



# **Independent Assessment of Specific Administrative Controls for the Savannah River Tritium Enterprise**

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Office of Enterprise Assessments  
U.S. Department of Energy

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## Acronyms

AC	Administrative Control
DOE	U.S. Department of Energy
DSA	Documented Safety Analysis
EA	Office of Enterprise Assessments
SAC	Specific Administrative Control
SC	Safety Class
SRFO	Savannah River Field Office
SRNS	Savannah River Nuclear Solutions, LLC
SRS	Savannah River Site
SRTE	Savannah River Tritium Enterprise
SS	Safety Significant
SSCs	Structures, Systems, and Components
TEF	Tritium Extraction Facility
TF	Tritium Facility
TSR	Technical Safety Requirement

# INDEPENDENT ASSESSMENT OF SPECIFIC ADMINISTRATIVE CONTROLS FOR THE SAVANNAH RIVER TRITIUM ENTERPRISE

## 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) for the Savannah River Tritium Enterprise (SRTE), which includes the Tritium Facility and Tritium Extraction Facility at the Savannah River Site, from June to September 2023. This assessment was performed within the broader context of 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*.

Savannah River Nuclear Solutions, LLC (SRNS) appropriately identified SACs based on the hazard and accident analyses and the hierarchy of controls of DOE-STD-3009-94. Except as noted below, the SACs are adequately developed and flowed down into implementing procedures to ensure that their safety functions are reliably met.

EA identified the following strengths at SRTE, including one best practice:

- The Savannah River Field Office triennially assesses the flowdown and implementation of a sample of SACs. (Best Practice)
- SRNS effectively summarizes the development basis and implementation requirements for SACs in program description documents.
- SRNS is cross-training professional instructors and operators and employing a “mock glovebox trainer” to further improve operator training, including training on SAC implementation.

EA identified three deficiencies in meeting the requirements of DOE-STD-3009-94 and one deficiency in meeting the requirements of DOE Order 414.1D, *Quality Assurance*, as summarized below:

- SRNS did not identify or evaluate components supporting five SACs for functional classification as safety components.
- For four SACs, the SRNS descriptions and evaluations are insufficient to ensure that their safety functions can be met.
- The SRNS safety bases incorrectly credit attributes of eight administrative controls that are not SACs as providing safety functions and risk reduction.
- SRNS incorrectly classified software that supports the implementation of two SACs as non-safety software.

In summary, the identification, development, and implementation of SACs for the SRTE generally meet the requirements of DOE-STD-3009-94. Although there are identified issues associated with SAC development, no imminent safety concerns were identified. Resolution of the issues identified in this assessment will support a more robust and reliable control set.

# INDEPENDENT ASSESSMENT OF SPECIFIC ADMINISTRATIVE CONTROLS FOR THE SAVANNAH RIVER TRITIUM ENTERPRISE

## 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) for the Savannah River Tritium Enterprise (SRTE) Tritium Facility (TF) and Tritium Extraction Facility (TEF) from June to September 2023. This assessment was performed within the broader context of 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 2023 Plan for the Independent Assessment of Specific Administrative Control Implementation Across the DOE Complex*. Per this plan, 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*, which is more commonly invoked than DOE-STD-3009-2014, *Preparation of Nonreactor Nuclear Facility Documented Safety Analysis*.

Savannah River Nuclear Solutions, LLC (SRNS) manages SRTE under the direction and oversight of the National Nuclear Security Administration Savannah River Field Office (SRFO). SRTE is in the H Area portion of the Savannah River Site (SRS). The TF mission is to provide the DOE and the U.S. Department of Defense (DoD) with reservoirs filled with deuterium/tritium mixtures that meet Weapons Design Agency requirements; to provide tritium to DOE for commercial uses; and to produce inert reservoirs to meet DOE and DoD needs. The TEF activities include the receipt, storage, processing, and handling of tritium production burnable absorber rods that have been irradiated in commercial reactors; the processing of extraction gases; and the transferring of extracted tritium gas to the TF.

## 2.0 METHODOLOGY

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

As identified in the 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 TF and TEF safety analysis reports, referred to as documented safety analyses (DSAs) herein, the technical safety requirement (TSR) 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 DOE-STD-3009-94 requirements and provides guidance for the development and implementation of SACs. Administrative controls (ACs) were reviewed to determine whether they are appropriately classified as ACs rather than SACs (i.e., the ACs do not perform a safety significant [SS] or a safety class [SC] function). EA also reviewed implementing

documents (e.g., procedures) to determine whether SAC and AC requirements are adequately captured. The second part of the assessment was conducted at SRS and consisted of field observations, walkdowns, and tabletop presentations of SAC-related operations, as well as interviews with SRNS and SRFO personnel responsible for SAC development, implementation, and oversight.

A written comment and response process was used to address issues identified during the review. Follow-on discussions with SRNS and SRFO 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 TF and TEF SACs are appropriately identified and developed in accordance with the requirements of DOE-STD-3009-94 and the expectations of DOE-STD-1186-2004.

EA evaluated all 11 SACs in the TF and TEF DSAs. The SACs are appropriately identified based on the control selection in the hazard and accident analyses. The TF and TEF DSAs follow the hierarchy of controls from DOE-STD-3009-94 and appropriately credit SC and SS engineered features prior to identifying SACs. Nine SACs are designated as SS for reducing the probability or radiological consequences of accident scenarios. The *Tritium Facilities Inventory Controls* and the TEF *Inventory Controls* SACs establish SC initial conditions to ensure that the analyzed radiological consequences to the public do not exceed the Evaluation Guideline of DOE-STD-3009-94. Additionally, EA reviewed eight SAC program description documents. SRTE effectively uses these documents to summarize the development basis (safety function, purpose, and key attributes) and implementation requirements of each SAC in a single document.

EA identified issues with five SACs that rely on structures, systems, and components (SSCs) to ensure that the SAC safety function is met. Functional requirements are not provided for these support SSCs in the DSAs, and there is no determination of whether the SSCs should be functionally classified. DOE-STD-3009-94, section 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. Additionally, DOE-STD-3009-94, section 4.5.X.3 requires functional requirements to be provided for the SAC and any necessary support SSCs. (See **Deficiency D-SRNS-1**.) Not properly identifying support SSCs, evaluating them for functional classification, providing functional requirements, or justifying why functional classification is not required may result in an ineffective hazard control. The following is a list of the five SACs and associated SSCs that were not evaluated for functional classification:

- The *Tritium Facilities Inventory Controls* and the TEF *Inventory Controls* SACs rely on pressure gauges and temperature indicators to determine tritium mass.
- The TF *Empty Container Verification Controls* SAC employs installed pressure gauges, temperature indicators, and calorimeters to determine vessel contents.
- The TF *Secondary Container Controls* SAC relies on pressure gauges to verify secondary container backfill and flush.
- The *Fire Water Volume Determination* SAC relies on level indicators to determine fire water volume.

Software supporting the *Tritium Facilities Inventory Controls* and the *TF Empty Container Verification Controls* SACs was incorrectly classified as non-safety software. Specifically, the Automated Reservoir Management System (ARMS) software that supports the implementation of the SACs is incorrectly classified as non-safety software, which does not meet the requirements of DOE Order 414.1D, *Quality Assurance*. DOE Order 414.1D, sections 7.u and 7.x, defines safety software as inclusive of “safety management and administrative controls software.” The SRS Quality Assurance Manual 1Q, Procedure 20-1, *Software Quality Assurance*, attachment 8.6, *Safety Software Inventory List (SSIL) Criteria*, repeats the DOE Order 414.1D definition of safety management and administrative controls software. Application of the graded approach in Manual 1Q, Procedure 20-1, attachment 8.1, *Graded Approach to Software Classification*, should result in designating ARMS as safety software, whereas SRNS has incorrectly designated ARMS as non-safety software. (See **Deficiency D-SRNS-2**.) Implementation of both the *Tritium Facilities Inventory Controls* and the *TF Empty Container Verification Controls* SACs relies on the ARMS software to ensure that radiological inventories remain within specified limits. The use of a non-safety software could result in ineffective SAC implementation.

Further, contrary to DOE-STD-3009-94, sections 4.5.X.2, 4.5.X.3, and 4.5.X.4, the DSA descriptions and evaluations for four SACs are insufficient to ensure that their safety function can be met. (See **Deficiency D-SRNS-3**.) Inadequate description and evaluation of a SAC may result in an ineffective control. The following is the list of the four SACs and associated missing requirements:

- The *Tritium Facilities Inventory Controls* and the *TEF Inventory Controls* SACs refer to facility procedures on how to maintain inventory logs without providing specific requirements to confirm that the inventory is kept within the limits after each transfer.
- The *Tritium Facilities Inventory Controls* and the *TEF Inventory Controls* SACs refer to physical inventory schedules based on the requirements of the Nuclear Materials Control Program; however, the SACs do not justify how these requirements are sufficient to ensure that nuclear safety assumptions are maintained.
- The *TEF Inventory Controls* SAC does not describe the inventory verification requirements for gas transfers. Gas transfer inventory calculations are typically performed using non-safety software, which necessitates the use of manual calculations for verification. Operating procedures specify that the TEF operations shift manager is responsible for verifying that inventory calculations are correct. However, the DSA and implementing procedure do not identify that these verifications must be performed by a manual calculation.
- The *Fire Water Volume Determination* SAC references a site procedure without providing specific direction on how the water level in the fire water tank is to be reliably measured.
- The *Process Hood Transient Combustible Material* SAC excludes various items (e.g., fixtures, jigs, and cups) as transient combustibles without limiting the quantity or collocation of the excluded items or documenting the basis for concluding that the safety function is met with these exclusions.

EA evaluated 10 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). Eight ACs were incorrectly credited as SS controls in hazard events to provide risk reduction to workers. Contrary to the definition of a SAC in DOE-STD-3009-94, specific credited attributes of these ACs are not identified as SACs. (See **Deficiency D-SRNS-4**.) 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 ACs. ACs are not implemented as rigorously as SACs, and therefore cannot ensure the risk reduction identified in the hazard analysis. SRNS has submitted a DSA revision to SRFO for review and approval that elevates key attributes of ACs credited with risk reduction to SACs, or eliminates credited risk reduction due to ACs (e.g., events mitigated by the

emergency preparedness program). A detailed review of this DSA, which is a combined DSA for TF and TEF and includes changes for modeling radiological releases for several postulated hazard events, is beyond the scope of this assessment.

There are no imminent safety concerns associated with SACs that warrant immediate resolution due to the issues discussed above.

### **SAC Identification and Development Conclusions**

The SACs are appropriately identified based on the control selection in the hazard and accident analyses, and safety functions are adequately derived. SRTE effectively summarizes the development basis and implementation requirements for SACs in program description documents. However, SSCs supporting five SACs are not identified, evaluated for functional classification, or the SAC evaluation does not provide justification for why functional classification is not required. Additionally, software that supports the implementation of two SACs is incorrectly classified as non-safety software. Further, the descriptions and evaluations in the DSAs for four SACs are insufficient to ensure that the safety function can be met. Finally, attributes of eight ACs that are not SACs are incorrectly credited for risk reduction. Although there are identified issues associated with SAC development, no imminent safety concerns were identified.

### **3.2 SAC Implementation**

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

TF and TEF SACs, as developed in chapter 4 of the DSAs, are adequately captured in the TSRs as nine directive action SACs and two that establish limiting conditions for operation. The SACs are effectively flowed down into detailed operating procedures and programs.

Training and qualification of TF and TEF personnel responsible for SAC implementation and compliance activities is sufficient to ensure effective SAC implementation. Reviewed course material, on-the-job training requirements, and observed classroom training were adequate. SRTE training and qualification managers, a facility manager, operations managers, engineering managers, qualified operations staff, and qualified engineers demonstrated sufficient knowledge of SACs and proficiency in implementation during observed evolutions, field walkdowns, tabletop presentations, and interviews.

Further, at SRTE SRNS is cross-training professional instructors and operators, and employing a “mock glovebox trainer” (MGT) to further improve operator training, including training on SAC implementation. Technical instructors are assigned to specific operations on a temporary full-time basis to achieve qualification/certification and to obtain proficiency. Qualified/certified operators also temporarily rotate as technical instructors in the training organization. The MGT was established to train workers on proper in-glovebox processing methods in a safe and controlled environment. The MGT can be used to support development of prototype procedures for new projects and has the potential to prevent operator and procedural errors.

SRNS personnel at SRTE adequately assess the implementation of all SACs on a three-year cycle. Reviewed SRNS assessments of SAC implementation performed from 2020 through 2022 adequately meet DOE-STD-1186-2004, section 2.2, expectations that SACs are independently assessed on a periodic basis with a focus on performance-based methods. Additionally, the SRNS Independent Evaluation Board performs contractor oversight assessments, including assessment of SAC implementation.



Finally, EA reviewed the Federal oversight of SAC implementation at TF and TEF. SRFO assessments appropriately use document reviews, field observations, and interviews to evaluate SACs. The SRFO assessments are prioritized based on risk and historical performance. Uniquely, SRFO assesses the flowdown of controls from the DSAs to implementation for a sample of SACs on a triennial basis, similar to assessments of credited SSCs regularly performed by safety system experts of SRFO and other field offices. Reviewed SRFO SAC assessments and interviews of SRFO personnel demonstrated that these assessments are effectively performed. Consequently, this EA assessment did not identify any SAC implementation issues. Performance of formal, periodic assessments of SAC implementation is cited as a **Best Practice** for consideration by other field offices, as SACs perform hazard controls of equal importance to those performed by credited SSCs, which are regularly assessed by field office safety system experts. Federal oversight of SAC implementation is also performed by Facility Representatives through observation of TF and TEF activities, as is typically relied upon by other field offices to oversee SAC implementation. SRFO personnel also shadow contractor implementation verification review activities.

### **SAC Implementation Conclusions**

SACs are adequately implemented at TF and TEF. Reviewed SAC implementing documents appropriately include requirements from the TSR document. Training on SACs is sufficient for SRNS personnel. SRNS assessments and Federal oversight of TF and TEF SAC implementation are adequate. The performance of formal, periodic assessments of SAC implementation by SRFO is considered a best practice.

## **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. The following best practice was identified as part of this assessment:

- SRFO formally assesses the flowdown of controls from the DSAs to implementation for a sample of SACs on a triennial basis, similar to assessments of credited SSCs regularly performed by safety system experts of SRFO and other field offices.

## **5.0 FINDINGS**

No findings were identified during this assessment.

## **6.0 DEFICIENCIES**

Deficiencies are inadequacies in the implementation of an applicable requirement or standard. Deficiencies that did not meet the criteria for findings are listed below, with the expectation from DOE Order 227.1A for site managers to apply their local issues management processes for resolution.

### **Savannah River Nuclear Solutions, LLC**

**Deficiency D-SRNS-1:** SRNS did not identify or evaluate in the DSAs SSCs supporting five SACs for functional classification as safety SSCs. (DOE-STD-3009-94, secs. 4.5.X.2 and 4.5.X.3)

**Deficiency D-SRNS-2:** SRNS incorrectly classified software that supports the implementation of two SACs as non-safety software. (DOE Order 414.1D, secs. 7.u and 7.x; and SRS Quality Assurance Manual 1Q, Procedure 20-1, atts. 8.1 and 8.6)

**Deficiency D-SRNS-3:** SRNS DSA descriptions and evaluations for four SACs are insufficient to ensure that their safety function can be met. (DOE-STD-3009-94, secs. 4.5.X.2, 4.5.X.3, and 4.5.X.4)

**Deficiency D-SRNS-4:** The SRNS DSAs incorrectly credit attributes of eight ACs that are not SACs as providing SS functions and risk reduction. (DOE-STD-3009-94, Definition of SAC)

## **7.0 OPPORTUNITIES FOR IMPROVEMENT**

No opportunities for improvement were identified during this assessment.

## **8.0 ITEMS FOR FOLLOW-UP**

SRNS submitted, and SRFO approved, a DSA that covers both TF and TEF. Before implementing this DSA, SRNS submitted a revision to SRFO for review and approval. The revision elevates key attributes of ACs credited with risk reduction to SACs, or eliminates credited risk reduction for ACs (e.g., events mitigated by the emergency preparedness program), increasing the analyzed consequences for some events. This revision also includes changes for modeling radiological releases for several postulated hazard events. The analyzed consequences to the public are close to the Evaluation Guideline and exceed the consequence threshold for workers by thousands of rem, warranting additional follow-up. EA will work with SRFO to coordinate an EA review of the combined tritium facility DSA revision.

## **Appendix A Supplemental Information**

### **Dates of Assessment**

June to September 2023

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### **Quality Review Board**

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