



# **Independent Assessment of the Transuranic Waste All-Hazards Planning Basis at the Savannah River Site**

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Office of Enterprise Assessments  
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## Acronyms

AHS	All-Hazards Survey
DOE	U.S. Department of Energy
DOE-SR	DOE Savannah River Operations Office
DSA	Documented Safety Analysis
EA	Office of Enterprise Assessments
EAL	Emergency Action Level
EPHA	Emergency Planning Hazards Assessment
EPZ	Emergency Planning Zone
PA	Protective Action
SRNS	Savannah River Nuclear Solutions, LLC
SRS	Savannah River Site
SWMF	Solid Waste Management Facility
TRU	Transuranic

# INDEPENDENT ASSESSMENT OF THE TRANSURANIC WASTE ALL-HAZARDS PLANNING BASIS AT THE SAVANNAH RIVER SITE

## Executive Summary

The U.S. Department of Energy (DOE) Office of Enterprise Assessments (EA) conducted an independent assessment of the all-hazards planning basis for transuranic (TRU) waste operations at the Savannah River Site (SRS) from December 2022 to January 2023. This assessment evaluated the effectiveness of both the DOE Savannah River Operations Office (DOE-SR) and its management and operating contractor, Savannah River Nuclear Solutions, LLC (SRNS), in developing and maintaining the all-hazards planning basis for TRU waste operations. The all-hazards planning basis includes development and maintenance of an all-hazards survey and an emergency planning hazards assessment (EPHA). DOE Order 151.1D, *Comprehensive Emergency Management System*, identifies requirements for the all-hazards planning basis, and the associated emergency management guide provides guidance for implementing the requirements. EA primarily focused on hazards identification and screening and the documented analysis for supporting the development of response plans, emergency action levels, predetermined protective actions, and sizing of the emergency planning zone. EA also evaluated the utility of the EPHA as a reference for a consequence assessment team when conducting dispersion modeling of analyzed release scenarios.

EA identified the following strengths:

- SRNS has developed procedures that are accurate, complete, and compliant. The procedures define adequate processes for effectively implementing the all-hazards planning basis requirements of DOE Order 151.1D.
- SRNS has prepared, and DOE-SR has approved, all-hazards surveys for SRS facilities where TRU waste is generated, stored, and packaged for shipping that effectively implement the applicable requirements of DOE Order 151.1D.
- SRNS has prepared, and DOE-SR has approved, EPHAs for facilities where TRU waste is generated, stored, and packaged for shipping that effectively implement the applicable requirements of DOE Order 151.1D. The EPHAs are technically accurate and provide information to support the development of response plans, emergency action levels, predetermined protective actions, protective action recommendations, and sizing of the emergency planning zone. In addition, the EPHAs provide the data, methods, and assumptions needed for a consequence assessment team to replicate the analysis in response to an incident.
- SRNS has prepared Engineering Study/Report S-ESR-G-00058, *Consequence Assessment for Emergency Planning Hazards Assessments*, to document modeling input parameters for use in all site EPHAs. When performing dispersion modeling, many parameters are needed, such as deposition velocity (terminal velocity of the contaminant towards earth), terrain roughness settings (contaminant removal by surface structures and dilution by air turbulence mixing), fuel pool surface areas in fire scenarios (affecting the rate of contaminant rise), and effective release height and release duration. Development and use of S-ERG-G-00058 enhances the effectiveness of the technical planning process at SRS.

In summary, EA identified no significant weakness associated with TRU waste technical planning basis. DOE-SR and SRNS developed a technically sound all-hazards planning basis for TRU waste operations that meets DOE requirements to support the development of response plans, emergency action levels, predetermined protective actions, and sizing of the emergency planning zone. Additionally, the SRS EPHAs are established using standardized modeling input parameters that can be applied consistently across the site; the EPHAs provide pertinent information to support incident analysis by a consequence assessment team.

# INDEPENDENT ASSESSMENT OF THE TRANSURANIC WASTE ALL-HAZARDS PLANNING BASIS AT THE SAVANNAH RIVER SITE

## 1.0 INTRODUCTION

The U.S. Department of Energy (DOE) Office of Emergency Management Assessments, within the independent Office of Enterprise Assessments (EA), conducted an assessment of the all-hazards planning basis for transuranic (TRU) waste operations at the Savannah River Site (SRS). The all-hazards planning basis includes development and maintenance of all-hazards surveys (AHSs) and emergency planning hazards assessments (EPHAs). EA conducted this assessment as the first in a series of assessments of the TRU waste all-hazards planning basis for sites that make shipments to DOE's Waste Isolation Pilot Plant. EA conducted the assessment during December 2022 and January 2023 in accordance with the *Plan for the Independent Assessment of the Transuranic Waste All-Hazards Planning Basis at the Savannah River Site, November 2022-February 2023*.

The DOE Savannah River Operations Office (DOE-SR) and its management and operating contractor, Savannah River Nuclear Solutions, LLC (SRNS) are responsible for the development of the all-hazards planning basis for TRU waste operations. The all-hazards planning basis is used to develop response plans, emergency action levels (EALs), predetermined protective actions (PAs) or PA recommendations, and the emergency planning zone (EPZ). EA's assessment evaluated the effectiveness of SRNS in developing and maintaining the all-hazards planning basis for TRU waste operations at various SRS facilities.

## 2.0 METHODOLOGY

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

As identified in the assessment plan, this assessment considered requirements related to DOE Order 151.1D, *Comprehensive Emergency Management System*. EA also used section 4.2, *All Hazards Planning Basis*, of Criteria and Review Approach Document 33-09, Rev. 0, *DOE O 151.1D Emergency Management Program*. EA also considered the guidance provided in DOE Guide 151.1-1B, *Comprehensive Emergency Management System Guide*.

EA examined key documents, such as SRNS's procedures for developing and maintaining AHSs and EPHAs, the AHS and EPHA for facilities where TRU waste is generated or stored, the documented safety analysis (DSA) for reviewed facilities, and other relevant programmatic documentation supporting the preparation of the all-hazards planning basis. EA remotely interviewed key personnel responsible for TRU waste operations and the development of all-hazards planning basis documents, including Solid Waste Management Facility (SWMF) operations personnel. The members of the assessment team, the Quality Review Board, and the management responsible for this assessment are listed in appendix A.

The primary facility that EA reviewed was SWMF, where the most significant operations for the storage, characterization, processing, and preparation for offsite shipment of TRU waste occur. EA also reviewed

facilities where TRU waste is generated, stored, and shipped to SWMF, including: Building 235-F; Concentration, Storage, and Transfer Facilities; F/H Area Laboratory; F-Canyon; and H-Canyon.

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

### **3.0 RESULTS**

#### **3.1 Procedures**

This portion of the assessment determined whether SRNS procedures provide clear and appropriate guidance for developing, documenting, and maintaining the AHSs and EPHAs, including identifying roles and responsibilities for review and approval. The AHS and EPHA procedures are applicable to all hazards at the site, including TRU waste.

SRNS has an adequate set of program documents for developing and maintaining a technically based emergency management program that meet all DOE requirements. Together, SRNS procedures 6Q-011, *Development and Maintenance of an All-Hazards Survey*, and 6Q-001, *Standards for Development and Maintenance of an Emergency Planning Hazards Assessment (EPHA)*, implement the technical and administrative requirements for the development of AHSs, EPHAs, EALs, predetermined PAs, and EPZs. The procedures are compliant with DOE Order 151.1D and provide clear guidance for developing, documenting, and maintaining AHSs and EPHAs, including identifying roles and responsibilities for review and approval.

The SRNS AHS development and maintenance procedure 6Q-011 provides a comprehensive, systematic process to identify, record, and screen facility hazards. The procedure provides adequate guidance on identifying and estimating hazardous material release scenarios, both man-made and those associated with natural phenomena, in terms of type, quantity, and form of radioactive and other hazardous materials. The procedure provides a clear description of the hazardous materials screening process and its application to the hazardous materials in a facility for AHS and EPHA development. The hazardous materials screening process requires the identification of all hazardous materials (e.g., radiological, chemical, explosives, hazardous biological agents and toxins) in a facility for a qualitative assessment based on DOE screening criteria.

The SRNS EPHA development and maintenance procedure 6Q-001 provides accurate and complete guidance for preparing an EPHA that defines the provisions of the emergency management hazardous materials program, as required by DOE Order 151.1D. The procedure requires a quantitative analysis of all hazardous materials identified for further analysis in the AHS; provides correct criteria for excluding hazardous materials from further analysis in the EPHA; identifies receptors of interest for consequence projections; and provides source term determination instructions that effectively establish conservative material-at-risk quantities. In addition, the procedure appropriately defines conservative and average meteorological conditions and includes PA guides for both radioactive and chemical hazardous materials. Finally, the procedure effectively describes the establishment of a spectrum of potential emergency incident scenarios for analysis in the EPHA.

SRNS Engineering Study/Report S-ESR-G-00058, *Consequence Assessment for Emergency Planning Hazards Assessments*, documents modeling input parameters for use in EPHAs. When performing dispersion modeling, analysts need many modeling input parameters, such as deposition velocity (terminal velocity of the contaminant toward earth), terrain roughness settings (contaminant removal by surface structures and dilution by air turbulence mixing), fuel pool surface areas in fire scenarios (affecting the rate of contaminant rise), and effective release height and release duration. Determining the

values for these attributes requires the application of professional judgment using scientific and engineering principles, guidance in the Comprehensive Emergency Management System Guide, the associated dispersion-modeling program user's guides, and published information from technical studies (internal and external to DOE). All analytical assumptions are required to be stated in an EPHA to support replication during a response. SRNS has established the appropriate parameters in S-ESR-G-00058 to ensure consistent and effective application across all SRS EPHA facilities. Reviews of the EPHAs for the SRS facilities identified in section 2.0 of this report demonstrate that the modeling parameters are implemented consistently by SRNS. Use of this engineering study enhances the effectiveness of the technical planning process at SRS.

Both the AHS and EPHA development and maintenance procedures appropriately require facility management and suitable technical expert involvement in developing, reviewing, and approving AHSs and EPHAs. Specifically, the procedures appropriately require review and approval of the AHS and EPHA by the applicable Facility Manager, Facility Operations Manager, Emergency Management Manager, Nuclear and Criticality Safety Engineering Area Manager, and others as deemed necessary (e.g., Facility Chief Engineer, Atmospheric Technology Group) prior to being submitted to DOE-SR for review and approval.

Furthermore, both procedures have adequate maintenance provisions that require AHSs and EPHAs to be reviewed after any update to the facility's safety basis documents and updated prior to significant changes to the facility/site operations or to hazardous material inventories, but not less than every three years as required by DOE Order 151.1D, att. 4, sec. 2, par. o.

### **Procedures Conclusions**

SRNS has prepared procedures that are compliant with DOE Order 151.1D and provide accurate, clear guidance for developing, documenting, and maintaining the all-hazards planning basis. SRNS's use of an engineering study that documents modeling input parameters for use in EPHAs enhances the effectiveness of the technical planning process at SRS.

### **3.2 All-Hazards Survey**

This portion of the assessment determined whether the AHSs prepared by SRNS and approved by DOE-SR identify all hazards that are applicable to TRU waste operations and establish the appropriate input for the planning basis of the emergency management program.

SRNS prepared, and DOE-SR approved, AHSs consistent with DOE Order 151.1D and procedural requirements. The AHS S-EHS-E-00001, *All Hazards Survey for E-Area*, accurately describes the TRU waste operations and hazards at SWMF. The results of the AHS are informative and technically sound, consistent with DOE guidance. Additionally, the AHSs that EA reviewed for other facilities where TRU waste is generated, stored, and packaged for shipping (e.g., Building 235-F, H-Canyon) were prepared in accordance with procedure 6Q-011 and accurately describe hazards associated with TRU waste operations.

S-EHS-E-00001 identifies all hazards applicable to operations at SWMF, including chemical and radiological hazards. The E-Area AHS documents that SWMF does not contain any biological agents or toxins. In addition, the AHS effectively identifies and documents the generic types (natural, technical, and human-caused) of serious emergency incidents or conditions to which SWMF may be exposed. The AHS also identifies the applicable core program planning and preparedness requirements that constitute the basis for the emergency management program. The hazardous materials and emergency conditions identified in the AHS are consistent with the DSA for SWMF operations.

The E-Area AHS includes screening of hazardous materials to identify those requiring quantitative analysis in an EPHA. The screening criteria meet DOE Order 151.1D and procedural exclusion requirements as described in the AHS development and maintenance procedure 6Q-011. The E-Area AHS appropriately screened out from further evaluation all chemical hazards within SWMF. The E-Area AHS requires further analysis in an EPHA of all TRU waste above ground due to multiple radionuclides exceeding the category 3 thresholds in DOE-STD-1027-2018, *Hazard Categorization of DOE Nuclear Facilities*.

### **All-Hazards Survey Conclusions**

SRNS has effectively prepared, and DOE-SR has approved, AHSs for TRU waste operations at SWMF and other facilities where TRU waste is generated, stored, and packaged for shipping that are complete and accurate. The AHSs identify all applicable hazards, establish the planning basis for the emergency management program, and comply with DOE Order 151.1D requirements.

### **3.3 Emergency Planning Hazards Assessment**

This portion of the assessment determined whether the SRS EPHAs define the provisions of the emergency management hazardous materials program and provide the basis for establishing a graded approach that meets the hazardous material program requirements in DOE Order 151.1D, att. 4, sec. 2.

SRNS prepared, and DOE-SR approved, EPHAs consistent with DOE Order 151.1D and procedural requirements for SRS facilities where TRU waste is generated, stored, and packaged for shipping. The SWMF EPHA, S-EHA-E-00007, *Emergency Planning Hazards Assessment for the SWMF*, used a comprehensive, systematic process to identify and analyze hazards associated with TRU waste operations. The EPHA contains a quantitative analysis of all hazardous materials identified for further analysis in the AHS, and the assumptions made in the EPHA are consistent with operational activities and the DSA.

The facility and process descriptions in the SWMF EPHA are consistent with the SWMF AHS and DSA, and the EPHA contains a current and accurate compilation of hazardous material maximum quantities associated with TRU waste operations at SWMF. For each accident scenario, consequence assessment results and a corresponding incident classification are provided.

S-EHA-E-00007 analyzes a comprehensive set of accident scenarios based on SWMF operations. SRNS evaluated seven scenarios in the EPHA ranging from low consequence and high probability to high consequence and low probability. The EPHA identifies analyzed scenarios using short descriptive names with: (1) tabulated consequences for each scenario at identified receptor locations, (2) consequences versus distance under conservative and average dispersion conditions, and (3) distances at which the protective action criteria and thresholds of early lethality are projected to be exceeded at identified receptor locations. The source term for each scenario was appropriately converted to an equivalent isotope to facilitate dispersion modeling calculations. For all scenarios, the source terms were converted into plutonium-238 equivalent regardless of the presence of plutonium-238 in the original inventory. SRNS detailed the source term conversion to plutonium-238 equivalent for each accident scenario evaluated in the EPHA. Calculations use the appropriate protective action criteria of 1 rem for the radioactive material analyzed, as stated in the EPHA development procedure. Consequences were calculated for receptors of interest under two sets of atmospheric conditions representing the 95% worst case and 50% average meteorological conditions for SRS as determined by the SRNS Atmospheric Technology Group and allowed by DOE Order 151.1D. Modeling parameters used in EPHA calculations are documented in the EPHA and are consistent with guidance in SRNS Engineering Study/Report S-ESR-G-00058.



EA reviewed the SWMF EPHA and determined that the results are consistent with DOE guidance and are accurate and technically sound. Conservative assumptions are used, and the calculations are accurate based on EA's replication of a sample of four of seven scenarios presented in the document using the HotSpot dispersion-modeling program. The EPHA clearly identified hazardous materials that were analyzed, how the results were formulated, and how the results relate to facility operations and configurations in a way that can be replicated and effectively used by SRNS consequence assessment personnel during an Operational Emergency response.

In addition to the SWMF EPHA, EA reviewed other EPHAs for facilities where TRU waste is generated, stored, and packaged for shipping. The facilities included Building 235-F, the Concentration, Storage, and Transfer Facilities, F/H Area Laboratory, F-Canyon, and H-Canyon. These EPHAs were consistent with the SWMF EPHA in the analysis of the hazards associated with TRU waste operations and were prepared in accordance with DOE Order 151.1D and SRNS procedural requirements. SRNS has used the results of the EPHAs to develop response plans, EALs, PAs, and EPZ sizing for SRS facilities.

### **Emergency Planning Hazards Assessment Conclusions**

SRNS has prepared, and DOE-SR has approved, EPHAs for TRU waste operations at SRS facilities that are technically accurate; effectively implement the requirements in DOE Order 151.1D; provide sufficient information to support EALs, PAs, and EPZ development; and provide necessary information for a consequence assessment team to replicate the analysis. SRNS has used the results of the EPHAs in developing response plans, EALs, PAs, and EPZ sizing for SRS EPHA facilities.

#### **4.0 BEST PRACTICES**

No best practices were identified during this assessment.

#### **5.0 FINDINGS**

No findings were identified during this assessment.

#### **6.0 DEFICIENCIES**

No deficiencies were identified during this assessment.

#### **7.0 OPPORTUNITIES FOR IMPROVEMENT**

No opportunities for improvement were identified during this assessment.

## **Appendix A Supplemental Information**

### **Dates of Assessment**

Remote Assessment: December 1, 2022 to January 18, 2023

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

John E. Dupuy, Director, Office of Enterprise Assessments  
William F. West, Deputy Director, Office of Enterprise Assessments  
Kevin G. Kilp, Director, Office of Environment, Safety and Health Assessments  
David A. Young, Deputy Director, Office of Environment, Safety and Health Assessments  
Kevin M. Witt, 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  
Vacant, Director, Office of Nuclear Engineering and Safety Basis Assessments

### **Quality Review Board**

William F. West, Advisor  
Kevin G. Kilp, Chair  
Anthony R. Taylor  
David Olah  
Michael A. Kilpatrick

### **EA Assessment Team**

Brad J. Edler, Lead  
Robert F. Gee  
Jonathan L. Pack