the Tennessee Valley Authority and processing aluminum-clad domestic and foreign research reactor fuels. Many of the major process systems, notably solvent extraction, are being placed in a layup status with a scheduled completion date in 2024.

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 approved plan, this assessment considered requirements from EA Criteria and Review Approach Document (CRAD) 34-02, *Specific Administrative Controls*, and CRAD EA-30-07, *Federal Line Management Oversight Processes*. The assessment was conducted in two parts. The first part of the assessment was conducted remotely and focused on SAC identification and development. EA reviewed the H-Canyon documented safety analysis (DSA), the technical safety requirements (TSRs) document, and relevant reference documents to determine whether SAC identification and development meet the requirements of DOE-STD-3009-94. DOE-STD-1186-2004, *Specific Administrative Controls*, clarifies

those requirements and provides guidance for the development and implementation of SACs, and is cited as a requirement in the H-Canyon DSA. Programmatic administrative controls (ACs) were reviewed to determine whether they are appropriately classified as programmatic ACs rather than SACs (i.e., the programmatic ACs do not perform a safety significant [SS] or safety class [SC] function). EA also reviewed implementing documents (e.g., procedures) to determine whether SAC and programmatic AC requirements are adequately captured. The second part of the assessment was conducted at the Savannah River Site and consisted of field observations of SAC-related operations and interviews with SRNS and DOE-SR personnel responsible for SAC development and implementation.

EA used a written comment and response process to address issues identified during the review. Follow-on discussions among EA, SRNS, and DOE-SR personnel were conducted to clarify and resolve comments.

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

3.0 RESULTS

3.1 SAC Identification and Development

This portion of the assessment determined whether the H-Canyon SACs are appropriately identified and developed in the DSA in accordance with the requirements of DOE-STD-3009-94 and the expectations of DOE-STD-1186-2004.

EA evaluated 14 of the 16 SACs in the H-Canyon DSA. The reviewed SACs are appropriately identified based on the control selection in the hazard and accident analyses. The H-Canyon DSA follows the hierarchy of controls from DOE-STD-3009-94 and appropriately credits SC and SS engineered features prior to identifying SACs. Most SACs are designated as SS, and they reduce the probability or radiological consequences of accident scenarios. Three SACs are designated as SC, all of which were reviewed in this assessment. The SC SACs control the radiological material inventory in the facility, prevent ammonium nitrate explosions in the process vessel vent (PVV) filters, and provide combustible loading control. SAC safety functions are adequately derived in the hazard and accident analyses.

EA identified six SACs where the DSA, chapter 4, SAC description, functional requirements, and/or evaluation do not contain sufficient information to justify that the SAC can meet its safety function as required by DOE-STD-3009-94, secs. 4.5.X.2, 4.5.X.3, and 4.5.X.4. (See **Deficiency D-SRNS-1**.)

- The *Radiological Material Inventory Control* SAC does not provide a comprehensive evaluation of the SAC functional requirements. The discussion of the process used to ensure that inventory limits are met is limited to a requirement for an engineering calculation, with no description of how that calculation protects limits.
- The *Venting of Tanker Head Space & Hanford Containers* SAC description and evaluation are not sufficient to ensure that the SAC can meet its safety function. For example, there is no discussion of how tankers are vented, or the surveillance frequency for filter inspection on the Hanford containers.
- The *Sump Flush Control* SAC does not provide adequate performance criteria to ensure that its safety function can be met. The functional requirement requires inspecting rack pans and canyon cells for evidence of leaks or fissile material accumulation. However, there are no performance

criteria that characterize specific operational responses or the capabilities necessary to meet the functional requirements.

- The *PVV Filter Control for Ammonium Nitrate* SAC relies on a technical basis that contains unverified assumptions that may invalidate the SAC evaluation.
- The *Product Evaporator 17.6E Mass Control* and *Tank 9.8 Soluble Neutron Poison Control* SACs do not provide sufficient information to demonstrate that the established criticality safety limits are met. The DSA does not provide the bases for assuming homogenous concentrations in the criticality safety evaluations without a TSR-level requirement for periodic mixing.

Incomplete SAC descriptions, functional requirements, and evaluations may result in controls that do not fulfill their safety functions. The SRNS responses to EA's comments indicate that SRNS will address the EA-identified issues in a revision to the DSA.

EA also identified issues with five SACs that rely on structures, systems, and components (SSCs) to perform the SAC action. Functional requirements are not provided for these support SSCs, and there is no determination of whether the SSC should be functionally classified as SS or SC. In some cases, support SSCs are not identified in the SAC description. DOE-STD-3009-94, sec. 4.5.X.2, requires SSCs whose failure would result in losing the ability to complete the action required by the SAC to be functionally classified at the same level as the SAC. DOE-STD-3009-94, sec. 4.5.X.3, requires functional requirements to be provided for the SAC and any necessary support SSCs. (See **Deficiency D-SRNS-2**.)

- The *Radiological Material Inventory Control* SAC relies on level instrumentation to control concentrations in several systems. Level instrumentation is not identified in the SAC or evaluated for functional classification.
- The *Venting of Tanker Head Space & Hanford Containers* SAC relies on filters and differential pressure gauges for the Hanford containers and level indication on the high activity transport trailer tanks to ensure that flammable gas concentrations remain below the lower flammability limit. These SSCs are not identified in the SAC or evaluated for functional classification.
- The *Sump Flush Control* SAC relies on SSCs (i.e., canyon crane, crane camera, flush wand, flush water valves, sump level indicators, and the sump jet) to perform its safety function. These SSCs are not identified in the SAC or evaluated for functional classification.
- The *PVV Filter Control for Ammonium Nitrate* SAC relies on specific air and water flow rates to achieve adequate scrubbing of ammonium nitrate from the exhaust stream. The instrumentation required to measure or maintain these flow rates is not identified in the SAC or evaluated for functional classification.
- The *Evaporator Feed Steam Stripping Controls* SAC relies on instrumentation that is not evaluated for functional classification.

Not identifying support SSCs, evaluating them for functional classification, and providing functional requirements may result in an ineffective hazard control. The SRNS responses to EA's comments indicate that SRNS will address the EA-identified issues in a revision to the DSA.

EA evaluated 13 of 22 programmatic ACs in the TSR document to determine whether their attributes are properly categorized (i.e., they do not perform an SS or SC function and therefore, are not required to be SACs). EA identified seven programmatic ACs credited as SS or SC controls in hazard events to provide risk reduction to workers and the public. Contrary to the definition of a SAC and the *Introduction* (page 12) in DOE-STD-3009-94, specific credited attributes of these ACs are not identified

as SACs. (See **Finding F-SRNS-1**.) DOE-STD-3009-94 requires formal evaluation of SACs in the DSA to demonstrate that the controls can perform their safety functions; there are no similar requirements for programmatic ACs. While EA did not identify any imminent safety concerns, programmatic ACs are not implemented as rigorously as SACs and therefore cannot ensure the risk reduction identified in the hazard analysis. SRNS acknowledges a potential gap between DOE-STD-1186-2004 expectations and the currently approved SAC determinations. The SRNS responses to EA's comments indicate that they will evaluate the EA-identified issues for incorporation, as appropriate, into a DSA revision.

SAC Identification and Development Conclusions

The reviewed SACs are appropriately identified based on the control selection in the hazard and accident analyses. SAC safety functions are adequately derived in the hazard and accident analyses. However, for six SACs, weaknesses in the functional requirements and performance criteria make it difficult to ascertain from the SAC descriptions and evaluations that the SAC safety functions can be met. Further, for five SACs, support SSCs are not adequately described in the SAC or evaluated for functional classification. Finally, specific credited attributes of seven programmatic ACs are inappropriately not identified as SACs.

3.2 SAC Implementation

This portion of the assessment determined whether the H-Canyon SACs are implemented and maintained in accordance with the requirements of DOE-STD-3009-94 and the expectations of DOE-STD-1186-2004.

In most cases, H-Canyon SACs, as developed in chapter 4 of the DSA, are adequately captured in the TSRs as directive action SACs. Generally, SACs are effectively implemented in detailed operating procedures and programs. EA conducted walkdowns, tabletop reviews, and interviews that confirmed effective SAC implementation. EA also observed a field surveillance and conducted walkdowns and interviews associated with select programmatic ACs that confirmed that credited aspects of the ACs are implemented.

EA identified two issues where the implementation of the SC *Radiological Material Inventory Control* SAC does not meet the requirements of 10 CFR 830, *Nuclear Safety Management*. (See **Deficiency D-SRNS-3**.)

- The TSR for the *Radiological Material Inventory Control* SAC does not include the material limits, but rather references external information provided in the DSA, table 3-12. This practice does not satisfy the 10 CFR 830.3 definition of a TSR, that is (in part) "The limits, controls, and related actions that establish the specific parameters and requisite actions for the safe operation of a nuclear facility." DOE Guide 423.1-1B, *Implementation Guide for Use in Developing Technical Safety Requirements*, sec. 4.3.4.3, and WSRC-TR-2003-00573, *TSR Methodology Manual*, also prescribe that the TSR should never reference an external document for necessary data. The material limits in the DSA may be changed with contractor approval under the unreviewed safety question process. Not providing the SAC material limits within the TSR could violate the requirement in 10 CFR 830.205(a)(2) to obtain DOE approval for all TSR changes.
- There is no implementing procedure identified for the H-Canyon portions of the *Radiological Material Inventory Control* SAC. The SAC states "radiological material must be verified by developing a Type 1 calculation or operating procedure and comparing the results to the values or locations in Table 3-12." In practice, the process is informal and more complex, requiring a bounding

calculation of material at risk, a dissolver charge plan, charge plan-specific calculations for chemical additions and dissolver level requirements, and at least two procedures to ensure that the concentration limits are met. Although these documents exist for charges to the dissolver, they are not linked to the SAC, and there is no formal record that the radiological material inventory requirements are met. 10 CFR 830.122(e)(1) requires work to be performed in accordance with approved instructions, procedures, or other appropriate means. Not including SAC requirements in formal operating procedures may result in ineffective SAC implementation.

EA reviewed the training and qualification of H-Canyon personnel responsible for SAC implementation and compliance activities to determine whether training is sufficient to ensure SAC effectiveness. EA reviewed qualification cards, course material, and on-the-job training requirements. The evaluation also included discussions with the Training and Qualification Manager, facility Operations Manager, qualified operations staff, and qualified engineers. Personnel demonstrated sufficient knowledge of SACs and proficiency in implementation during an observed evolution, field walkdowns, and interviews. Training and qualification are sufficient to ensure effective SAC implementation.

Further, EA reviewed recent SRNS assessments of SAC implementation performed in 2018 through 2022. DOE-STD-1186-2004, sec. 2.2, expects that SACs are independently assessed on a periodic basis to verify safety function performance and focuses on performance-based methods for this verification. Assessment Plans require that all SACs are reviewed during each three-year cycle. Although SRNS appropriately performs triennial reviews of SACs with a focus on the adequacy of implementing procedures, performance-based reviews are not performed. (See **OFI-SRNS-1**.) SRNS has an Independent Evaluation Board responsible for independent performance-based assessments across all SRNS facilities. An assessment of TSR implementation at H-Canyon was performed in 2022 with satisfactory results.

Finally, EA reviewed the Federal oversight of SAC implementation at H-Canyon. DOE-SR has procedures governing its oversight process. These procedures address areas including review and approval of safety basis documents, oversight of the safety basis implementation process, and corrective action management. DOE-SR assessments use document reviews, field observations, and interviews to implement the oversight process. The DOE-SR assessments are focused on TSR changes while considering hazards, associated risks, and past performance. SAC implementation assessment activities are included as part of shadow implementation verification reviews or operational awareness activities outlined in annual assessment plans. Federal oversight of SAC implementation is primarily performed by Facility Representatives through observation of H-Canyon activities, which involve SACs. EA reviewed DOE-SR SAC assessments and interviewed DOE-SR personnel and verified that assessments are appropriately performed.

SAC Implementation Conclusions

SACs are adequately implemented at H-Canyon except for one SAC that does not meet the DOE nuclear safety requirements of 10 CFR 830.205(a)(2) and 10 CFR 830.122(e)(1). In most cases, SAC implementing documents appropriately include requirements from the TSR document. Training on SACs is sufficient for SRNS personnel. While SRNS appropriately evaluated SAC implementation at H-Canyon, the triennial assessments of SAC implementation were not performance based. Federal oversight of H-Canyon SAC implementation is appropriately focused and implemented.

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.

Savannah River Nuclear Solutions, LLC

Finding F-SRNS-1: Attributes of seven programmatic ACs with credited SS or SC functions are not identified as SACs. (DOE-STD-3009-94, *Definition of SAC*, and *Introduction*, page 12)

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 Nuclear Solutions, LLC

Deficiency D-SRNS-1: For six SACs, the DSA chapter 4 SAC description, functional requirements, and/or evaluation do not contain sufficient information to justify that the SAC can meet its safety function. (DOE-STD-3009-94, secs. 4.5.X.2, 4.5.X.3, and 4.5.X.4)

Deficiency D-SRNS-2: For five SACs, SRNS did not identify all support SSCs, functionally classify or provide functional requirements, or include a justification for not functionally classifying the SSCs as SS or SC. (DOE-STD-3009-94, secs. 4.5.X.2 and 4.5.X.3)

Deficiency D-SRNS-3: The implementation of the SC *Radiological Material Inventory Control* SAC does not meet the requirements of 10 CFR 830. (10 CFR 830.3, 10 CFR 830.205(a)(2), and 10 CFR 830.122(e)(1))

7.0 OPPORTUNITIES FOR IMPROVEMENT

EA identified the OFI 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. This OFI is offered only as a recommendation for line management consideration; it does not require formal resolution by management through a corrective action process and is not intended to be prescriptive or mandatory. Rather, it is a suggestion that may assist site management in implementing best practices or provide potential solutions to issues identified during the assessment.

Savannah River Nuclear Solutions, LLC

OFI-SRNS-1: Consider enhancing the triennial assessments of SAC effectiveness by including performance-based elements, such as a review of completed SAC implementing documents and observation of operational activities.

Appendix A
Supplemental Information

Dates of Assessment

December 2022 to March 2023

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