

**Office of Enterprise Assessments
Assessment of the Savannah River Site Fire
Protection Program as Implemented at the
H-Canyon and K-Area**



June 2017

**Office of Nuclear Safety and Environmental Assessments
Office of Environment, Safety and Health Assessments
Office of Enterprise Assessments
U.S. Department of Energy**

Table of Contents

Acronyms	ii
Executive Summary	iii
1.0 Purpose.....	1
2.0 Scope.....	1
3.0 Background	1
4.0 Methodology	2
5.0 Results.....	3
5.1 Fire Protection Program.....	3
5.2 Fire and Related Safety Hazards Analyses	7
5.3 Fire Prevention and Protection SSCs and Design Requirements.....	9
5.4 Operations, Surveillance, Testing, and Maintenance.....	12
5.5 Contractor Self-Assessment Program	13
5.6 DOE Field Element Oversight.....	14
5.7 SWPF Follow-up	15
6.0 Findings.....	15
7.0 Opportunities for Improvement.....	15
8.0 Items for Follow-up.....	16
Appendix A: Supplemental Information.....	A-1
Appendix B: Key Documents Reviewed, Interviews, and Observations.....	B-1
Appendix C: Deficiencies	C-1

Acronyms

AHJ	Authority Having Jurisdiction
BNA	Baseline Needs Assessment
CFR	Code of Federal Regulations
CRAD	Criteria and Review Approach Document
DOE	U.S. Department of Energy
DOE-SR	Savannah River Operations Office
DSA	Documented Safety Analysis
EA	Office of Enterprise Assessments
FHA	Fire Hazards Analysis
FPE	Fire Protection Engineer
FPP	Fire Protection Program
KIS	K-Area Interim Surveillance
NFPA	National Fire Protection Association
OFI	Opportunity for Improvement
PFHA	Project Fire Hazards Analysis
SSC	Structures, Systems, or Components
SRNS	Savannah River Nuclear Solutions, LLC
S/RID	Standards/Requirements Identification Document
SRS	Savannah River Site
SWPF	Salt Waste Processing Facility
TRM	Target Residual Material
TSR	Technical Safety Requirement
USQ	Unreviewed Safety Question
WE	Wood Equivalent

Office of Enterprise Assessments
Assessment of the Savannah River Site Fire Protection Program as
Implemented at the H-Canyon and K-Area

EXECUTIVE SUMMARY

The U.S. Department of Energy (DOE) Office of Nuclear Safety and Environmental Assessments, within the independent Office of Enterprise Assessments (EA), conducted an assessment of the Savannah River Site (SRS) fire protection program as implemented at the H-Canyon and K-Area, which are operated by Savannah River Nuclear Solutions, LLC (SRNS). EA sampled fire protection program implementation for the H-Canyon Target Residual Material project and the K-Area Interim Surveillance Vault facility to provide data for this assessment.

The SRS fire protection program, as implemented for H-Canyon and K-Area, is appropriately maintained, has a robust design, and has detailed procedures. The SRNS fire protection engineering staff evaluated for this assessment are adequately trained and qualified. The SRS fire department is appropriately staffed and equipped to respond to the emergency events as evaluated in the baseline needs assessment and described in the safety basis and facility fire hazards analyses. Overall, the fire protection systems designed for the facilities are adequate and well-maintained, and the SRNS and DOE staff members interviewed have a good understanding of how H-Canyon and K-Area fire protection systems and support systems function to protect the facilities. However, EA identified deficiencies in the facility-specific fire protection programs in the areas of combustible loading control, fire impairment processes, fire incident response, technical/analytical basis documentation and integration into the fire hazards analysis, and program assessment planning and criteria.

The responsible DOE field office, Savannah River Operations Office (DOE-SR), has an adequately documented structure for providing oversight of fire protection programs at SRS, but some improvement should be considered regarding implementation of the oversight program. DOE-SR evaluates site programs, using written plans and schedules for assessments, and reviews the contractor's self-assessments of processes and systems. DOE-SR also performs the required triennial SRNS fire protection program assessments; however, EA noted that the DOE-SR assessment plan does not address oversight of all of the contractor's fire protection program triennial self-assessments.

EA also conducted a follow-up assessment of corrective actions for two findings identified during a December 2015 fire protection assessment at the SRS Salt Waste Processing Facility. The finding associated with fireproofing of structural members has been resolved, but the finding associated with performance of triennial assessments has not been adequately addressed; the Salt Waste Processing Facility has not performed a triennial fire protection program self-assessment.

Office of Enterprise Assessments
Assessment of the Savannah River Site Fire Protection Program as
Implemented at the H-Canyon and K-Area

1.0 PURPOSE

The U.S. Department of Energy (DOE) Office of Nuclear Safety and Environmental Assessments, within the independent Office of Enterprise Assessments (EA), conducted an assessment of the Savannah River Site (SRS) fire protection program (FPP) as implemented at the K-Area Interim Surveillance Vault facility and H-Canyon Target Residual Material project. The purpose of this assessment was to evaluate the implementation of program requirements and the adequacy of controls designed to reduce the risk from a fire or explosion at nuclear facilities. This assessment was designed to evaluate specific core fire protection elements and to provide information to all stakeholders for benchmarking the program's effectiveness. EA conducted the onsite portions of this assessment January 9-13, 2017, and January 23-27, 2017.

2.0 SCOPE

EA assessed the effectiveness and implementation of selected elements of the SRS FPP, with specific attention to flowdown of program requirements and program implementation at the K-Area and H-Canyon. EA evaluated key elements of the SRS FPP and the facility-specific FPPs of the K-Area and the H-Canyon. Those key elements included program documentation; authority having jurisdiction (AHJ) determinations and exemption and equivalency processes; baseline needs assessments (BNAs); fire hazards analysis (FHA) and building FPP assessments; pre-fire plans; ignition sources and combustible controls; fire system impairment processes; inspection, testing, and maintenance of suppression and alarm systems; and inspection, testing, and maintenance of supporting infrastructure. EA also evaluated the integration of the FHA with the documented safety analysis (DSA), the flowdown of the safety basis requirements into the FPP, and the oversight processes utilized to verify the adequacy of the SRS FPP. EA also assessed the DOE's Savannah River Operations Office (DOE-SR) oversight activities related to fire protection.

The most recent EA FPP assessment for SRS was completed at the Salt Waste Processing Facility (SWPF) in January 2014. A follow-up on that assessment, *Office of Enterprise Assessments Salt Waste Processing Facility Construction Quality and Fire Protection Systems Follow-up Review at the Savannah River Site*, was completed in December 2015. During this 2017 assessment, EA performed a follow-up assessment on the status of the findings that remained in 2015.

3.0 BACKGROUND

The Savannah River Site comprises multiple nuclear facilities and operations. DOE-SR provides direction and oversight for the design and operation of SRS nuclear facilities for the DOE Office of Environmental Management (EM). Savannah River Nuclear Solutions, LLC (SRNS) is the primary contractor responsible for the management and operation of SRS facilities not involved in the processing of liquid waste. In addition, the primary FPP functions and responsibilities at SRS are managed by SRNS.

EA selected the K-Area and H-Canyon for this targeted assessment as an example of implementation of FPPs at SRS. Specifically, EA sampled program implementation for the H-Canyon Targeted Residual

Material Project (TRM) project and the K-Area Interim Surveillance (KIS) Vault Glovebox operations. The H-Canyon TRM project receives and prepares highly enriched uranium (HEU) for processing. The HEU, which is transported as a liquid solution in casks, is received through the H-Canyon Truckwell Extension, and the HEU liquid contents are transferred by piping from the shipping cask to a sample tank. The uranium is recovered and shipped offsite for further processing. The KIS Vault Glovebox operations allow for non-destructive and destructive examination of transuranic storage containers, non-destructive examination of shipping packages, and the shipment of sample materials to the Savannah River National Laboratory (SRNL) for analysis.

The SRS FPP is documented in SRNS-RP-2008-00086-012-M&O, *Standards/Requirements Identification Document*; Manual 2Q Procedure 2.0, *Site Fire Protection Management and Administration*; F-PP-G-00006, *Savannah River Site Fire Protection Program Plan*; K-Area FPP-4.01, *Fire Protection Program*; and, 221-H-9594, *H-Canyon/H-Outside Facilities Fire Protection Program Plan*.

4.0 METHODOLOGY

The EA independent assessment program is designed to enhance DOE safety and security programs by providing DOE and contractor managers, Congress, and other stakeholders with an independent evaluation of the adequacy of DOE policy and requirements, as well as the effectiveness of DOE and contractor line management performance in safety and security and other critical functions as directed by the Secretary of Energy. The DOE independent oversight program is described in and governed by DOE Order 227.1A, *Independent Oversight Program*. EA implements the independent oversight program through a comprehensive set of internal protocols, operating practices, assessment guides, and process guides. Organizations and programs within DOE use varying terms to document specific assessment results. In this report, EA uses the terms “deficiencies, findings, and opportunities for improvement (OFIs)” as defined in DOE Order 227.1A. In accordance with DOE Order 227.1A, DOE line management and/or contractor organizations must develop and implement corrective action plans for the deficiencies identified as findings. Other important deficiencies not meeting the criteria for a finding are also highlighted in the report and summarized in Appendix C. These deficiencies should be addressed consistent with site-specific issues management procedures.

As identified in the *Plan for the Office of Enterprise Assessments, Assessment of the Fire Protection Programs at the K Area and H Canyon at the Savannah River Site*, dated January 2017, this assessment considered requirements related to Part 830 to Title 10 of the *Code of Federal Regulations* (10 CFR), *Nuclear Safety Management*; 10 CFR Part 851, *Worker Safety and Health Program*; DOE Order 420.1C, *Facility Safety*; DOE-STD-1066-2012, *Fire Protection*; and, National Fire Protection Association (NFPA) codes and standards.

EA used applicable sections of Criteria and Review Approach Document (CRAD) 31-12, *Fire Protection Program Criteria and Review Approach Document*, Revision 0, for this targeted assessment, with particular emphasis on the following elements:

- FP-1, Fire Protection Program
- FP-2, Fire and Related Safety Hazards Analyses
- FP-3, Fire Prevention and Protection Structures, Systems, and Components (SSCs) and Design Requirements
- FP-4, Operations, Surveillance, Testing and Maintenance
- FP-5, Contractor Self-Assessment Program

- FP-6, DOE Field Element Oversight.

EA also used selected elements of CRAD 45-21, *Feedback and Continuous Improvement Inspection Criteria and Approach – DOE Field Element*, Revision 1, to collect and analyze data on DOE-SR oversight activities for the FPP. EA examined key documents, such as system descriptions, work packages, procedures, manuals, analyses, policies, training and qualification records, and numerous other documents. EA also conducted interviews of key personnel responsible for developing and executing the associated programs; observed the K-Area demonstration glovebox process and the H-Canyon control room monitoring cameras; and, walked down portions of the K-Area TRM project, focusing on safety basis controls. The members of the EA assessment team, the Quality Review Board, and EA management responsible for this assessment are listed in Appendix A. A detailed list of the documents reviewed, facility walkdowns, and personnel interviewed during this assessment, relevant to the findings and conclusions of this report, is provided in Appendix B.

In January 2014, EA conducted an assessment of the SWPF construction quality and fire protection systems. EA followed up on the 2014 assessment in December of 2015. This 2017 assessment examined the completion and effectiveness of corrective actions meant to address the findings that remained as of the 2015 assessment. Results of the corrective action assessments are included in Section 5.0, Results, of this report.

5.0 RESULTS

5.1 Fire Protection Program

EA reviewed the policy, program, and procedures that establish the SRS, H-Canyon, and K-Area FPPs to ascertain alignment with external requirements, site and facility operations, and hazards.

Criteria:

Policy. The site contractor has an established Policy Statement that affirms the contractor's commitment to provide a comprehensive fire protection and emergency response program. (DOE O 420.1C, Chapter II, Fire Protection, Attachment 2)

Codes and Standards. The applicable building code and National Fire Protection Association (NFPA) codes and standards are identified in the fire protection and emergency response programs. (DOE O 420.1C, Chapter II, Fire Protection, Attachment 2, applicable codes and standards from the site-specific Standards/Requirements Identification Document)

FPP Programmatic Elements. A documented FPP exists as required by applicable safety criteria and includes the elements and requirements for design, operations, emergency response, fire analysis and assessments, wildland fire, and site-specific fire protection criteria. (DOE O 420.1C, Chapter II, Fire Protection, Attachment 2)

Fire Protection Engineers. A process exists to assure that all fire prevention and protection features are reviewed and approved by a qualified fire protection engineer. (DOE O 420.1C, Chapter II, Fire Protection, Attachment 2)

Pre-Incident Plans. Pre-incident strategies, plans, and standard operating procedures have been established to enhance the effectiveness of emergency response activities. (DOE O 420.1C, Chapter II, Fire Protection, Attachment 2; site FPP description document)

5.1.1 Fire Protection Program Elements

The SRNS Policy Statement, Manual 1-01, Procedure 5.40, *Fire Protection Policy*, affirms the contractor's commitment to provide a comprehensive fire protection and emergency response program in accordance with Department directives and other applicable requirements consistent with SRNS facility hazards. The Standards/Requirements Identification Document (S/RID), Functional Area 12, enumerates appropriate regulations, codes, and standards consistent with SRNS operations and hazards, including NFPA 72, *National Fire Alarm Code*, and NFPA 70, *National Electrical Code*. SRS, H-Canyon, and K-Area FPP documents are approved and further discuss requirements, criteria, and procedures for design, operations, emergency response, fire analysis and assessments, and site-specific fire protection criteria from the S/RID. Wildland fire is managed by the United States Forest Service under interagency agreement, DE-AI09099SR22188/124, with support from SRNS.

The SRNS fire protection engineering program includes adequate qualification standards for fire protection engineers (FPEs) for both industrial and nuclear facility responsibilities. SRNS procedures appropriately require that qualified FPEs review and approve all fire prevention and protection features, including equivalencies. EA evaluated four equivalencies and found that they were prepared and approved by a qualified FPE (QFPE) II, and that each included further approvals from the Design Authority Engineer, Fire Protection Engineering Manager, and Facility Manager. SRNS fire protection engineering also has been delegated certain fire protection-related authority having jurisdiction (AHJ) duties described in OSQA-14-0130, *Savannah River Management & Operation (M&O) Contract DE-AC09-08SR22470; DOE O 420.1C, Facility Safety, Dated December 4, 2012, Delegation of Authority Having Jurisdiction and Facility Assessment Frequencies*, September 30, 2014. DOE-SR, however, appropriately retains full AHJ authority and responsibility and selectively monitors SRNS activities. This is adequately documented in Manual 2Q, Procedure 2.0; FPP Plan F-PP-G-00006; and the S/RID as required by DOE Order 4201.1C, Chapter II, *Fire Protection*.

SRNS maintains a current mutual aid agreement approved by DOE-SR. The agreement includes the counties that bound the SRS reservation and adequately establishes roles and responsibilities, command and control systems, communications protocol for emergency responders and the use of exercises to ensure readiness of off-site response organizations. Annual exercises include participation from offsite fire departments, as demonstrated by the May 2016 Site Evaluation Exercise that was evaluated by the SRNS emergency preparedness organization.

SRNS recently established a pilot Fire Protection Code Committee to facilitate collaboration across the DOE complex in the review of fire protection codes and standards. Thirteen sites have agreed to participate. The committee is a promising initiative with potential to reduce workload and support collaboration across the complex.

SRNS uses fire control preplans to be readily available during an emergency response. In conjunction with fire control preplans, and in accordance with NFPA 1620, *Standard for Pre-Incident Planning*, the SRS Incident Command System has emergency contact numbers for notifying operations, utilities, and security personnel to ensure prompt access to the H-Canyon and K-Area facilities. However, floor plan and hose layout diagrams for H-Canyon and K-Area do not identify several locations for fire hydrants, standpipes, and fire department connections that are specifically referenced in the hose-lay instructions for establishing fire attack lines, nor is the placement of the electrical disconnect provided in H-Canyon, 1st Level, Sections 1-9.

Record retention requirements supporting the FPP are identified in Manual 1B-3.31, *Records Management*, and are maintained in accordance with WSRC-EM-96-00023, *Records Retention Schedule Matrix (RSM)*. The manual was consistent with record retention requirements for K-Area and H-Canyon.

EA evaluated the combustible loading programs for both H-Canyon and K-Area, which are defined by procedures 221-H-8087, *Controls and Limits of Transient Combustibles in 221-H*, for H-Canyon, and FPP-4.03, *Control of Combustibles*, and SOP-FP-005-K, *K-Area Allowable Transient Combustibles*, for K-Area. Walkdowns of the H-Canyon and K-Area confirmed that combustibles were adequately controlled. However, based on the following quality concerns, EA determined that the H-Canyon combustible control procedure, 221-H-8087, inadequately defines the combustible loading and control program as required by DOE-STD-1066-2012, Section 5.1.4, and Manual 2Q, Procedure 5.5, *Control of Combustible Materials*, Section 5.3.5 (**Deficiency**):

- The SRS FPP requirement to prohibit storage of combustible materials in mechanical and transformer rooms, under unprotected stairs or in stairwells, within 15 feet of energized transformers and switchgear, and areas where radioactive materials may be present, was not included in the procedure. The flowdown of these program requirements from the site procedure to the H-Canyon procedure was inadequate.
- No technical basis is referenced to support the combustible loading limit of “100 pounds of Class A” combustibles stated in the procedure. This does not comply with the DOE-STD-1066-2012, Section 5.1.4.1, requirement to identify the baseline standards applied to manage the fire safety risks associated with the use and storage of combustible, flammable, radioactive and hazardous materials. In addition, DOE-STD-1066-2012, Appendix B, Section B.4.3.1, states that combustible control programs should address the quantity, type, and location limits on combustibles allowed in critical areas.
- The definition of combustible liquids in the procedure is not consistent with NFPA 30, *Flammable and Combustible Liquids Code*. While procedure 221-H-8087 defines a combustible liquid as a term generally used to describe both flammable and combustible liquids, NFPA 30 defines these liquids separately and bases them on their flashpoint temperatures and fire hazards properties.

5.1.2 Fire Impairment Program and Implementation

EA evaluated the fire impairment processes for both H-Canyon and K-Area, which are defined by Manual 2Q, Procedure 5.6, *Fire Protection Impairment Control Procedure*, and FPP-4.06, *Fire Protection Impairment Control and Compensatory Action*, for H-Canyon and K-Area, respectively. For H-Canyon, the site fire impairment procedure, Manual 2Q, Procedure 5.6, lacks adequate guidance for establishing priorities of fire system impairments. The procedure does not direct FPEs to consider risks such as property loss or life safety, or to assign appropriate compensatory measures, when using the impairment process. The requirements of DOE-STD-1066-2012, Section 5.1.5.1, to consider risks were not adequately incorporated into the H-Canyon fire impairment process. (**Deficiency**)

EA made an additional observation regarding the implementation of the fire impairment process for H-Canyon. Contrary to the site procedure, Manual 2Q, Procedure 5.6, *Fire Protection Impairment Control Procedure*, the dry pipe sprinkler system installed in Building 254-19H was described as “fully operational” on the fire system impairment permit (Ref. 2015-348). The term “operable” is defined in Manual 2Q, Procedure 5.6, as in-service, meeting functional requirements, and designed in accordance with applicable NFPA codes and standards as defined in Manual 2Q, Procedure 5.6. The system impairment resulted from a design non-compliance involving sprinkler obstruction. Thus, the impairment should have been assigned a “functional status,” which is defined in Manual 2Q, Procedure 5.6, as being “in-service” and meeting design basis code performance requirements, but due to one or more non-critical deficiencies, does not fully comply with NFPA codes and standard requirements.

Finally, for K-Area, SRNS identified that components of the safety-significant Shuffler Room Fire Suppression System exhibited a degraded condition. The K-Area safety-significant diesel driven fire pump, K1-192-2-FP-P-001, has been impaired since June 2015. In addition, SRNS identified that the fire water storage tank interior and exterior coating is degraded. Both the pump and tank issues are being addressed; however, they are longstanding issues, and site efforts to correct the impairments have not yet led to a timely resolution. EA will track these issues as follow-up items.

5.1.3 Baseline Needs Assessment

Criterion:

The site emergency response capabilities meet site needs as established in the baseline needs assessment (BNA), safety basis requirements, and applicable regulations, codes and standards. (DOE O 420.1C, Chapter II, Fire Protection, Attachment 2; applicable codes and standards from the site-specific Standards/Requirements Identification Document; site FPP description document)

The current SRNS BNA is adequate and meets applicable requirements. It includes a mobile apparatus inventory for first-line response and reserve capabilities, as well as the maintenance for operability using practices outlined in NFPA 1901, *Automotive Fire Apparatus*. The BNA describes the fire department capabilities that are necessary to provide medical emergency services, search and rescue, response to events involving hazardous materials, and an effective response to extinguish fires. The BNA also discusses the required minimum fire department shift staffing, mobile apparatus, equipment, and procedures, consistent with principals of NFPA 1710, *Standard for the Organization and Deployment of Fire Station Operations, Emergency Medical Operations, and Special Operations to the Public by Career Fire Departments*. During a 2015 fire protection assessment at SRS, EA visited and walked down two of the three fire department facilities and viewed the available firefighting equipment. The fire departments were well-equipped, and the equipment was well-maintained. The equipment observed during those walkdowns is accurately reflected in the current BNA. The SRS fire department adequately plans to update the BNA at least every three years by conducting joint walkdowns and reviews with FPEs. A draft of Revision 9 to the 2014 BNA was being developed at the time of this assessment.

SRNS currently performs routine fire department training evolutions every other month, but this training does not fully consider the complexities of high hazard nuclear facilities. For example, establishing the required hose stream and pressure for H-Canyon, Building 221-H, has numerous challenges, including accessing an exterior dry pipe standpipe on the east side of Building 221-H; maintaining building ventilation, especially when exterior doors cannot be fully open for more than 20 minutes, due to safety basis building ventilation assumptions; airborne contamination; and, deploying approximately 400 feet of fire hose by hand for processing areas potentially containing fissile material. Likewise, there are significant potential challenges to supplying required firefighting water to areas within the K-Area Building 105-K, which houses the KIS Vault, Glovebox, and Shuffler Room,. Specifically, the fire department may encounter significant obstacles in deploying 250 to 550 feet of three-inch fire hose through multiple corridors, stairwells, doors, and processing areas by hand; and navigating through airborne contamination and moderator exclusion zones will present additional challenges. NFPA 1410, *Standard on Training for Emergency Scene Operations*, states, “The engine truck company operations shall provide a mechanism to measure performance of routine tasks that are required to support an effective fire suppression operation in a structure.” As discussed, EA observed that the SRS fire department training does not demonstrate adequate performance to verify initial response proficiency for events at hazard category 2 nuclear facilities, in accordance with NFPA 1410 and DOE Order 420.1C. **(Deficiency)**

With the exception of the inadequacy regarding training fire department personnel to respond to unique facilities with unusual firefighting challenges, the needs set forth in the approved BNA have been adequately met or are being addressed.

5.1.4 Fire Protection Program Conclusion

For the most part, SRNS has adequately implemented the appropriate program elements at the H-Canyon and K-Area. However, the deficiencies associated with the combustible loading program and fire impairment program documentation, and fire department training warrant increased management attention.

5.2 Fire and Related Safety Hazards Analyses

Criteria:

FHAs have been conducted for each nuclear facility and reviewed every 3 years by an FPE and revised as appropriate. (DOE O 420.1C, Chapter II, Fire Protection, Attachment 2,)

FHAs have been revised to accommodate changes to the facility, processes (operations), occupancy, safety basis, or BNA; or when new fire safety risks are introduced. (DOE O 420.1C, Chapter II, Fire Protection, Attachment 2)

The results of the FHA have been coordinated with and integrated into the DSA. (DOE O 420.1C, Chapter II, Fire Protection, Attachment 2; 10 CFR 851; NFPA 801)

Fire and related safety hazards on site (or within the facility) have been identified and evaluated in conjunction with current and comprehensive FHAs and building FPP assessments. (DOE O 420.1C, Chapter II, Fire Protection, Attachment 2)

Facility fire protection assessments are conducted annually for facilities valued over \$100 million dollars, facilities considered a high hazard, or those with vital programs; or at least every three years for low and ordinary hazard facilities; or at a frequency with appropriate justification approved by the DOE head of field element. (DOE O 420.1C, Chapter II, Fire Protection, Attachment 2, paragraph 3.f(2))

The FHAs and building FPP assessments address all essential elements for a complete analysis as delineated in DOE O 420.1C. (DOE O 420.1C, Chapter II, Fire Protection, Attachment 2)

5.2.1 H-Canyon Fire Hazards Analysis

The H-Canyon FHA, F-FHA-H-00073, *Fire Hazards Analysis for Building 221-H, H-Canyon*, comprehensively documents the risk of fire within the individual fire areas and adequately addresses the fire protection controls. The conclusions of the FHA have been adequately incorporated into the DSA supporting the “design-basis fire,” in accordance with DOE Order 420.1C. The FHA addresses the adequacy of the fire protection controls selected in the DSA for the identified hazards in uniquely identified individual fire areas. A concise description of building construction is provided, as required, and fire-rated area separations are identified and described. Facility classification and applicable DOE Orders and industry codes and standards are identified and determined to be compliant with applicable requirements. Although the H-Canyon FHA was otherwise generally adequate, EA observed an exception where an analysis had not been adequately maintained and integrated into the FHA, as discussed below. Similarly, EA observed instances in the Project Fire Hazards Analysis (PFHA) for the TRM project, F-PFHA-H-00020, *Project Fire Hazard Analysis for H-Area Target Residual Material*

(TRM) Project, where analyses were not adequately performed or integrated. Integration of these technical analyses into the fire hazards analyses is required by Manual 2Q, Procedure 2.14, *Fire Hazard Analysis Document*, or in the case of the last observation listed below, NFPA 801, *Standard for Fire Protection for Facilities Handling Radioactive Materials (Deficiency)*:

- The H-Canyon FHA referenced a hydrant flow test completed in March 2009. However, contrary to NFPA 25, *Standard for the Inspection, Testing and Maintenance of Water-Based Fire Protection Systems*, the flow test was not performed on a five-year interval to monitor potential hydraulic degradation. The next hydrant flow test was completed in 2015 but was not evaluated when the FHA was revised in April 2016 through the appropriate issuance of a design change form in accordance with the SRNS process for FHA revisions. Although the hydrant flow test data did not reveal measurable hydraulic degradation, the test data was not assessed in support of the water supply analysis, as required by Manual 2Q, Procedure 2.14, Section 5.8.3.3.
- F-PFHA-H-00020, did not adequately integrate technical analyses, as required by Manual 2Q, Procedure 2.14, Section 5.8.3.2. The fire analysis, F-TRT-H-00023, *Fire Scenarios Document for Target Residue Materials (TRM) Project in Building 221-H Truckwell and Truckwell Airlock*, determined that the recently installed dry pipe sprinkler system in the truckwell would not activate under normal conditions, due to the high air movement of the H-Canyon ventilation system. This technical analysis that identifies the sprinkler system's non-compliance with NFPA 13, *Standard for the Installation of Sprinkler Systems*, was not integrated into the FHA.
- The H-Canyon DSA evaluates fuel in a flatbed trailer truck transporting an International Organization for Standardization (ISO) container (see S-DSA-H-00001, Chapter 3, Appendix B, Hazard Evaluation Table - Event TRM-2-004); however, this was not evaluated in the PFHA. The fuel is postulated in evaluation C-ESR-H-00045, *Engineering Evaluation and Recommendations Regarding a Propane Explosion in the 221-H Truckwell Airlock*, to be an "extreme fuel load." This increase in analyzed fire risk was not integrated into the PFHA.
- Controls necessary to prevent radiologically contaminated runoff resulting from sprinkler activation and/or firefighting efforts have not been evaluated in the PFHA, as required by Manual 2Q, Procedure 2.14, Section 5.8.3.5.B, although temporary spill enclosures are used for water containment.

5.2.2 K-Area Fire Hazards Analysis

In accordance with DOE-STD-1066-2012, Appendix B.4.5, the FHA and its conclusions have been addressed in the facility DSA and reflect relevant fire safety objectives, as defined in DOE Order 420.1C. The conclusions of the FHA have been incorporated in the DSA and there is consistency between the fire accidents analyzed in the DSA and the actual fire hazards analyzed in the facility. The FHA has been updated as necessary to maintain consistency with the DSA. The FHA addresses the adequacy of the fire protection controls selected in the DSA for the identified hazards. Additionally, it comprehensively and qualitatively identifies the fire hazards and assesses the risk from fire in uniquely identified individual fire areas. A concise description of building construction is provided, as required, and fire rated area separations are identified and described. Facility classification and applicable DOE Orders and industry codes and standards are identified. Table 14 of the FHA tabulates open facility issues identified during the latest FHA revision process as required by DOE-STD-1066. The FHA for K-Area was compliant with applicable requirements.

Although the FHA was generally adequate, and combustible loading criteria identified for the various facility fire areas were generally consistent with analyses, the quantity of combustibles assumed for the

KIS Vault analysis in the FHA differed from what was considered in the safety basis analysis. Specifically, the implementing procedure uses larger, less conservative, values for allowable combustible loading than is analyzed in the safety basis calculation. Refer to Section 5.3, *Combustible Loading*, for further detail.

5.2.3 Building Fire Protection Program Assessments

EA evaluated reports 2016-SA-000070, *Annual Fire Protection Building Assessment for Building 221-H*, and 2015-SA-004732, *Annual Fire Protection Building Assessment for Building 105K*, which document the assessments that SRNS performed to determine whether their building FPP is adequate and incorporated the major elements specified in the S/RID; Manual 2Q, Procedure 2.0; and, DOE Order 420.1C. EA evaluated SRNS's implementation of the program elements to ensure that building FPPs were assessed, analyzed, results documented, and deficiencies were identified and corrected. Further, EA evaluated if programmatic and physical features of the building FPP are operated and maintained in accordance with program requirements, as well as applicable codes and standards, to minimize the consequence of a fire-related event affecting the public, workers, environment, property, and DOE missions.

EA observed that SRNS is compliant in conducting building FPP assessments annually in accordance with frequencies defined in Manual 2Q, Procedure 2.0; Manual 2Q, Procedure 5.1, *Facility Fire Prevention and Life Safety Inspections*; H-Canyon 221-H-9594; and, K-Area FPP-4.01. Assessment summary forms are used to document H-Canyon and K-Area building assessments, which are appropriately comprised of lines of inquiry to verify FPP elements are in place, such as sprinkler systems, fire alarms, and life safety features. Through this methodology, SRNS confirms that fire protection systems are established in the building; however, they do not conduct evaluations, as part of the building FPP assessment, to determine the adequacy of the fire protection systems inspection, test, and maintenance programs. DOE Order 420.1C, Chapter II, Attachment 2, *Fire Protection*, Section 3.d(1)(h), requires written criteria and procedures be established for facility and FHA assessment programs. Although SRNS has developed written criteria for building FPP assessments, there is no procedure for conducting these assessments that ensure building fire protection systems are evaluated. (**Deficiency**)

5.2.4 Fire and Related Safety Hazards Conclusion

Other than the deficiencies summarized below, SRNS has adequately implemented the requirements for building assessments in H-Canyon and K-Area. SRNS has taken the actions needed to ensure that the fire and related safety hazards were identified and analyzed, and that the results were appropriately integrated into the DSA. However, SRNS has not established a procedure for conducting building FPP assessments, and the H-Canyon FHA has some inadequacies related to the integration of technical analyses to support FHA conclusions.

5.3 Fire Prevention and Protection SSCs and Design Requirements

Criteria:

Design Requirements. Fire protection design requirements are documented and incorporated into plans and specifications, including protection thresholds that are consistent with the safety authorization basis and FHAs. (DOE O 420.1C, Chapter II, Fire Protection, Attachment 2; 10 CFR 851; site DSA; site and facility FHAs; applicable NFPA codes and standards from the site-specific Standards/Requirements Identification Document)

Design Basis Documentation. Key design documents, including design basis and supporting documents, are established to support facility safety basis development and implementation. (DOE O 420.1C, Chapter II, Fire Protection, Attachment 2; 10 CFR Part 851; applicable NFPA codes and standards from the site-specific Standards/Requirements Identification Document)

Engineering. Engineered SSCs and processes are designed using sound engineering/scientific principles and appropriate standards. (10 CFR 830.122 Criterion 6)

Integration of Design Requirements. Applicable requirements and design bases for fire protection are incorporated in engineering design work and design changes (e.g., design calculations). (10 CFR 830.122 Criterion 6). Key fire protection design documents, including design basis and supporting documents, are identified and consolidated to support facility safety basis development and implementation. (DOE O 420.1C, Chapter II, Fire Protection, Attachment 2).

Design Verification and Validation. The adequacy of the fire protection design is verified or validated by individuals or groups other than those who performed the work. Verification and validation of the fire protection design is completed before approval and implementation of the design. (10 CFR 830.122 Criterion 6)

5.3.1 Integration of Facility Technical Basis (H-Canyon and K-Area)

The H-Canyon and K-Area safety basis documents generally identified and adequately described the safety functional requirements of the fire protection systems and the essential supporting systems. The facility risks associated with fire were well-defined, and appropriate controls were identified. Engineering analyses that support fire protection SSCs generally conform to requirements identified in DOE orders, standards, and consensus NFPA standards, and adhere to sound engineering principles. Also, with some exceptions, the configuration management generally provided adequate processes to establish, document, and control the facility design requirements and the facility baseline. For the H-Canyon TRM project and the K-Area KIS Vault and Shuffler Room, fire protection design requirements are generally well-documented and incorporated into facility plans and analyses, and the hazards identified in the FHA were consistently translated to the DSA. However, in the following areas some risks and controls were not adequately documented in the technical baseline documents (i.e., FHA and supporting technical analyses), in accordance with the Manual 2Q, Procedure 2.14, Section 5.8.4.2.C. **(Deficiency)**

H-Canyon

- SRNS has not provided a technical basis for the H-Canyon fire barriers, nor performed an evaluation of whether the facility DSA, S-DSA-H-00001, *H-Canyon & Outside Facilities, H-Area Documented Safety Analysis*, or other documents were affected. The Annual Fire Protection Building Assessment for Building 221-H, 2016-SA-000070, resulted in a finding, which concluded that there was no engineering evidence to support that fire barriers located within the H-Canyon are appropriately constructed sufficient to prevent the passage of flame and hot gases, as described in both the DSA and FHA. For reasons not documented in available records, the facility Management Review Team rejected the building assessment finding, thus resulting in the corrective actions of the assessment being designated to the SRS FPP for resolution. However, as of the date of this assessment, H-Canyon facility management has not evaluated the assessment results that found the indeterminate condition of the fire barriers.

K-Area

- The Shuffler Room fire suppression system hydraulic calculation, F-CLC-K-00029, *Shuffler Project*, Rev. 3, issued in December 2012, has not been revised to reflect a modification that replaced the safety-significant fire pumps in 2013. Although the flow test data will likely be bounded by, or not deviate significantly from, the old test data (due to the similar pump design), this calculation is the documented basis that the suppression system will meet the credited safety basis performance criteria and is required to be maintained. Criterion 6(2) of 10 CFR 830.122, *Quality Assurance Criteria*, requires that design documents are revised to establish design and to incorporate applicable design bases in design work and design changes. Further, Section 5.8 of DOE-STD-1073-2003, *Configuration Management*, as invoked by DOE Order 420.1C, requires that a complete and thorough review shall be done to identify each document affected by the modification and revised accordingly.
- The flow calculations and the working plans for the FM-200 clean agent fire suppression system in the KIS Vault are required by Section 5.1.2.5 of NFPA 2001, *Standard on Clean Agent Fire Extinguishing Systems*, to be submitted to the AHJ for approval. However, only the design criteria inputs and results are contained in the Chemetron vendor manual, which is contained in the documentation that is made part of a design modification submittal. Furthermore, the complete clean agent performance analysis was not translated into a facility controlled calculation and independently validated and verified. Chemetron references the CHEM-200 Version 5.0.0 software computer code used to perform the analysis, but QA qualification of the computer analysis software, consistent with the requirements of NQA-1, was not documented or demonstrated.
- Safety basis calculation S-CLC-K-00287, *Thermal Analysis of Fires in the KIS Vault*, assumes a derated total combustible loading input of 982 pounds wood equivalent (WE) and 70 pounds WE transient combustibles. However, the K-Area procedure SOP-FP-005-K, *K-Area-Allowable Transient Combustibles*, identifies the KIS Vault normal operational combustible loading as 2,100 pounds WE and a limit of 5,000 pounds WE. Contrary to Section 3.4 of DOE-STD-3009, this safety basis credited control is deficient, because both values used in the procedure significantly exceed the combustible loading considered in calculation S-CLC-K-00287, which determines the upper layer gas temperature based on the heat release rate for a fire in the KIS Vault (refer to Table 8, Page 22, of the calculation). Unlike the 910-B Vault, there is no Specific Administrative Control (SAC) to limit and control combustible loading in the Destructive Examination (DE) and Non-Destructive Examination (NDE) Rooms of the KIS Vault. Instead, the FPP procedure is credited as a preventive control in the DSA to limit transient combustibles. According to the FHA, the sources of combustibles in the DE room amount to 200 pounds WE. These combustibles are considered to be fixed, and therefore, not consistent with the calculation. The FHA does not quantify the amount of fixed combustibles in the NDE Room. DSA Section 3.4.1.5.6, *KIS Vault Fire Consequence Analysis*, states that consequences for the KIS Vault fire are in part developed by determining the room fire temperature by conservatively evaluating the amount of combustible material in the vault and establishing the maximum room fire temperature.

5.3.2 Fire Prevention and Protection SSCs and Design Requirements Conclusion

Overall, safety functional requirements of the fire protection systems and the essential supporting systems were identified and adequately described in the H-Canyon and K-Area FHAs that were assessed, and hazards were appropriately translated to the applicable DSAs. However, some risks and controls were not adequately documented or supported by technical baseline documents.

5.4 Operations, Surveillance, Testing, and Maintenance

Criteria:

Fire Safety Systems Installation, Operation, Testing and Maintenance: A complete spectrum of fire prevention controls and procedures have been developed and implemented as required by applicable fire safety criteria. (DOE O 420.1C, Chapter II, Fire Protection, Attachment 2; and applicable NFPA codes and standards.

All fixed fire protection features (appropriate construction types, fire barriers, fire alarm and signaling systems, manual and automatic fire suppression systems, etc.), that are required by authorization basis documents and FHAs, have been installed and are tested and maintained, as required by applicable fire safety criteria. (DOE O 420.1C, Chapter II, Fire Protection, Attachment 2; and applicable NFPA codes and standards from.

Surveillance and testing of the fire protection system demonstrates that the system is capable of accomplishing its safety functions and continues to meet applicable system requirements and performance criteria. (DOE O 420.1C, Chapter II, Fire Protection, Attachment 2; and applicable NFPA codes and standards.

Surveillance and test procedures confirm that key operating parameters for the overall fire protection system and its major components remain within safety basis, NFPA, and applicable consensus standards operating limits. (DOE O 420.1C, Chapter II, Fire Protection, Attachment 2; and applicable NFPA codes and standards.

The acceptance criteria from the surveillance tests used to confirm fire protection system operability are consistent with the safety basis. (DOE O 420.1C, Chapter II, Fire Protection, Attachment 2)

EA evaluated technical safety requirement (TSR) surveillance testing procedures for the H-Canyon TRM, the Shuffler Room fire systems, and the KIS Vault fire protection systems. All SSCs with key operating parameters associated with credited safety functions were appropriately surveilled to demonstrate those safety functions and meet documented performance acceptance criteria. The facility TSR surveillance testing procedures appropriately require operability to be demonstrated, and the TSRs indicate that safety significant fire safety systems and components are tested and inspected on an acceptable schedule.

Overall, H-Canyon and K-Area surveillance, testing, and maintenance records indicate that the fire systems are adequately surveilled and maintained. However, in H-Canyon, EA identified some problems related to oversight of fire system maintenance activities as indicated by the following observations:

- The Site Utilities Engineering Manager currently serves as the Design Authority for underground fire water supply and distribution systems, fire pumps, and fire water tank, etc., in accordance with Manual 2Q, Procedure 8.0, *Fire Protection System Maintenance, Test and Inspection*. Completed fire system test data and degradation trending are not used to help measure the performance of the H-Canyon underground fire water distribution system. In addition, although SRS has an aging underground fire water piping infrastructure, inspection data is not used in H-Canyon to help identify fire system piping and equipment that could be vulnerable to potential failures and leaks.
- The Fire System Maintenance, Testing and Inspection Manager is responsible for providing oversight of the fire alarm system spare parts in accordance with Manual 2Q, Procedure 8.0. Several fire alarm panels located at SRS are obsolete and those in use at H-Canyon are aged. The lack of availability of spare parts has contributed to avoidable impairments. SRNS has not initiated actions to address this

and ensure availability of the systems. SRNS is not fulfilling the site-level responsibility to identify critical systems lacking spare parts, and there is currently no path forward to obtain funding necessary to replace these aged fire systems to increase reliability.

5.5 Contractor Self-Assessment Program

Criteria:

A documented comprehensive self-assessment of the fire protection program is performed by the site contractor at least every 3 years, or at a frequency with appropriate justification approved by the DOE head of field element. (DOE O 420.1C, Chapter II, Fire Protection, Attachment 2)

This area of the assessment focused on implementation of the triennial self-assessment requirement (Manual 2Q, Procedure 2.0 and DOE Order 420.1C) and the implementation of program elements to ensure that self-assessments verify the adequacy of the SRS and facility-specific FPPs and identify strengths and weaknesses in the FPPs.

5.5.1 Site Triennial Self-Assessment

The minimum elements of the triennial FPP self-assessments performed by SRNS are documented in Manual 2Q, Procedure 2.0. The triennial self-assessment performed by SRNS of the SRS FPP is well-documented and includes an evaluation of 19 key program elements from Manual 2Q, including verifying implementation of the SRS FPP at several facilities across the site. The self-assessment helps to confirm the adequacy of the FPP and identifies several weaknesses with proposed solutions to enhance the program.

5.5.2 H-Canyon and K-Area Triennial Self-Assessments

Manual 2Q, Procedure 2.0, Section 5.4.1, requires that facility-specific FPPs also be assessed every three years. For H-Canyon and K-Area, SRNS assesses the required elements over the course of three years, as opposed to performing one assessment every three years. EA evaluated each of the assessments that comprise the most recent triennial period. Manual 2Q, Procedure 2.0, Section 5.4.1.2, states, “The principal objective of the comprehensive fire protection self-assessment is to verify the adequacy of the site-wide, and/or facility-specific, fire protection program(s) and identify strengths and weaknesses within the program(s).” Areas of the program SRNS assessed included an evaluation of procedures, inspection and test records, inspection and test schedules, and training requirements, which identified issues with the inspection and repair of life safety systems and lack of an inspection schedule for flammable storage cabinets. The SRNS assessments were adequate based on the level of detail, the deficiencies that were identified, and the selected areas that were evaluated and their significance to the FPP. EA was unable to complete a comprehensive evaluation of the corrective actions associated with these self-assessments due to their recent completion. However, EA will track these corrective actions as follow-up items.

In addition to the program elements that SRNS assesses triennially, DOE-STD-1066-2012, Section 3.2.2, and Manual 2Q, Procedure 2.0, Section 5.4.1.6, suggests evaluating the following additional program elements when verifying the adequacy of the FPP:

- Procedures for engineering design and review
- Fire Protection Engineering staff (number, qualifications, training)
- Emergency response organizations (BNA, staffing, training, and equipment)

- Documented exemptions and equivalencies
- Fire protection system impairment process.

5.5.3 Contractor Self-Assessment Program Conclusion

SRNS has adequately assessed the H-Canyon and K-Area FPPs, as well as the overarching SRS FPP, by evaluating both programmatic and physical features, and identifying weaknesses and proposed solutions for improving the overall SRS FPP. Results of the self-assessment demonstrate that SRNS has an established FPPs that, in general, adequately meet the requirements of DOE Order 420.1C.

5.6 DOE Field Element Oversight

Criteria:

DOE field element line management has established and implemented effective oversight processes to evaluate the contractor's FPP and verify implementation (including compliance with requirements). (DOE Order 226.1B)

The DOE field element line oversight program includes written plans and schedules for planned assessments, focus areas for operational oversight, and reviews of the contractor's self-assessment of processes and systems. (DOE Order 226.1B, 4b (2))

Oversight processes are tailored according to the effectiveness of the contractor assurance systems, the hazards at the site/activity, and the degree of risk, giving additional emphasis to potentially high consequence activities. (DOE Order 226.1.B, 4b (5))

DOE field element staff are adequately trained and qualified to perform assigned oversight activities. (DOE Order 226.1B)

This area of the assessment focused on DOE-SR's implementation of the oversight process and its major elements specified in DOE Order 226.1B, *Implementation of Department of Energy Oversight Policy*, to ensure SRNS and DOE programs and management systems are evaluated.

DOE-SR structures its line management oversight of the FPPs and fire protection safety systems in accordance with DOE Order 226.1B. DOE-SR has an approved FPP, SRM-420.1.1B, *Department of Energy (DOE) Savannah River Operations Office (SR) Fire Protection Program Manual*, as defined in DOE 420.1C, *Facility Safety*, DOE Order 440.1B, *Worker Protection Program for DOE (Including the National Nuclear Security Administration) Federal Employees*, and DOE Standard 1066-2012, *Fire Protection*. To implement this manual, DOE-SR has further approved plans and schedules that include assessments of the SRS FPP and the FPPs implemented for H-Canyon and K-Area. By evaluating training and qualification records, EA determined that DOE-SR has two trained and qualified FPEs that have successfully completed the DOE technical qualification program. The qualified FPEs perform reviews and approvals of SRS FPP description documents, evaluations and engineering equivalencies applicable to H-Canyon and K-Area, and the SRS fire department BNA. DOE-SR FPEs were also involved with the recent fire pump replacements for K-Area, evaluated maintenance and operations of SRNS fire protection systems, and provided support to SRNS to significantly reduce fire system impairments.

DOE-SR completed a triennial assessment of the FPP associated with the SRNS-operated areas of the site in January 2016. However, the approach DOE-SR took to implementing Order 226.1B, Section 4.b(1),

oversight requirements did not result in evaluating the H-Canyon and K-Area triennial FPP self-assessments performed by SRNS; and therefore, DOE-SR missed an opportunity to validate the contractor's observations and self-assessment capability.

Additionally, a long-standing (2014) temporary exemption was approved for the 782-A fire water storage tank (Ref. letter SRNS-H8000-2014-00083), which includes compensatory actions contingent with the temporary exemption. However, the temporary exemption does not incorporate corrective actions or a schedule for addressing tank issues (i.e., tank leaks, degrading interior tank coating) to minimize the time which DOE accepts the risk. EA observed that the 782-A fire water storage tank showed clear signs of external deterioration and structural stress, as well as several temporary patches installed on its exterior. SRNS operates the tank under provisions of the DOE-SR approved temporary exemption. EA will track this issue as a follow-up item.

Overall, DOE-SR has an adequate approach for providing oversight at SRS, but improvement is needed in some areas of implementation. The lack of criteria in the DOE-SR assessment plan to address oversight of contractor triennial FPP assessments warrants increased management attention.

5.7 SWPF Follow-up

EA performed a follow-up and update on the status of the findings identified in *Office of Enterprise Assessments Salt Waste Processing Facility Construction Quality and Fire Protection Systems Follow-up Review at the Savannah River Site*, December 2015. To address Finding F-SWPF-2015-1 regarding triennial FPP self-assessments, SWPF provided two annual FPP building assessment reports. However, EA is still waiting to receive a completed triennial FPP self-assessment report to verify that the F-PP-J-00001, *SWPF Fire Protection Program Plan*, Section 7.7, requirement is satisfied. Therefore, EA concludes that sufficient information to adequately address Finding F-SWPF-2015-1 has not yet been provided.

EA conducted a walkthrough of the SWPF to evaluate the spray-on fire proofing applied to walls and tubular structural supports. Areas previously identified as not meeting fire proofing criteria standards had been revamped and corrected. Thus, EA concludes Finding F-SWPF-2015-2 has been resolved.

6.0 FINDINGS

EA identified no findings during this assessment.

7.0 OPPORTUNITIES FOR IMPROVEMENT

EA identified no OFIs during this assessment.

8.0 ITEMS FOR FOLLOW-UP

- K-Area safety-significant diesel driven fire pump impairment. See Section 5.1.2.
- Increased fire risk to H-Canyon of fuel in a flatbed trailer truck transporting an ISO container not evaluated in the PFHA. See Section 5.2.1. Corrective actions resulting from most recent SRNS triennial fire protection self-assessments. See Section 5.5.2.
- Temporary exemption for the 782-A fire water storage tank. See Section 5.6.

Appendix A Supplemental Information

Dates of Assessment

Onsite Assessment: January 9-13, 2017
 January 23-27, 2017

Office of Enterprise Assessments (EA) Management

Glenn S. Podonsky, Director, Office of Enterprise Assessments
William A. Eckroade, Deputy Director, Office of Enterprise Assessments
Thomas R. Staker, Director, Office of Environment, Safety and Health Assessments
William E. Miller, Deputy Director, Office of Environment, Safety and Health Assessments
C. E. (Gene) Carpenter, Jr., Director, Office of Nuclear Safety and Environmental Assessments
Kevin G. Kilp, Acting Director, Office of Worker Safety and Health Assessments
Gerald M. McAteer, Director, Office of Emergency Management Assessments

Quality Review Board

William A. Eckroade
John S. Boulden III
Thomas R. Staker
William E. Miller
C. E. Carpenter, Jr.
Gerald M. McAteer
Michael A. Kilpatrick

EA Site Lead for

Alem Boatright

EA Assessors

Alem Boatright – Team Lead
Jeffrey Robinson
Joseph Panchison
Barry Snook

Appendix B
Key Documents Reviewed, Interviews, and Observations

Documents Reviewed (relative to the observations and report conclusions)

- F-PFHA-H-00020, Rev 1, *Project Fire Hazard Analysis for H-Area Target Residual Material (TRM) Project*, 11/15/2014
- F-PP-G-00006, Rev. 0, *Savannah River Site Fire Protection Program Plan*, August 22, 2016
- F-MOU-K-00001, Rev. 0, *Memorandum of Understanding Between Site Services (SS) and K-Area Complex (KAC) to Supply Water for 100-K Facilities*, 8/6/15
- SRNS-RP-2008-00086-012-M&O, Rev. 15-04-MO, *Standards/Requirements Identification Document, Functional Area 12, Fire Protection*, August 17, 2015
- OSQA-14-0130, *Savannah River Management & Operation (M&O) Contract DE-AC09-08SR22470; DOE Order 420.1C, Facility Safety, Dated December 4, 2012, Delegation of Authority Having Jurisdiction and Facility Assessment Frequencies*, September 30, 2014
- Manual 1B, Procedure 3.31, *Records Management*
- WSRC-EM-96-00023, *Records Retention Schedule Matrix (RSM)*
- WSRC-TM-95-1, Rev. 7, *SRS Engineering Standards Manual*, 10/22/07
- Manual 2Q, Procedure 2.0, Rev. 13, *Site Fire Protection Management and Administration*, 10/27/2016
- Manual 2Q2, Procedure 4.0, Rev. 31, *Fire Control Development Manual Preplan*, 2/4/14
- Manual 2Q2-4-H.1, Rev. 15, *Fire Control Preplans*, 9/28/16
- 2Q2-4-K, Rev. 33, *105-000K Fire Control Preplan*, 3/31/15
- Manual 2Q2, Procedure 12.2, Rev. 6, *Emergency Scene Operations & Establishment of Incident Command*, 9/14/2016
- Manual 2Q, Procedure 2.12, Rev. 8, *Evaluation and Resolution of Fire Protection Engineering Issues*, 4/18/2016
- Manual 2Q, Procedure 2.14, Rev. 3, *Fire Hazard Analysis Document*, 2/11/2016
- Manual 2Q, Procedure 5.1, Rev. 5, *Facility Fire Prevention and Life Safety Inspections*, 7/28/2016
- Manual 2Q, Procedure 5.5, Rev. 4, *Control of Combustible Materials*, 5/23/12
- Manual 2Q, Procedure 5.6, Rev. 13, *Fire Protection Impairment Control Procedure*, 6/23/2016
- Manual 1-01, Procedure 5.40, Rev. 0, *Fire Protection Policy*, 6/11/2015
- Manual 2Q, Procedure 8.0, Rev 12, *Fire Protection System Maintenance, Test and Inspection*
- C-ESR-H-00045, Rev. 0, *Engineering Evaluation and Recommendations Regarding a Propane Explosion in the 221-H Truckwell Airlock*
- F-DCF-H-00696, Rev. 0, *Update to TRM Project Fire Hazards Analysis for DSA Rev. 10 Changes*, 6/27/2016
- F-ESR-K-00053, Rev. 1, *Fire Door Assembly to the KIS Vault*, 6/16/14
- F-ESR-00055, Rev. 0, *Penetration Seal at Specialty Cable*, 9/21/06
- F-ESR-K-00059, *K-Area Interim Surveillance Limiting Oxygen Concentration Method*, 3/15/2007
- F-ESR-K-00093, Rev. 0, *Introduction of Radioactive Metals in K Area Interim Surveillance (KIS) Glovebox and KIS Vault and KIS Glovebox Fire Protection Features*, 8/8/2013
- F-TRT-H-00023, *Fire Scenarios Document for Target Residue Materials (TRM) Project in Building 221-H Truckwell and Truckwell Airlock*,
- FPP-4.01, Rev. 15, *Fire Protection Program*, 9/26/2016
- FPP-4.03, Rev. 14, *Control of Combustibles*, 9/26/2016
- FPP-4.06, Rev. 2, *Fire Protection Impairment Control and Compensatory Action*, 3/31/15
- 221-H-8087, Rev. 15, *Controls and Limits of Transient Combustibles in 221-H*, 7/7/2016
- 221-H-9594, Rev. 13, *H-Canyon/H-Outside Facilities Fire Protection Program Plan*, 7/7/2016

- U-JCO-H-00002, Rev. 0, *Use of Propane in the 221-H Truckwell Airlock*, August 2015
- F-CLC-H-00132, Rev. 4, *Analysis of Postulated Exposure to Select Shipping Containers at the 221-H South Loading Dock and Railroad Tunnel Airlock*, 8/20/2014
- S-DSA-H-00001, Rev. 10, *H-Canyon & Outside Facilities, H-Area Documented Safety Analysis*, February 2016
- SOP-FP-005-K, Rev. 35, *K-Area Allowable Transient Combustibles*, 9/26/10
- SRNS-E3000-2016-00014, *Qualified Fire Protection Engineers*, December 1, 2016
- SRNS-RP-20011-00957, Rev. 8, *Baseline Needs Assessment*, May 30, 2014
- SRNS-RP-2016-00639, Rev. 0, *Fire Protection and Emergency Response Program Comprehensive Self-Assessment Plan*, October 3, 2016
- SRNS-H8000-2014-00083, *Temporary Exemption Request SRS-SRID-FA12-TE-2014-001, R 0* September 17, 2014
- 2013-SA-005509, *Fire Protection Program Fire Hazards Analysis Review*, 9/26/2013
- 2015-SA-003312, *Facility Level Self-Assessment to Review Compliance of Implementation Requirements for Select Fire Protection Program (Manual 2Q) Procedures*, 11/16/2015
- 2015-SA-003954, *Facility Level Self-Assessment to Review Compliance of Implementation Requirements for Select Fire Protection Program (Manual 2Q) Procedures*, 2/8/2016
- 2015-SA-006572, *Facility Level Self-Assessment (for Fiscal Year 2016) to Review Compliance of Implementation Requirements for Select Fire Protection Program (Manual 2Q) Procedures*, 2/23/2017
- 2016-SA-001543, *Facility Level Self-Assessment to Review Compliance of Implementation Requirements for Select Fire Protection Program (Manual 2Q) Procedures*, 1/26/2017
- 2016-SA-002831, *Facility Level Self-Assessment (for Fiscal Year 2016) to Review Compliance of Implementation Requirements for Select Fire Protection Program (Manual 2Q) Procedures*, 11/20/2016
- 2016-SA-000070, *Annual Fire Protection Building Assessment for Building 221-H*, 5/19/2016 through 5/31/2016
- 2015-SA-004732, *Annual Fire Protection Building Assessment for Building 105K*, conducted 11/9/2015 through 12/9/2015
- SRM 420.1.1B, *Fire Protection Program Manual*, February 11, 2016
- Longenecker and Associates, *Savannah River Nuclear Solutions Fire Protection Program Assessment*, June 27, 2016
- OSQA-14-0082, *Savannah River Nuclear Solutions, LLC (SRNS) Request for Department of Energy approval of Revision 8 of the Fire Department (SRFD) Baseline Needs Assessment (BNA) Document (SRNS-J8000-2014-00025, J. Tomac to J. Harris 06/03/2014)*, July 17, 2014
- COR-SRSOMA-11.10.2009-212427, *Authority Having Jurisdiction (AHJ) Approval of National Nuclear Security Administration (NNSA) Related Activities on the Savannah River Site*, November 17, 2009
- *Standard Mutual Aid Agreement*, December 16, 2015
- DOE-SR, *Triennial Assessment of the Fire Protection Program*, January 26, 2016
- SRS FPE Organizational Chart, 1/3/2017
- S-CLC-K-00287, *Thermal Analysis of Fires in the KIS Vault*, April 16, 2015
- F-CLC-K-00029, Rev. 3, *Shuffler Project*, December 5, 2012
- F-DCP-K-06001, *Clean Agent KIS*, July 14, 2006
- WSRC-SA-2002-00005, Revision 11, *K Area Documented Safety Analysis*, April 6, 2016
- F-FHA-K-00006, Revision 14, *Fire Hazards Analysis for Building 105-K*, August 10, 2015
- F-FHA-H-00073, Revision 0, *Fire Hazards Analysis for Building 221-H, H-Canyon*, April 25, 2016
- WSRC-TS-96-20, Revision 42, *Technical Safety Requirements Savannah River Site, K-Area Complex*, April 4, 2016

- F-PP-J-00001, Rev. 1, *SWPF Fire Protection Program Plan*, 5/22/2015
- SWPF-SR-3443, *SWPF Warehouse Tri-Annual Inspection*, 3/4/16
- SWPF-SR-3444, *Tri-Annual FP Assessment of SWPF Administration Bld. 704-J*, 3/25/16

Interviews

- SRNS Fire Protection Engineering Manager
- SRNS Field Support Department Manager
- SRNS Business Support Manager
- SRNS ITM Manger for Fire Systems
- H-Canyon Fire Protection Engineer (TRM Project)
- H-Canyon Fire Protection Coordinator
- H-Canyon Nuclear Criticality Safety Engineer
- H-Canyon Operations Support Manager
- H-Canyon Operations Support Lead
- K-Area Fire Protection Engineer
- K-Area Fire Protection Coordinator
- Safety Basis Engineer
- DOE-SR Fire Protection Engineer

Observations

- Demonstration of KIS Vault mockup facility work activities.
- Walkdown of the H-Canyon Truckwell Airlock.
- Walkdown of the H-Canyon fire water pump house.
- Walkdown of 782-A fire water storage tank.

Appendix C Deficiencies

Deficiencies that did not meet the criteria for a finding 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

- The combustible loading and control programs do not fully comply with all requirements of DOE-STD-1066-2012, Section 5.1.4, and Manual 2Q, Procedure 5.5, *Control of Combustible Materials*, Section 5.3.5.
- For the fire impairment process, flowdown from the SRS FPP procedure to facility-specific procedures did not adequately occur, and requirements delineated in DOE-STD-1066-2012 were not adequately implemented in all cases.
- The SRS fire department training does not demonstrate performance to adequately verify initial response proficiency for events at hazard category 2 nuclear facilities, in accordance with NFPA 1410 and DOE Order 420.1C.
- Technical analyses have not been adequately integrated into the H-Canyon FHA and TRM PFHA in all cases, as required by Manual 2Q, Procedure 2.14, *Fire Hazard Analysis Document*.
- SRNS did not evaluate fire protection systems when conducting building FPP assessments, and a procedure to delineate building FPP assessment criteria has not been established, as required by DOE Order 420.1C, Chapter II, Attachment 2, *Fire Protection*, Section 3.d(1)(h).
- Risks and controls were not adequately documented in the technical baseline documents (e.g., FHA and supporting technical analyses) in all cases, in accordance with DOE Order 420.1C and other applicable DOE regulations and standards.

Savannah River Operations Office

- DOE-SR did not plan or conduct a triennial assessment that adequately reviewed SRS FPPs, because the assessment that was performed did not require an evaluation of the triennial FPP self-assessments performed by SRNS, as required by Order 226.1B, Section 4.b(1).