Office of Enterprise Assessments
Assessment of the Savannah River Site
Emergency Management Exercise Program

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Acronyms

AEC	Area Emergency Coordinator
APC	Assessment and Planning Coordinator
CAR	Consequence Assessment Room
CAT	Consequence Assessment Team
CRAD	Criteria and Review Approach Document
DOE	U.S. Department of Energy
DOE-SR	Savannah River Operations Office
EA	Office of Enterprise Assessments
EAL	Emergency Action Level
ED	Emergency Director
EDO	Emergency Duty Officer
EEG	Exercise Evaluation Guide
EMG	Emergency Management Guide
EMInS	Emergency Management Information System
ENF	Emergency Notification Form
EOC	Emergency Operations Center
EPHA	Emergency Planning Hazards Assessment
EPIP	Emergency Plan Implementing Procedure
ERO	Emergency Response Organization
FEC	Facility Emergency Coordinator
GE	General Emergency
HAZMAT	Hazardous Material
IC	Incident Commander
ICP	Incident Command Post
ISC	Incident Scene Coordinator
NARAC	National Atmospheric Release Advisory Center
NIMS	National Incident Management System
NNSA	National Nuclear Security Administration
OFI	Opportunity for Improvement
OF-H	Outside Facilities H-Area
OSC	Operations Support Center
OST	Office of Secure Transportation
PA	Protective Action
PAC	Protective Action Criteria
PAR	Protective Action Recommendation
RPD	Radiological Protection Department
SAE	Site Area Emergency
SM	Shift Manager
SRSFD	Savannah River Site Fire Department
SRNS	Savannah River Nuclear Solutions, LLC
SRR	Savannah River Remediation, LLC
SRS	Savannah River Site
SRSOC	Savannah River Site Operations Center
SRTE	Savannah River Tritium Enterprise
TEL	Threshold to Early Lethality
TSR	Technical Support Room
WINDS	Weather Information and Display System

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EXECUTIVE SUMMARY

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 emergency management exercise program at the Savannah River Site (SRS). The overall purpose was to assess the effectiveness of the emergency management program by observing and evaluating the full-scale exercise, identifying performance strengths and weaknesses, and conducting limited causal analysis of observed weaknesses. The assessment also included a review of the exercise program and an appraisal of the closure of two previous findings. The SRS emergency management program is currently making the transition from DOE Order 151.1C, *Comprehensive Emergency Management System*, to DOE Order 151.1D requirements.

Savannah River Nuclear Solutions, LLC (SRNS) is responsible for overall site management and operations, including the site-level emergency management program. SRNS, Savannah River Remediation, LLC, and Ameresco, Inc. operate hazardous material facilities at SRS and are responsible for implementing the facility-level exercise program at their respective facilities. The DOE Office of Environmental Management is responsible for overall site operation, including oversight of the site-level emergency management program, and provides Federal oversight through the Savannah River Operations Office. The National Nuclear Security Administration Savannah River Field Office provides Federal oversight for tritium facilities and operations.

EA assessed the exercise plans and procedures and exercise schedules and found that, with a few specific exceptions, SRNS adequately documents and describes the site exercise program in appropriate plans and procedures. SRNS expended significant effort in the last three years to improve the program, and the exercise schedule for the site contains a detailed rotation of planned exercises among the facilities, associated hazards, and program activities over the next five years. SRNS is meeting the five-year schedule requirements for a severe incident exercise by conducting a significantly challenging exercise to evaluate the interactions of multiple concurrent incidents and to test the integration and interoperability of the response efforts at multiple site locations.

After observation of the 2018 full-scale exercise, EA concluded that overall, the site, area, and facility emergency response organizations (EROs) followed procedures and adequately performed many response functions, including issuing appropriate protective actions to co-located workers and notifications to executives and workers. Nevertheless, integrated ERO actions to communicate, assess, and respond to the potential exposure to fire department and facility responders from the postulated tritium release were not fully adequate. For example, the risk posed by the tritium release was not effectively communicated among the site response locations, and consequently actions to protect H-Area outside responders were not completely implemented. Finally, the protective actions implemented at the tritium facility did not ensure the safety of all facility personnel, because the effects of the postulated earthquake on the facility were not fully addressed.

EA performed a limited causal analysis of several observed performance weaknesses and examined the emergency plan and implementing procedures; training, drills, and exercises; and communications and interoperability. SCD-7, *SRS Emergency Plan*, and response procedures do not fully protect responders from potential hazardous material exposures, because SRNS has not established conservative, initial protective actions for the on-scene responders, similar to the 360-degree zone for general employees,

which accounts for the variability in meteorological conditions that can easily place response personnel, although upwind, in danger. In addition, tritium facility emergency procedures do not provide clear, complete direction to resolve potential conflicts between different default protective actions. The lack of interaction among the facilities and first responders during the emergency response exercise and the issues with protective actions for H-Canyon responders can be attributed to a combination of weaknesses. Insufficiently detailed or incomplete procedures and checklists contributed to communications and interoperability (the ability of emergency response groups to operate in conjunction with each other) issues, because ERO personnel were not prompted to consider or communicate conditions at adjacent facilities for this type of event. Also, although SRNS completes many drills and exercises throughout the year, most drills and exercises are confined to a single facility or area with few or no consequences elsewhere onsite and minimal need for interoperability with the other site facilities. Finally, the equipment to record and disseminate response information among response facilities and locations was not fully effective, in part because the automated emergency management information system capability to capture, distribute, and share emergency information among the site's response facilities is very limited.

Overall, the implementation of corrective actions for the previous EA findings resulted in improvements to the emergency management program; however, during the exercise, several performance issues, such as, untimely consequence assessment and inadequate responder protective actions, observed in the 2014 full-scale exercise recurred. Additionally, EA assessed the closure of two findings identified during the 2015 assessment. The first finding, related to validation of all elements of the emergency management program over a five-year period, was adequately addressed. However, the risk-based methodology applied as part of the issues management system to close the other finding, related to ineffectively managing some significant issues and corrective actions from assessments, did not lead to corrective actions that fully resolved the underlying issues and SRNS did not require validating the effectiveness of the corrective actions. Also, the exercise evaluation guides used in this exercise were not tailored to include specific, attainable, and measurable criteria from procedures and checklists, so some critical actions and time requirements necessary to an effective response were not evaluated. Moreover, the 2015 EA assessment also identified this lack of specific guidance regarding exercise evaluations.

SRNS should consider enhancing the protective actions for responders and interoperability among the site ERO elements. Actions to address responder protective actions include review and revision of plans and procedures governing the response to events impacting more than one facility or area. These actions should be integrated with training and drills to increase responder proficiency (communication and interoperability) for events that require effective ERO integration. In addition, improvements in identifying and establishing the initial protective actions using the fire department response procedures and in resolving potential conflicts in protective actions in facility procedures should be considered. To improve interoperability among the SRS response facilities and provide a full common operating picture and shared situational awareness during an emergency, SRNS should also consider expanding the site's use of automated information systems, such as the Emergency Management Information System© and geographical information systems, to locations outside the emergency operations center. Detailed procedures and checklists should be developed and included in the exercise evaluation process to ensure that program weakness and strengths are objectively identified.

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1.0 PURPOSE

The U.S. Department of Energy (DOE) Office of Emergency Management Assessments, within the independent Office of Enterprise Assessments (EA), assessed the emergency management exercise program at the Savannah River Site (SRS). The overall purpose of the assessment was to assess the effectiveness of the SRS emergency management program by evaluating the site's readiness to respond to emergencies and effectively identify and correct findings. EA conducted this assessment from April to June 2018, within the broader context of a series of assessments of emergency management programs at DOE sites across the complex.

2.0 SCOPE

EA conducted this assessment in accordance with the *Plan for the Office of EA Assessment of the Emergency Management Exercise Program at the Savannah River Site, April – June 2018*. This assessment evaluated specific aspects of the SRS emergency management readiness assurance program, including review of the exercise program, observation and evaluation of the May 2018 full-scale exercise, and closure of corrective actions for findings identified during the 2015 EA assessment of the SRS emergency management exercise program. EA also reviewed a limited set of data on Savannah River Operations Office (DOE-SR) oversight activities related to the emergency management program.

3.0 BACKGROUND

SRS was constructed during the early 1950s to produce the basic materials used in the fabrication of nuclear weapons, primarily tritium and plutonium-239, in support of our nation's defense programs. Current site missions include management and disposition of nuclear materials; disposition of solid, liquid, and transuranic wastes; spent fuel management; tritium operations; and nuclear chemical separations. The significant quantities of radioactive material and hazardous chemicals present at the site require an Operational Emergency hazardous material (HAZMAT) program in accordance with DOE Order 151.1D, *Comprehensive Emergency Management System*.

Savannah River Nuclear Solutions, LLC (SRNS); Savannah River Remediation, LLC (SRR); and Ameresco, Inc. operate the HAZMAT facilities at the site. SRNS is responsible for overall site management and operations, including the site-level emergency management program, and for nuclear materials and tritium operations. Savannah River Remediation and Ameresco are responsible for implementing the facility-level exercise program at their facilities. Centerra-SRS provides security services for all facilities within SRS's 310 square-mile boundary.

The DOE Office of Environmental Management is the "landlord" responsible for overall site operation, including oversight of the site-level emergency management program. The Office of Environmental Management provides Federal oversight of cleanup activities through DOE-SR. The National Nuclear Security Administration (NNSA) Savannah River Field Office provides Federal oversight for tritium facilities and operations.

The SRNS emergency management program is currently making the transition from DOE Order 151.1C to DOE Order 151.1D requirements, which is scheduled to be completed during calendar year 2020. The most significant program element not currently updated is the technical planning basis, which affects the hazards surveys, emergency planning hazards assessments (EPHAs), emergency action levels (EALs), predetermined protective actions (PAs) and protective action recommendations (PARs), and emergency planning zone. DOE Order 151.1D includes many response attributes and served as the basis for the 2018 annual site-level exercise evaluation criteria except for the technical planning basis documentation used by response elements. SRNS closed previous EA findings under DOE Order 151.1C requirements, which was in effect at the time of disposition.

The EA 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 and the effectiveness of DOE and contractor line management's performance in safety and security and other critical functions as directed by the Secretary of Energy.

This assessment is part of a series of assessments to observe and evaluate the performance of emergency response organizations (EROs) during exercises or limited-scope performance tests at a number of DOE sites, as well as to evaluate the sites' actions to identify and correct exercise and EA assessment findings from previous reviews (and thus improve the effectiveness of their emergency management programs). Following observation of the exercise or limited-scope performance test, weaknesses in observed performance are used to guide the selection of program elements for more detailed assessment. Through these performance-based assessments, EA evaluates the ability of the sites to respond effectively and mitigate the impacts of a HAZMAT release or emergency incidents at DOE facilities, identifies areas of programmatic weakness requiring correction, and assesses whether corrective action programs are contributing to improvements in emergency response.

4.0 METHODOLOGY

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 EA assessment plan, this assessment considered requirements related to DOE Order 151.1C and was adjusted to include portions of DOE Order 151.1D (per the status of local implementation) at the request of DOE-SR, Savannah River Field Office, and SRNS during the assessment in-briefing. The criteria that were used to guide this assessment were based on specific objectives and criteria from Section 4.0 of EA Criteria and Review Approach Document (CRAD) 33-05, *Contractor Readiness Assurance and Exercise Program*; EA CRAD 33-07, *DOE/NNSA Emergency Management Exercise Review*; CRAD 45-21, Rev. 1, *Feedback and Continuous Improvement Assessment Criteria and Approach–DOE Field Element*; and portions of DOE Order 151.1.D.

This assessment was based on a sample of data and was not intended to represent a full programmatic assessment of the SRS emergency management program. EA observed the 2018 full-scale exercise through the post-exercise hot wash discussions and completion of the evaluators' exercise evaluation guides (EEGs),), but did not evaluate the exercise after-action report because it was not issued during EA's data collection period. EA observed the exercise to assess the level of preparedness of the SRNS emergency responders, validate SRNS plans and procedures, and determine the effectiveness of SRNS corrective actions to prevent recurrence of previous EA findings. EA performed a limited causal analysis of several observed performance weaknesses to identify the contributing programmatic reasons for these performance weaknesses, leading to further examination of the program areas of emergency plan implementing procedures (EPIPs), training and drills, and technical planning basis. EA examined key documents, such as the emergency plan, EPHAs, EPIPs, and checklists. EA also conducted interviews with personnel responsible for developing and executing the associated programs and responders participating in the exercise.

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, personnel interviewed, and observations made during this assessment, which are relevant to the findings and conclusions of this report, is provided in Appendix B. Deficiencies not meeting the criteria for a finding are also highlighted in the report and are summarized in Appendix C.

From May to June 2014, EA conducted an assessment of the SRS site-level exercise, which was documented in the January 2015 report, *Office of Enterprise Assessments Review of the Savannah River Site 2014 Site-Level Exercise*. EA also conducted a follow-up assessment of the SRS emergency management exercise program in February and March 2015, which was documented in the November 2015 report, *Office of Enterprise Assessments Review of the Savannah River Site Emergency Management Exercise Program*. This 2018 assessment examined the completion and effectiveness of corrective actions from two findings identified in the 2015 follow-up report. Results of the corrective action assessments are included in Section 5.4, below.

5.0 RESULTS

5.1 Contractor Exercise Program

This section discusses EA's assessment of the SRS exercise program, the SRNS, SRR, and Ameresco adherence to the facility-level exercise scheduling, and DOE-SR's oversight of the SRS program.

Criteria: DOE sites/facilities/activities with an emergency management HAZMAT program must establish and maintain a site-level exercise program that validates its emergency response capability to the hazards identified in EPHAs. These DOE sites/facilities/activities must accomplish the following:

- *Develop a formal exercise program that includes (1) a matrix that identifies planned exercises over the next five years and the elements tested; (2) rotation among scenarios identified in the Technical Planning Basis; (3) exercise scenarios involving radiological HAZMAT, if applicable; (4) a method for determining the appropriate number of exercises, and rotation of exercise scenarios among HAZMAT facilities over a five year period, to ensure demonstration of responder proficiency; (5) invitation of offsite responding agencies and national assets, e.g., Centers for Disease Control, Department of Agriculture, etc., every three years; (6) severe event scenarios every five years; (7) test of design control and/or mitigation features in multiple facilities; (8) demonstration of ERO capability; and (9) integration with local, state, and Federal agencies.*

- *Develop challenging exercises based on scenarios identified in the technical planning basis that involve high-consequence scenarios, involve multiple response elements, and result in offsite effects.*
- *In order to test and demonstrate the site/facility/activity integrated emergency response capability, conduct the annual site-level exercise as a full-scale exercise involving site-level ERO elements and resources. Invite some offsite response organizations to participate in a full-scale or full participation exercise every 3 years. This exercise must use a scenario from the spectrum of potential Operational Emergencies identified in EPHAs (rotated among facilities and type of incident and/or initiator) and include demonstration of PAs. (DOE Order 151.1D, Attachment 4, paragraph 15)*

To assess the site exercise program, EA evaluated the governing plans and procedures, the exercise schedules, and the exercise planning and assessment process. EA reviewed SCD-7, *SRS Emergency Plan*; SRNS-IM-2018-00006, *SRS 5-Year Site/Facilities Exercise Schedule & Assessment Plan*; applicable emergency management program procedures; and EPIPs. EA also reviewed after-action reports for site- and facility-level exercises conducted since the last SRS exercise observed by EA in 2014.

With a few specific exceptions, appropriate plans and procedures adequately document and describe the site exercise program. SRNS expended significant effort in the last three years to improve the program, including an analysis of appropriate design basis and safety documents to determine the number and type of required exercise scenarios, the implementation of a drill and exercise team, and a major revision of the rolling five-year exercise plan for all facility- and site-level exercises. The *SRS Emergency Plan* adequately describes exercise requirements, scenario development, and offsite coordination. SRNS-IM-2018-00006 describes the rotation of exercises among the facilities and identifies the facilities impacted, associated facility hazards, and the elements and criteria that are to be evaluated during exercises over the next five years. Although in draft status, 6Q-006, *Standards for the Development and Conduct of Drills and Exercise*, describes the requirements for developing and conducting the exercises.

Under the previous SRS exercise schedule, SRNS and SRR conducted annual facility-level exercises with one of these exercises designated as the annual site-level exercise. Since EA's last review, SRNS tested most of the SRS ERO capabilities including active shooter, alternate emergency operations center (EOC), and use of DOE's regional response assets. The current SRS five-year exercise schedule clearly includes most exercise program requirements. Although the schedule does not include a severe incident exercise, the 2018 exercise fulfills the requirement. Nevertheless, EA identified two deficiencies related to the implementation of the exercise schedule.

The Biomass Cogeneration Facility (operated by Ameresco) could experience an Operational Emergency up to a Site Area Emergency (SAE) (See Annex L of SCD-7), but DOE-SR has not ensured that Ameresco conducts annual exercises at the facility as required by DOE Order 151.1D. Although the emergency plan requires facilities with emergency plan annexes to maintain an ERO, perform emergency response notifications, maintain a personnel accountability system, and conduct facility-level drills and exercises, Ameresco has not conducted any exercises in the past four years and the current five-year SRS exercise schedule does not include exercises at the Biomass Cogeneration Facility. DOE-SR had not previously recognized this omission. (**Deficiency**)

SRNS also has not conducted a DOE/NNSA Office of Secure Transportation (OST) exercise in the last four years, and the current five-year schedule does not include an exercise with OST. SRNS conducted a tabletop drill with OST in 2016, but the tabletop drill does not fulfill the requirements of an exercise. The goal of the tabletop drill was for emergency responders, support personnel, and senior officials/leaders to gain a better understanding of their roles and challenges they would encounter during and immediately following an OST incident. Sites may use a tabletop exercise to validate procedures and training, but in this case, the tabletop drill provided an opportunity for discussion and training and did not focus on evaluation and validation. (**Deficiency**)

SRNS is improving its exercise program by implementing the Exercise Builder software, including the evaluation module, to support exercise planning, development, and execution. SRNS hired a fulltime contractor in early 2018 to work exclusively on implementing the program. Currently, SRNS has input baseline information for the site and most of the facilities, and the project goal is to conduct a facility-level exercise using all modules of the software in the fall 2018, with continued use in 2019 and beyond. Nevertheless, the EEGs used to evaluate the 2018 annual exercise contained mostly generic criteria obtained from DOE Emergency Management Guide (EMG) 151.1-3, *Programmatic Elements*, and were not tailored to include specific, attainable, and measurable criteria based on site- or facility-specific procedures and checklists, so some specific actions and time requirements were not included in the EEGs. For example, the consequence assessment team (CAT) EEG does not have a target time for initial modeling results, although the procedure establishes a goal of 20 minutes. Also, the SRS Operations Center (SRSOC) EEG does not list all notification information requirements required by DOE Order 151.1D. EA first identified this issue in 2012 and again in the 2015 report; the issue is discussed further in Section 5.4, below. (**Deficiency** and see **OFI-SRNS-01**.)

Overall, with a few exceptions, SRNS adequately documents and implements the site exercise program in appropriate plans and procedures to ensure sustainability of the program for meeting DOE requirements. SRNS and SRR have appropriately conducted annual facility- and site-level exercises. However, DOE-SR has not ensured that Ameresco conducted an exercise at the Biomass Cogeneration Facility. Similarly, SRNS has not conducted an exercise with OST in four years, and no exercises are planned for the next five years. Finally, although being actively improved, SRNS's EEGs do not yet contain specific, attainable, and measurable criteria based on site- or facility-specific procedures and checklists, hampering the effective evaluation of the program's strengths and weaknesses.

5.2 Full-Scale Exercise

EA observed the ERO response to the 2018 full-scale exercise to assess the effectiveness of the expected emergency response.

Criteria: DOE sites/facilities/activities with an emergency management HAZMAT program must establish and maintain a site-level exercise program that validates its emergency response capability to the hazards identified in EPHAs. (DOE Order 151.1D, Attachment 4, paragraph 15)

DOE sites/facilities/activities must identify PAs commensurate for the potential hazards of the site/facility/activity and maintain procedures for prompt issuance of PAs to workers. PAs must be predetermined and serve to minimize emergency-related consequences and maximize life safety and health. (DOE Order 151.1D, Attachment 3, paragraph 9)

Operational Emergencies must be categorized as promptly as possible, but no later than 15 minutes after identification by the predetermined decision maker for the categorization, in accordance with the emergency management plan, but no more than 30 minutes from initial discovery. (DOE Order 151.1D, Attachment 3, paragraph 8.b)

Notify the Field Element or appropriate Federal Manager, Headquarters Watch Office, and state, local, and tribal organizations within 30 minutes of declaration or termination of an Operational Emergency. (DOE Order 151.1D, Attachment 3, paragraph 11.a.(4))

Notify local, state, tribal, and Federal authorities of classified Operational Emergencies within 15 minutes of categorization. (DOE Order 151.1D, Attachment 4, paragraph 12)

Emergency notification to the Headquarters Watch Office must consist of initial notification by phone call providing as much information as is known at the time and subsequent notice electronically with receipt confirmation. If information is unknown at the time of the report, specify so in reporting. The initial notification must include the description of the emergency, date and time emergency was discovered or terminated, damage and casualties, PAs implemented, potential and actual impacts, agencies involved, level of public/media attention, and contact information. (DOE Order 151.1D, Attachment 3, paragraph 11.a.(6))

In order to test and demonstrate the site/facility/activity integrated emergency response capability, conduct the annual site-level exercise as a full-scale exercise involving site-level ERO elements and resources. Invite some offsite response organizations to participate in a full-scale or full participation exercise every 3 years. This exercise must use a scenario from the spectrum of potential Operational Emergencies identified in EPHAs and include demonstration of PAs. (DOE Order 151.1D, Attachment 4, paragraph 15.c)

The SRS emergency response concept of operation includes site-level, area-level, and facility-level EROs with specific roles, responsibilities, and interfaces. Collectively, the site-level ERO, nine facility-level EROs, a fulltime fire department, and the protective force constitute the majority of the SRS emergency personnel. The site-level ERO functions from the SRSOC and the EOC. The facility- and area-level EROs function from facilities within the letter-designated areas (e.g., H-Area), which comprise the 310 square-mile SRS. Facility-level EROs are led by a Facility Emergency Coordinator (FEC) and/or Area Emergency Coordinator (AEC), who reports incident information to either the emergency duty officer (EDO) in the SRSOC or the emergency director (ED) in the EOC when the EOC is operational.

The FEC, AEC, incident commander (IC), and EDO have defined initial areas of responsibilities, with most EDO responsibilities transferring to the EOC upon activation. The facility-level EROs, led by an FEC and/or AEC, have operational response duties within their jurisdiction, including response to operational alarms, personnel PAs, accountability, and interface with incident command. FECs are responsible for emergency categorization and classification, facility ERO command and control, and PAs for the facility personnel. FECs initiate implementation of the emergency plan and EPIPs. The AECs have responsibilities similar to FECs that extend from the facility to the area boundary. The FEC and/or AEC maintain command and control of facility and area operations and coordinate response activities with the IC, who is responsible for response activities at the event scene.

Upon activation of the facility ERO, the FEC dispatches a facility incident scene coordinator (ISC) to the incident scene, who becomes the IC for Operational Emergencies until relieved by the SRS Fire Department (SRSFD). The IC is responsible for command and control of the incident response and PAs at the scene. After formal command transfer, the ISC remains at the incident command post (ICP) and serves as the interface between the SRSFD and facility response organizations. The IC relies on the facility ISC, supported by radiological protection department (RPD) and industrial hygiene personnel, to monitor habitability of the command post.

The EDO has responsibilities similar to FECs that apply from the area boundary to the SRS boundary. As the 24-hour point of contact, the EDO, who is supported by emergency communication specialists, becomes the ED and manages the initial site-level response actions, such as dispatch of the SRSFD and protective force personnel to incident scenes. The EDO also activates the site-level ERO, provides offsite notifications, directs PAs for a two-mile buffer around a HAZMAT release and downwind affected areas, and adjusts the protective force barricade locations. After the EOC is operational and a turnover briefing occurs, ED responsibilities (except issuing ED approved notification forms) transfer from the EDO in the SRSOC to the ED in the EOC.

The EOC staff provides site-level support to the IC, including activating and deploying additional site response assets to the scene, sending mutual aid requests to the offsite agencies, providing technical support (such as an consequence assessment), coordinating with state and local governments, and performing incident categorization, classification, notification, and communication functions. The EOC staff consists of a command team, located in the EOC command room; the CAT, located in the consequence assessment room (CAR), adjacent to the command room; and technical support staff located in the technical support rooms (TSRs) within the EOC complex.

5.2.1 Exercise Scenario

The full-scale exercise scenario involved an earthquake with limited damage to SRS H-Area facilities. The damage included a partial loss of power to H-Canyon and HB-line, loss of containment of nitric acid in the Outside Facilities H-Area (OF-H), a ceiling collapse and deflagration in a Savannah River Tritium Enterprise (SRTE) building resulting in a radiological stack release of tritium in the form of tritium oxide gas (referred to as tritium in this report), and loss of power to the H-Area Tank Farm. Multiple injuries occurred, some of which included chemical or radiological contamination. All H-Canyon, HB-line, OF-H, SRTE, H-Area Tank Farm, and Effluent Treatment Facility personnel participated in the response, although by exercise design only H-Canyon/OF-H and SRTE EROs were activated. In addition, personnel in the nearby site training center participated by taking appropriate PAs for co-located workers.

The full-scale exercise used a design basis incident analyzed in the EPHA involving a tritium release at the SRTE, resulting in an SAE declaration, and a nitric acid spill at the OF-H, resulting in an Alert declaration. The calculated consequences from a one-hour exposure associated with the release of 31 million curies include a protective action criteria (PAC) distance of 5.8 miles, greater than 25 rem potential exposure out to 2,500 feet, and greater than 100 rem potential exposure out to 700 feet. PAC distance, the distance for which PAs must be taken for a radiological incident, is 1 rem. One hundred rem is the threshold to early lethality (TEL) for radioactive exposures, and 25 rem is the level at which only volunteers fully aware of all the risks may proceed for lifesaving activities in an emergency event.

5.2.2 H-Canyon/Outside Facilities H-Area

The AEC adequately directed the actions of the H-Canyon/OF-H operators and responders and correctly classified the OF-H incident. In response to initial indications of an earthquake, the H-Canyon control room operators executed appropriate response procedures, made public address announcements, and directed emergency response from the emergency desk within the control room. When notified of two injured personnel, the Shift Operations Manager declared himself the H-Canyon FEC and appropriately focused his efforts on the victims' status. The FEC quickly requested the dispatch of the fire department and emergency medical services. When notified of the nitric acid spill, the FEC ordered remain-indoors PAs; promptly entered EPIP-HSEP-001, *Emergency Classification*; and activated the H-Canyon ERO, at which point the Shift Operations Manager also became the H-Area AEC, reviewed the EALs, discussed an Alert classification with the EDO via telephone, and correctly declared an Alert four minutes after notification of the spill.

Although the H-Canyon operators demonstrated a well-staffed and organized ERO, EA identified some weaknesses. The H-Area personnel did not evaluate the consequences of the tritium release to H-Area personnel and operations and did not communicate the details of the release effectively to the response teams. For example:

- After initial notification of a tritium release, the AEC did not ask any clarifying questions, investigate whether and how the release would affect other H-Area responders, or request additional risk assessments from the CAT (via the TSR).

- The AEC did not inform H-Canyon/OF-H Operations Support Center (OSC) personnel and the ISC of the additional risk due to the tritium release (the H-Canyon incident operations sector command post was within 1,000 feet of the release and doses from one-hour exposures could be between 25 and 100 rem). Establishment of the operations sector command by SRSFD is further discussed in Section 5.2.5. The hot wash revealed that the H-Canyon/OF-H OSC coordinator dispatched 14 teams to H-Area buildings and outside facilities.

- The AEC did not provide information regarding the release to the rest of H-Area, HB-line, Effluent Treatment Facility, or H-Area Tank Farm FECs.

- The AEC and ISC established the location of the sector command based on the nitric acid spill without considering the tritium release.

- Soon after the notification of the tritium release, an individual asked the AEC for safe routing to his car located in the north parking lot. The AEC incorrectly stated that the wind was from the north and that the individual was safe to use his car, when in fact it placed him directly downwind of the tritium release.

The AEC and H-Canyon operators focused on the incident in the H-Canyon/OF-H instead of assessing the risk of the tritium release to H-Canyon responders. (See **Finding F-SRNS-01**.)

Additionally, the actions for mitigating the nitric acid spill were not well executed and coordinated with the sector command and IC. The AEC initially requested the acid be diluted by water from fire hoses, but quickly rescinded this request and then ordered the spill be diluted by using a safety shower overflowing into the ditch. When the AEC was informed that the outfall valves were closed (preventing the ditch from draining), he ordered the ISC to crack open the valves to avoid overflowing the ditch. Finally, after being ordered by the IC, a truckload of soda ash and sand bags reported to the scene, unknown to the ISC and the AEC. The potential action to dilute the spill with fire hoses and the operating of the outfall valves increased the exposure of responders to nitric acid fumes.

Overall, the H-Area ERO responded appropriately as a well-staffed and organized ERO and adequately performed many response functions, but the ERO did not respond effectively to conditions at the tritium facility. The H-Area ERO did not effectively communicate the additional risk posed by the tritium release to H-Area responders in the area and to personnel with adjacent control rooms, resulting in undue risk and increased exposure to responders.

5.2.3 Savannah River Tritium Enterprise

SRTE responded in a manner that adequately addressed the situation presented by the exercise. Control room operators maintained clear concise communications, implemented their procedures, responded to alarms, and provided feedback to the Shift Manager (SM)/FEC. The FEC implemented EPIP-TRIT-111, *FEC Response Actions*, to guide his overall response. In addition, operators and the facility data recorder ensured that events were appropriately recorded. The FEC's facility briefings effectively kept control room staff aware of incident progression. The SRTE control room was fully staffed for emergency response, including a shadow force to maintain facility response to ongoing normal operations.

After initial indications of an earthquake, the control room received alarms indicating a tritium stack release. The SM effectively focused the team on responding to the indications and implementing their procedures. The SM then directed a facility announcement acknowledging the release and issued a remain-indoors PA. Within six minutes of the indications of a release, the SM, in conjunction with the

STE, consulted EPIP-TRIT-001, *Emergency Classification*, briefed the AEC for H-Area and the EDO, and with EDO concurrence declared an SAE. The SM then announced he had assumed the position of FEC. The FEC effectively continued to take actions to address incident consequences. Specifically, once the release terminated and the conditions in SRTE stabilized, the FEC, along with the OSC, took actions to assess facility conditions and move towards recovery.

Although the overall response to the tritium release followed the appropriate EPIPs, the responders did not fully implement the PAs in the EPIPs. Specifically, in establishing the facility PAs, the FEC did not address additional hazards associated with the earthquake or fully assess the "immediate area" affected by the release. Consequently, individuals were directed to remain in or enter buildings that could have been compromised as a result of the earthquake. Additional issues include:

- The table in Attachment 6 to EPIP TRIT-111 contains entries (with PAs) for events including earthquake and release. The FEC consulted the table and chose the actions for release without considering additional or possible conflicts with different PAs in response to the earthquake.

- Attachment 6 to EPIP TRIT-111 states for an earthquake, "After the initial shockwave, determine whether [it is] safer to remain indoors or evacuate," but there was no discussion or assessment of any safety considerations before making the remain-indoors PA.

- Although a ceiling had collapsed causing personnel injury and a tritium release, the FEC did not call for an evacuation of building 234-H, and accountability was accomplished only when the responding Fire Captain requested accountability 30 minutes after the earthquake.

- The default PA for a release as directed in EPIP-TRIT-001 for EAL SAE-1.1 is "Evacuate immediate area; all others remain indoors." The FEC considered the room with the collapsed ceiling to be the immediate area and did not assess potential hazards in the remainder of the building where the collapsed roof led to the release.

Not addressing all the possible consequences from an earthquake before directing a remain-indoors PA potentially placed facility workers at greater risk of injury. The evacuation PA for the building would have immediately resulted in the conduct of accountability, ensuring that all personnel potentially in the building were safe or identified as needing rescue. (See **Finding F-SRNS-01** and **OFI-SRNS-02**.)

Also, weaknesses in communication contributed to the lack of maintaining a common operating picture across the site while responding to the incident. After the initial declaration of an SAE, the FEC and STE did not discuss additional declarations across the site with the EDO or H-Area AEC. In addition, procedures do not require the FEC to participate in any additional communications with the ED or H-Area AEC as conditions progressed at SRTE. (See Section 5.3.4 for further discussion.)

Overall, the SRTE FEC exhibited effective command and control and control room staff briefings. The control room operators responded to conditions using their operating procedures and maintained an appropriate conduct of operations atmosphere in the control room. However, the FEC did not implement PAs as intended by procedure and consequently did not ensure the safety of all personnel. Additionally, internal communications (for example, with the SRSOC, EOC, and other facility control rooms) did not ensure a common operating picture across all SRS emergency facilities, leading to inadequate PAs for H-Canyon responders.

5.2.4 Savannah River Site Operations Center

SRNS fully staffed the SRSOC and provided an adequate shadow force for real-time operations, and exercise personnel appropriately responded in accordance with response procedures. The EDO adequately determined goals, tasks, and priorities for SRSOC operations, and tracked the completion of assigned tasks. The EDO efficiently supported or performed timely classification of all incidents, which included the following:

- Consulting with the SRTE SM regarding the building 234-H tritium release (EPIP-TRIT-001 SAE-1.1) to reach an agreement on the SAE classification.

- Consulting with the H-Canyon/OF-H AEC regarding the OF-H nitric acid spill (EPIP-HSEP-001 A-2.1) to reach an agreement on the Alert classification.

- Declaring a General Emergency (GE) (EPIP 6Q15.001, *Emergency Classification (EALs)*, GE-3.2) based on having a catastrophic incident resulting in multiple emergency declarations across the site.

SRSOC personnel effectively dispatched the SRSFD to the incident scenes; established access control points to the H-Area; and directed ERO staff members to report to their duty stations, providing locations of the incidents with safe route information. SRSOC personnel also completed and issued four emergency notification forms (ENFs), which were approved by either the EDO or EOC ED.

Nevertheless, EA identified some concerns about the notification process. SRNS issued untimely initial notification to DOE Headquarters. The initial notification was not completed until 32 minutes after the SAE declaration, rather than within the requirement of 15 minutes, which SRNS self-identified as a deficiency. In addition, the SRSOC did not satisfy all notification information requirements to the DOE Headquarters Watch Office because the offsite notification process does not require these actions. EPIP 6Q15.1-120, *Savannah River Site Notifications*, does not include all notification requirements in DOE Order 151.1D, which contains a list of itemized topics to be reported whether the information is known or not. Some ENF information was incorrectly recorded or not provided in the ENF when the information was known. For example:

- The initial ENF made no mention of an earthquake and recorded the type of incident as "other" instead of "radiological and/or chemical" when both types of releases had occurred.

- The initial ENF logged the radiological and chemical release information as "N/A" instead of "To Be Determined."

- The initial ENF recorded ingestion pathway advisories as "N/A" instead of "To Be Determined," despite the fact that SRNS had potentially released 31 million curies of tritium, as documented in the ENF, and there was no analysis to support the ingestion pathway conclusion.

- The first radiological and chemical release information provided in an ENF was not until four hours after the incidents occurred, which served to notify offsite agencies that the tritium release had reached the site boundary three hours earlier, with a projected committed effective dose of 196 mrem.

Although the EDO used the EPIP to declare the GE (based on a "catastrophic incident"), the EAL is inappropriate because the event described in the exercise plan does not meet the criteria for a catastrophic incident based on the Office of Health, Safety and Security OE-1:2013-01, *Operating Experience Level 1 Improving Department of Energy Capabilities for Mitigating Beyond Design Basis Events*, and DOE

Guide 151.1-2, *Technical Planning Basis*. Per these documents, a catastrophic incident is a severe incident that affects both the DOE/NNSA site and the surrounding community and overwhelms the capabilities of the site and the surrounding offsite mutual aid organizations. EPIP 6Q15.001 GE-3.2 is not consistent with these criteria for identifying a catastrophic incident. In addition, upon declaring a GE, the EDO did not provide the required PARs to the surrounding community when the potential impact of chemical or radiological HAZMAT releases is expected to exceed the limits set forth by the PAC at or beyond the site boundary. (See Section 5.2.8 and **OFI-SRNS-03**.)

Overall, the SRSOC completed all essential functions required by EPIPs and checklists. However, weaknesses with the notification process resulted in the untimely initial notification of DOE Headquarters. Importantly, many of the notification issues were the result of not achieving timely situational awareness during the exercise. (See Section 5.3.4 for further discussion.)

5.2.5 Incident Command Post

The IC effectively directed the SRSFD's approach to the HAZMAT incidents, established individual operation sectors for each of the two HAZMAT incidents, and tracked patient status. The IC appropriately established the operations sector commands for SRTE and H-Area and directed the SRSFD responders to approach from upwind of the two HAZMAT releases, in accordance with EPIP 2Q2-1.1-701, *HAZMAT Response*, and EPIP 2Q2-1.1-702, *HAZMAT Incident Command*. The IC established the ICP near the entry road to H-Area, separate from the sector commands. In addition, the IC assigned an operations officer, communicator (at the ICP), and dedicated radio channels for each incident. The ISCs for each incident established command posts, confirmed habitability associated with the HAZMAT at the respective incident scene, and turned over command to the respective SRSFD officer. The ISCs, with RPD, industrial hygiene, and protective force personnel, then supported the sector command post. Additionally, the operations sector officers maintained adequate communications with the IC by providing routine status reports of patient and response activities. Finally, the IC effectively communicated with the SRSFD specialist in the H-Area TSR by providing status updates on response activities and patients and coordinating resources.

However, the IC (and supporting EROs) did not adequately consider the potential dose from the tritium release and monitor the safety of SRSFD and facility responders. Most importantly, the IC did not ensure timely tritium habitability monitoring for these locations or provide notice to sector command of the potential exposure. The projected dose for a one-hour exposure to the release at the responder locations exceeded 25 rem. Identified concerns include:

- Although the H-Canyon ISC declared the H-Area sector command post habitable, response personnel did not conduct tritium monitoring until more than an hour after the establishment of the sector command post, at which time the release had stopped and dissipated.

- Similarly, the field monitoring team conducted tritium monitoring at the ICP two hours after the IC declared the ICP operational.

- The EOC (via the TSR) or facility did not advise the IC to relocate the command posts to a safe distance from the tritium incident scene or conduct habitability monitoring.

- The IC directed dispatch to have the Effluent Treatment Facility personnel transport an employee with minor injuries and no contamination to medical without safe route information.

- The IC did not demonstrate an awareness of the 360-degree radius of PAs necessary to protect responders because of the potential for complex meteorological conditions, including nearby buildings, as well as light and variable winds.

These weaknesses are similar to a previous finding identified by EA during the 2014 exercise. (See **Finding F-SRNS-01**, **OFI-SRNS-04**, and **S**ections 5.3.1 and 5.4 for further discussion.)

Furthermore, after staffing the sector comment posts, the staff available at the ICP was not sufficient to effectively support the IC or establish good communications with facility response personnel and achieve full situational awareness. Most notably, because the ISCs and support staff members remained at the operations sector command posts, no facility ISCs and RPD personnel arrived to support the IC's initial size up and assessment to determine the building 234-H tritium release effects on the H-Area sector operations and the ICP. In addition, the safety officer and protective force officer did not promptly respond to the ICP. Additionally, after the safety officer accountability briefing to the IC, the safety officer turned over the accountability responsibilities to the IC and left the ICP to support the H-Area operations sector command. Consequently, this left the IC without adequate technical command staff to perform critical functions, such as initial assessment, incident action planning, patient tracking, and responder accountability tracking, so some tasks were not performed in a timely manner. Further compounding the situation, no direct communication occurred between the IC and ISCs, FECs or AEC, reducing situational awareness. Moreover, the IC did not use visual aids (e.g., a map or graphical display) to promote an understanding of responder, incident, or plume locations and had limited access to automated information management resources. (See **Finding F-SRNS-02** and Section 5.3.4 for further discussion.)

Overall, the IC appropriately established individual operation sectors for each of the two HAZMAT incidents, and tracked overall patient recovery, transport, and hospital transfer per contamination control protocol. The IC directed the SRSFD to approach the HAZMAT incident scenes considering the potential impacts of the earthquake and wind direction and appropriately established the framework for adequate command and control. Nevertheless, the IC (and ERO) did not adequately consider the potential dose from the tritium release and monitor the safety of SRSFD and facility responders. In addition, the IC did not assemble an adequate command staff or establish effective communications with facility response personnel, which negatively affected situational awareness and contributed to the IC's lack of awareness of the potential dose from tritium exposure to response personnel.

5.2.6 H-Canyon and Savannah River Tritium Enterprise Technical Support Rooms

In general, TSR personnel appropriately responded to the emergency incidents in accordance with EPIPs and checklists, with some exceptions. Technical support coordinators in each TSR determined goals, tasks, and priorities for TSR operations, and tracked the completion of assigned tasks. In addition, the coordinators conducted frequent briefings to keep cadre members informed and focused on TSR response tasks.

All seven tasks specified in the WebEOC TSR Pre-Canned Tasks checklist were completed; however, two of the tasks—to review the EAL and define the refined source term—were not completed by the SRTE TSR until more than two hours into the exercise. Although there were valid reasons for the delay (e.g., to determine the extent of damage to the room and its contents), the command room and CAR were not informed of this concern, and the lengthy delay rendered the information unreliable or unusable. (See **OFI-SRNS-05**.)

Information management between the TSRs and facilities was ineffective in supporting overall situational awareness. For example, determining the status of accountability was considered not applicable by the

SRTE TSR because the remain-indoors PA was in effect and accountability was not required. However, the SRSFD officer responding to building 234-H had requested that personnel accountability be conducted. (See **Finding F-SRNS-02** and Section 5.3.4 for further discussion.)

5.2.7 Consequence Assessment Room

During the exercise, the CAT used the designated consequence assessment models[1] to perform its airborne and waterborne consequence assessment tasks. The CAT was initially tasked with developing plume plots using default source terms and real weather conditions, followed by refined source terms as information became known. In addition, the CAT was responsible for developing deposition plots to support PA decision making and field monitoring activities by personnel in the EOC command room, in the field, and by the affected states. The CAT was further tasked with corroborating these results with a separate dispersion modeling program. The CAT provided products for the tritium and the nitric acid releases but encountered some significant difficulties in developing timely and accurate products.

The CAT adequately initiated its response using EPIP 6Q15.1-825, *Consequence Assessment Operations*. The CAT, comprised of an assessment specialist who serves as the team leader, two dispersion modeling system specialists (modelers), a field monitoring team specialist, an industrial hygiene specialist, a dose assessment liaison, and a security field operations coordinator, promptly arrived in the CAR. The field monitoring specialists, industrial hygiene specialist, and security field operations coordinator adequately performed their activities in accordance with 6Q15.1-825. The CAT adequately communicated with field monitoring personnel, discussed the hazards of nitric acid using appropriate references, and posted traffic control points on a computer-based mapping system with a site-wide PA overlay to aide in positioning traffic control points at safe positions.

Upon request from a state representative, the CAT provided an effective assessment of the water pathways to the Savannah River to support the state's decision making for mitigating environmental consequences from the nitric acid spill. The CAT used a feature in the Weather Information and Display System (WINDS) program to identify the pathway to the river and calculate the projected transport time. The ERO effectively used this information to plan mitigating strategies for environmental concerns.

Although the CAT completed its consequence assessment tasks, the CAT had difficulty developing an accurate, timely initial assessment of the tritium release consequences. For example:

- The initial modeling results were not available for the Assessment and Planning Coordinator (APC) command room briefing until 50 minutes after the modeler's arrival into the CAR, although the consequence assessment procedure establishes a timeliness goal of 20 minutes from the time of a modeler's arrival to complete the initial plume plot.

- In response to the modeler's request of the release location (which was not on the notification form), the EM coordinator provided an incorrect SRTE building number, which resulted in the CAT using incorrect release height, source term, release location, and release durations.

The CAT also had difficulty developing timely, accurate ongoing consequence assessments using a refined tritium source term.

- SRTE TSR personnel had difficulty acquiring refined source term information from the facility and

[1] SRS WINDS, a site-specific dispersion modeling program; the U.S. Environmental Protection Agency's Areal Locations of Hazardous Atmospheres program; and the National Atmospheric Release Advisory Center (NARAC) Web program.

provided the source term information to the CAT informally, rather than on the appropriate approval forms. The CAT was reluctant to use the informally-provided information.

- Based on TSR verbal information, the CAT eventually developed a plume projection using a larger, but incorrect, refined source term and a shorter release duration, while continuing to use the incorrect building parameters.

- After the EOC EM assistant entered the CAR with a TSR member and identified that a default source term was used rather than a refined source term in the latest refined source term projection, the modeler developed a projection using correct source term data, the results of which indicated that the plume had passed over the site boundary approximately 4.5 hours beforehand.

The CAT also had difficulty developing an accurate and timely assessment of the nitric acid airborne release for this challenging scenario, which resulted in the CAT completing the refined source term projection approximately three hours after the Alert declaration. For example:

- The CAT members completed the initial dispersion projections about 50 minutes after their arrival using the WINDS dispersion modeling program with correct default term information and real weather conditions; however, the default source term was not conservative because it is based on an intact tank containment area, while the scenario presented the modelers with a breached containment.

- Although the CAT demonstrated a good understanding of how to model the nitric acid spill, delays in acquiring the needed data from the H-Canyon TSR (i.e., the nitric acid puddle size, consisting of the containment area around the nitric acid tank and the surface area of the ditch where the nitric acid spill collected) resulted in delays in completing the analysis.

TSR personnel eventually provided dimensions of the containment area and ditch area for use in a WINDS projection, but data arrived informally and was provided in square feet rather than the expected square meters. Consequently, the modelers were reluctant to use the informal information provided but decided to use the dimensions of the containment area in square meters and disregarded the ditch area for completing the refined nitric acid spill projection.

The modeler could not provide the APC with modifications to the PAs in effect at the time based on the nitric acid plume plot. The modeler presented the plume plot to the APC but was unable to answer questions regarding adjustments to PAs for the areas on the plume plot where it indicated that criteria had been exceeded.

The CAT appropriately used the National Atmospheric Release Advisory Center (NARAC) Web to project the consequences of the nitric acid spill to corroborate the WINDS results, but the modelers used a source term of ten gallons spread over less than four square meters, instead of 6,600 gallons of nitric acid spread over 2,700 square meters used in the WINDS projection. The modelers concluded that the plume plot contours were consistent but did not share the NARAC results with other ERO members.

The CAT was not fully effective in providing timely, complete, and accurate assessment products to site and offsite response organizations, in part because many tasks in its procedure were not performed. Specifically, personnel in the CAR did not verify whether the default source term was correct, review the EAL for the source term information, verify input data used for plume plot development, obtain review and signatory approval of dispersion model plume plots, and reference the EPHA, documented safety analysis, EAL manual or other technical documents when encountering difficulties in determining the refined source terms. The CAT did not complete other position checklist tasks, such as providing

completed PA and PAR forms to the ED for the declared GE, developing an ingestion pathway intervention report based on derived intervention levels, providing Georgia and South Carolina emergency response groups with assessment information to enable the states to conduct an independent assessment, and posting projection outputs to the internal and external consequence assessment webpage.

Overall, the CAT adequately monitored traffic control locations and field activities and provided an adequate assessment of the nitric acid waterborne pathways to the Savannah River. However, the CAT did not develop timely and accurate consequence assessment products for airborne releases that were useful for decision making or supporting field monitoring activities. The CAT completed assessments of the airborne releases that did not accurately reflect the release conditions, and tritium projections were unavailable until after the plume had dispersed off site. Delays and errors in plume modeling are partly attributed to the CAT not being provided with timely and accurate information from the TSRs. Additionally, the CAT did not develop ingestion pathway deposition plots as required by procedures, to enable EOC command personnel to inform the states whether derived intervention limits were exceeded. DOE-SR and SRNS evaluators collectively identified concerns with the consequence assessment performance and procedure use discussed above as findings, deficiencies, or OFIs in their EEGs. This issue is a repeat of a previous finding that EA identified during the 2014 exercise.

5.2.8 Emergency Operations Center

EOC command room personnel appropriately responded to the emergency incidents in accordance with EPIPs and checklists. The ED and Federal managers determined goals, tasks, and priorities for EOC operations, and tracked the completion of assigned tasks in the EOC action plan. In addition, the ED conducted frequent briefings in the EOC to keep cadre members informed and focused on EOC response tasks. Likewise, the command room personnel adequately completed numerous situation reports to DOE Headquarters, provided timely new releases, and adequately briefed the executive team on the response.

Nevertheless, EA identified some weaknesses with the EOC command room response. Although command room personnel promptly reviewed and concurred with the EDO's GE declaration, command room personnel did not validate that the earthquake resulting in SAE and Alert declarations met the definition of a catastrophic incident. SRNS's exercise plan did not describe or use injects consistent with the catastrophic incident definition to postulated site conditions. The EOC command team also did not confirm that the EDO's determination of "no PAs" for the offsite PARs was correct for the GE declaration, which SRNS self-identified as a finding.

More significantly, the ED and EOC APC did not accomplish some important PA tasks required by EPIP 6Q15.1-103, *Protective Actions*. The APC did not provide adequate, timely information to the ED and ERO staff members on projected doses, emergency worker exposures, and PA decisions. In addition, the ERO staff did not verify that the ingestion pathway advisories recorded as "none" on the offsite notification forms were correct and based on a consequence assessor's determination. The CAT did not develop a derived intervention level determination for the release. Similar to the SRSOC, the EOC did not adequately use its geographical information capabilities to plot incident locations, potentially impacted areas, distances to PAC and/or TEL, and ICP locations.

The EOC's automated emergency information system, WebEOC, provided only a partial chronology of significant incident information created by a system administrator located in the EOC. Problems were encountered with posting incident information, which SRNS self-identified as a finding because it diminished the ability of the EOC to establish and maintain a common operating picture. However, WebEOC was not available at other response locations outside the EOC. (See **Finding F-SRNS-02** and Section 5.3.4 for further discussion.)

Also, although WebEOC is installed in the EOC, SRNS does not have an adequate communications protocol between SRS and offsite command centers, including DOE Headquarters, to provide shared situational awareness by providing access to unclassified emergency response information, such as ENFs, emergency status updates, plume projections, significant incident data, and field monitoring data. (**Deficiency**)

Overall, EOC command room personnel adequately accomplished executive notifications, worker notifications, and press releases in accordance with EPIPs and effectively performed most tasks. Nevertheless, EOC command room personnel did not accomplish some important PA tasks related to the assessment of projected doses, emergency worker exposures, and PA decisions. EOC command room response was impacted by ineffective interoperability among the SRS response facilities and performance of the CAR. (See Section 5.3 for further discussion of these programmatic weaknesses.)

5.2.9 Exercise Design and Conduct

In conjunction with exercise observation, EA assessed whether the design and conduct of the full-scale exercise (using a plausible scenario under reasonably realistic conditions) enabled the site to effectively test and validate its emergency management plan and EPIPs and identify areas for further program improvements.

SRNS designed a challenging scenario for the H-Area facility-level/area-level and site-level EROs that met the conditions of a full-scale exercise. It is realistic that an SAE hazard postulated in the EPHA would affect an entire area and involve multiple facilities and associated facility-level EROs. In addition, SRNS effectively conducted this multifaceted exercise in a manner allowing self-identification of exercise conduct weaknesses. However, EA observed two design weaknesses, including:

- The SRTE EPHA scenario cited in the EAL for the postulated incident was for a ground release plume. In contrast, the exercise field monitoring data package was for a stack release, which significantly changes the habitability impacts to responders.

- The earthquake was used primarily to initiate the HAZMAT releases, and the earthquake's effects on the site were largely discounted and not addressed in the exercise play. For example, at SRTE personnel did not consider the conflicting PAs between an earthquake and HAZMAT release response.

5.3 Contractor Programmatic Elements

EA analyzed specific response weaknesses observed during the exercise to evaluate whether programmatic weaknesses in such areas as the EPIPs, training and drills, and technical planning basis could be a causal factor. In its analysis, EA considered the design of the exercise and observed responder actions as well as DOE Order 151.1D and SRNS procedure requirements. EA excluded DOE Order 151.1D requirements that were not implemented by SRNS per the site's implementation plan. Specifically, EA applied DOE Order 151.1C requirements in analyzing the technical planning program element and its products. This section discusses EA's assessment of specific exercise performance weaknesses attributed to program weaknesses.

Criteria: Develop and maintain procedures that describe how the emergency management plan must be implemented and maintained. (DOE Order 151.1D, Attachment 3, paragraph 1.d.)
DOE sites/facilities/activities with an emergency management HAZMAT program must also accomplish the following. Identify predetermined onsite PAs and offsite PARs consistent with the hazard (internal vs. external exposure) and duration of the release (short vs. long) based upon the results of EPHAs. Identify

and evaluate incidents in which combinations of PAs for varying facilities/activities may apply. Establish methods for controlling, monitoring, and maintaining records of personnel exposures to HAZMAT. (DOE Order 151.1D, Attachment 3, paragraph 9a, b & d)

Site/facility-specific EALs must be developed for the spectrum of potential Operational Emergencies identified by the EPHA and must include PAs corresponding to each EAL. (DOE Order 151.1C, Attachment 2, paragraph 11. a.2. b. (2))

Notify the Field Element or designee, Headquarters Watch Office, and state, local, and tribal organizations of Operational Emergencies in accordance with site facility emergency management plan timelines. Complete notification within 30 minutes of declaration or termination of an Operational Emergency. (DOE Order 151.1D, Attachment 3, paragraph 11.a.(4))

Emergency notification to the Headquarters Watch Office must consist of initial notification by phone call providing as much information as is known at the time and subsequent notice electronically with receipt confirmation. If information is unknown at the time of the report, specify so in reporting. The initial notification must include the description of the emergency, date and time emergency was discovered or terminated, damage and casualties, PAs implemented, potential and actual impacts, agencies involved, level of public/media attention, and contact information. (DOE Order 151.1D, Attachment 3, paragraph 11.a.(6))

A comprehensive, coordinated, and documented program of training and drills must be an integral part of the emergency program to ensure that preparedness activities for establishing and maintaining program-specific emergency response capabilities are accomplished. (DOE Order 151.1D, Attachment 3, paragraph 5.)

5.3.1 Emergency Plan and Implementing Procedures

Although SRNS has made changes and improvements to its command media to incorporate requirements from DOE Order 151.1D and improve the emergency management program, SRNS has not yet achieved a fully integrated, effective set of command media to govern its emergency response. The structure of the current SRNS emergency operating system reflects a flow down from the emergency plan (program description) to documents (e.g., EPIPs and checklists) that provide the "how-to" instructions for the emergency management program elements (referred to as the command media). The exercise revealed weaknesses in establishing integrated emergency response actions within the emergency plan and implementing documents. The following paragraphs provide details concerning some of the observed weaknesses.

SCD-7 and the response procedures do not provide PA decision makers (i.e., the IC, FEC, AEC, ED or EDO) with all the instructions necessary to protect responders from potential HAZMAT exposure. SRNS recognizes the need to issue timely, conservative initial PAs for the general employee (a zone with a 360-degree, two-mile radius and downwind to the site boundary), but has not adopted a similar approach for the first responders. For example, this exercise scenario would result in the potential for tritium exposures between 25 and 100 rem to facility responders and SRSFD personnel at the sector command posts and ICP; however:

- Decision makers relied strictly on wind direction to establish the safety of the command posts, with no pre-established monitoring for tritium at adjacent areas or command posts. With no monitoring to confirm habitability, the responders were unnecessarily placed in a potentially hazardous atmosphere.

- The ISCs established the respective command posts based on individual facility conditions, without consideration of the conditions at adjacent facilities.

Some information that is readily available within the EPHAs, such as plume dispersion model output, is not included in the EALs or SRSFD and facility response procedures. For example, DOE Guide 151.1-2 (Sections 2.6.2 and 2.7.4); DOE Guide 151.1-4, *Response Elements* (Sections 4.5.2 and 6.5); and the U.S. Department of Transportation *Emergency Response Guidebook* discuss the use of an initial isolation zone, which takes into account the variability in meteorological conditions that can easily place response personnel, although upwind, in danger, and requires personal protective equipment and/or habitability monitoring for entry. Without a formal approach to identifying predetermined PAs for responders and establishing methods for controlling and monitoring ERO personnel exposures to HAZMAT at the scene, responders may be subjected to increased risk of exposure to HAZMAT. (See **Finding F-SRNS-01** and **OFI-SRNS-04**.)

In addition, some facility emergency procedures do not provide clear, complete direction on the implementation of PAs. Default PAs can sometimes be in conflict with each other during multiple events. For example:

- The default PAs identified in EPIP-TRIT-001 use the terminology "immediate area" to describe the area to be evacuated, but do not define (or explain the intent governing the implementation of) "immediate area," leaving the individual who is declaring an event to determine how to initiate such a PA.

- EPIP-TRIT-111, Attachment 6 provides guidance on initiating PAs that are incident driven, but if the emergency involves multiple incidents, the PAs can be in conflict and the procedure does not provide guidance or direction for resolving the conflicts. Specifically, the procedure does not provide guidance for resolving the conflicting PAs for an earthquake (e.g., determining whether it is safer to remain indoors or evacuate) and a release (e.g., determining to remain indoors).

Both of these examples contributed to the finding related to the SRTE FEC's implementation of PAs. (See **Finding F-SRNS-01** and **OFI-SRNS-02**.)

Further, the SCD-7 and area-level, facility-level, SRSFD, and Centerra-SRS EPIPs do not fully establish and define interfaces for an SRSFD response to an incident complex. The National Incident Management System (NIMS) supports the expansion of the incident command system for an incident complex, which consists of two or more individual incidents located in the same general area, assigned to a single IC, and managed under a single incident command system, as implemented during the exercise. Because the *SRS Emergency Plan* and EPIPs do not adequately align the various ERO elements with the IC for an incident complex, the IC did not have the same level of staff support or communication with the facilities. For example, the exercise response demonstrated that facility personnel adequately interfaced with sector command posts as if each was the ICP, which is not fully consistent with plans and EPIPs, but lack of technical support to the IC adversely affected initial size up and awareness of the impact of the tritium release on the ICP and sector command posts and contributed to placing responders in a potentially hazardous atmosphere. Additionally, inefficient communications between the IC and H-Area AEC resulted in multiple changes in the nitric acid spill response strategy and increased responder risk associated with multiple hot zone entries. SRNS identified an OFI regarding the lack of adequate communication between the IC and AEC but did not identify the misalignment of the emergency plan and facility and security procedures with NIMS as an issue. (**Deficiency** and see **OFI-SRNS-06**.)

EPIP 6Q15.1-825 also contributed to an ineffective response for the following reasons:

- Many procedure steps are written as guidance (e.g., there is a frequent use of "should"), so procedure users and exercise evaluators consider many critical steps as optional actions.

- The procedure does not specify when to use specific models in its suite of dispersion modeling programs or what to do with consequence assessment products.

- The procedure does not define default source terms, refined source terms, and corroborating source terms for use in dispersion modeling. During the exercise, the modelers used their discretion and used a default source term for a refined source term when calculating a tritium release projection and used a four-square meter puddle size to represent a 2,730 square-meter nitric acid puddle in a NARAC calculation.

- The procedure instructs the assessment specialist to confirm and document PAs by circling evacuation zones and shelter zones for ED use, but methods to identify evacuation zones or distinguish the geographic areas for applying the zones are not provided. The CAT did not demonstrate the implementing mechanisms during the exercise.

(See **OFI-SRNS-07**.)

5.3.2 Training, Drills, and Exercises

SRNS met the five-year exercise schedule requirements for severe incident exercises affecting multiple facilities by appropriately designing and conducting a significantly challenging exercise to test the communications among the facilities within the H-Area and to test how effectively the H-Area AEC would evaluate the interactions of the incidents and the integration of the response efforts. However, the lack of interaction and interoperability of the facilities and first responders during an emergency response and the weaknesses in PAs for H-Canyon responders can be attributed (to some extent) to weaknesses in the implementation of the drill and exercise program. SRNS completes many drills and exercises throughout the year but has not trained and drilled sufficiently for severe incident scenarios that affect multiple facilities and require EROs to consider the effect of conditions at one facility on the response at another facility. Almost all of the drills and exercises are confined to a single facility or area with little or no consequences to and interaction with the other site facilities. Various EROs and field responders concentrate on conditions within their own facility or command location without interacting with adjacent affected facilities, ignoring severe incidents. Further, by focusing on validating responder proficiency, as an end product, SRNS can determine the combination of drills and exercise to ensure responder proficiency for this type of incident. (See **Finding F-SRNS-02** and **OFI-SRNS-08**.)

In addition, members of the CAT were not proficient in executing all their functions and were not familiar with procedures and available reference material for use in completing tasks. There were similar weaknesses in communications between the CAT, TSR and EOC command room members. One modeler indicated that this exercise was a first-time experience and previous practice was limited to the observation of an active shooter exercise, which did not include a HAZMAT release, and participation in a drill. CAT performance issues (discussed in Section 5.2.7, above) inhibited the command staff from providing ERO members an adequate understanding of the potential consequences of the large tritium release. The DOE-SR evaluator adequately identified a finding for the CAR ERO members' lack of understanding of their functions and interfaces.

5.3.3 Technical Planning Basis

EPHAs establish the technical planning basis for the SRS emergency management program, identifying the planning and response actions for airborne HAZMAT releases. Significant response related EPHA products include EALs, PAs, and PARs provided in a conservative manner for execution when responders know limited information about an incident. During the preparatory actions and execution of the exercise, EA noted the following deviations in the technical planning basis used to support an appropriate and conservative response:

- The PAs provided in the tritium stack release EAL used during the exercise are incorrectly based on the analysis of a ground fire tritium release. Likewise, the ground fire tritium release EAL is based on the stack release analysis. SRNS attributed this mistake to a typographical error in the scenario identification number when incorporating the EPHA information into the EAL.

- The EPHA analysis of a nitric acid spill assumes a tank containment area of 2,730 square feet, but the associated EAL uses 2,730 square meters. CAT personnel delayed activities while questioning the difference in units.

- The default scenario for the tritium stack release pre-loaded into the WINDS program uses a 120-minute release duration while the EPHA uses a 20-minute release duration without a documented rationale. DOE EMG 151-1-4, *Response Elements*, describes an approach that uses the conservative assumptions established in the technical planning basis that is expanded upon during ongoing assessments with improved information and technical and human resources. Changing the release duration from 20 minutes to 120 minutes, without adequate rationale, projects a nonconservative dilution of airborne concentrations that is inconsistent with the SRNS EAL technical basis.

(See **OFI-SRNS-09**.)

5.3.4 Communications and Interoperability

SCD-7 and the EPIPs do not fully establish and define how SRNS effectively records and disseminates emergency information among the site's emergency facilities. Facility- and area-level EROs are responsible for assessing conditions, categorizing/classifying emergency conditions, notifying the SRSOC EDO, maintaining surveillance/control of operational processes, directing incident assessment and mitigating actions, approving overexposures, and determining and implementing facility/area PAs. Similarly, OSCs are responsible for conducting search missions, determining required protective equipment, issuing emergency dosimetry, performing radiological assessment, performing damage assessment, and performing incident mitigation. During the exercise, SRNS did not effectively distribute this response information, so the ERO was unable to achieve a common operating picture of the exercise incidents or maintain adequate situational awareness throughout the response.

SRNS's procedures and checklists contributed to the communications and interoperability issues by not prompting ERO personnel to consider the interdependency of the organizations involved in the response. For example:

- EPIP-TRIT-111 does not provide for direct, periodic communications among the emergency coordinators and ED (for example, additional communications between the SRTE FEC and the H-Area AEC and/or EOC to ensure that a common operating picture is maintained throughout the response to an event affecting the entire site).

Responsibility for two of the TSR Pre-Canned Tasks (accountability and verifying the facility has taken appropriate PAs) is not specified in the Responsibilities or Requirements sections of EPIP 6Q15.1-750, *Technical Support Staff Operations*, or its attachments. Thus, no position in the TSR is assigned responsibility for ensuring that these tasks are accomplished.

- The duties of the Fire Department (FD) Specialist, who was present in the TSR, are not contained in 6Q15.1-750 but rather in 6Q15.1-800, *Logistic Support Operations*. The FD Specialist checklist and Incident Scene Status Forms in 6Q15.1 were not used, although some patient tracking information was documented on the ERO Message Form. However, the FD Specialist did not complete the Incident Scene Status Form for use in updating the SRS Notification Form.

The 2018 exercise revealed a need for the site to improve the interoperability between emergency response facilities, as the processes and equipment to record and disseminate response information among response facilities were not fully effective. Importantly, SRNS has a very limited automated emergency management information system capability to capture, distribute, and share emergency information among the site's response facilities, which SRNS needs for rapid and accurate decision making. Control rooms throughout the site lack interoperability with the SRSOC, EOC, TSRs, and CAR. Consequently, SRNS was slow to share some response information or did not get some information to all the needed emergency responders. Most significant was an inadequate understanding of the potential consequences of the SRTE tritium release to other H-Area facilities and responders. For example, the H-Area AEC did not have use of the information management system providing information about all the incidents (e.g., releases, injuries, and contaminated personnel) occurring in H-Area. Similarly, difficulties in maintaining a common operating picture between the TSRs and affected facilities resulted in delay of information flow among SRTE, H-Canyon, TSRs, and CAT personnel.

Interoperability is a significant concern, as SRNS does not have adequate automated emergency management information system or procedures to capture, distribute, and share emergency information among the site's response facilities. The only SRS response facility with an automated emergency information system capability is the EOC, which uses WebEOC software and information boards. As used, WebEOC provided only a partial chronology of significant incident information (significant events, task assignments, and meteorological data) created by a system administrator located in the EOC and is not available at other onsite response locations outside the EOC. As a result, WebEOC did not enable adequate onsite communication among response facilities and field response elements to establish a common operating picture and shared situational awareness. In addition, SRNS has not established a communications protocol between SRS and offsite command centers to enable sharing unclassified WebEOC information, such as ENFs, emergency status updates, plume projections, significant incident data, and field monitoring data. Consequently, the current WebEOC emergency information system (and its use) was inadequate to support the information needs of the ERO, and during the exercise, emergency responders often did not receive timely critical response information or did not get all the necessary information. EA identified a similar issue in its January 2015 report, *Office of Enterprise Assessments Review of the Savannah River Site 2014 Site-Level Exercise*. (See **Finding F-SRNS-02** and **OFI-SRNS-10**.)

In addition, SRNS has not fully integrated its geographical information capabilities within emergency management to provide the ERO with maps, data, and analysis tools for the site, the surrounding area, and the interiors of many onsite facilities. Consequently, the SRSOC's initial response did not benefit from using a geographical information system map or job aid to plot and share incident locations, potentially affected areas, distances to PAC and/or TEL, ICP locations, and traffic control points. Likewise, other onsite emergency response facilities did not use a geographical information system map or job aid to plot and evaluate potential exposures to response personnel. (See **Finding F-SRNS-02** and **OFI-SRNS-10**.)

5.4 Corrective Actions

This section discusses EA's assessment of the closure of corrective actions for findings identified during the 2015 EA assessment of the SRS emergency management exercise program, using DOE Order 151.1C criteria.

Criteria: Corrective action items identified as a result of the critique process must be incorporated into the emergency management program. (DOE Order 151.1C, Attachment 2, paragraph 6.b)

Completion of corrective actions for facility and site exercises must include a verification and validation process, independent of those who performed the corrective action, that verifies that the corrective action has been put in place and that validates that the corrective action has been effective in resolving the original finding. (DOE Order 151.1C, Attachment 2, paragraph 6.b.(7)

Defense Nuclear Facilities must perform the following:

- *Conduct causal analysis to determine corrective actions for findings identified as a result of noncompliance for life safety.*

- *Develop formal corrective action plans for identified findings. The corrective action plan must be approved by the Cognizant Field Element Manager. The Cognizant Field Element Manager must ensure effective corrective actions are tracked, identified, and implemented.*

- *Evaluate the effectiveness of corrective actions through verification and validations conducted by an independent reviewer.*

- *Identify compensatory measures for findings until causal analysis is performed and corrective actions are identified and implemented. (DOE Order 151.1D, Attachment 4, paragraph 15. (j).(1)-(4))*

EA assessed the status of two findings identified during the 2015 assessment, paying particular attention to the validation of the effectiveness of the corrective actions. The first 2015 finding (Finding 2015-F-SRNS-1) concluded that the exercise program did not validate all elements of the emergency management program over a five-year period. Corrective actions included the development of a five-year drill and exercise schedule for site-level and facility-level evaluations using all DOE EMG 151.1-3 exercise evaluation criteria. SRNS commenced implementation of the five-year schedule in the current fiscal year, and this exercise was the first to be conducted under the current five-year schedule. SRNS closed this finding, and EA concluded that the completed corrective actions are adequate for closure.

The second 2015 finding (Finding 2015-F-SRNS-2) concluded that, contrary to DOE Order 151.1C, SRNS ineffectively managed some significant issues and corrective actions identified through some external and internal assessments. For example, SRNS had not adequately addressed a finding from 2012 regarding the lack of a comprehensive set of criteria and lines of inquiry for use during programmatic evaluations. In a number of cases, the SRNS emergency management organization relied on evaluators' subjective determination of whether responders successfully accomplished an objective. SRNS emergency management determined that the impact of this 2015 finding did not require a causal analysis or validation of effectiveness of corrective actions. SRNS used an apparent cause determination and addressed 2015 Finding F-SRNS-2, revising its issues management processes, as documented in the *Emergency Management Self-Assessment Plan*; performed assessments in accordance with site level Manual 12Q, SA-1, *Self-Assessment*; and developed corrective actions in accordance with site-level Manual 22Q CAP-1, *Corrective Action Program*. Notably, as part of the corrective actions for Finding

2015 F-SRNS-2, SRNS developed and implemented a comprehensive set of lines of inquiry (based on all 616 criteria found in DOE EMG 151.1-3, Appendix D) for use during programmatic evaluations and scheduled facility- and site-level assessments to cover all criteria at least once every five years. However, SRNS closed 2015 Finding F-SRNS-2 without fully developing performance evaluation criteria used during exercises (see Section 5.1, above) or fully integrating the site-level issues management process with emergency management requirements, including verification and validation for corrective actions resulting from emergency management evaluations, assessments, drills, exercises, and actual emergencies, as required by DOE Order 151.1D.

During the exercise, EA observed that SRNS has started the process of implementing Exercise Builder software, a DOE foundational tool for consistent exercise planning and evaluation documentation based on response steps found in EPIPs. Currently, SRNS has not fully developed the evaluation criteria database and site-specific exercise EEGs. Most of the EEGs used by evaluators during the exercise did not include relevant criteria with observable and measurable response steps, which the responders must complete to demonstrate successful performance of the objective. After evaluating the 2014 exercise, EA issued four findings to document responder performance weaknesses. Although SRNS had addressed and closed all the findings, EA observed similar performance weaknesses during the 2018 full-scale exercise related to the 2014 findings, as discussed previously in this report. Consequently, EA concluded that the SRNS issues management process was not fully effective in resolving the original findings and preventing recurrence. (**Deficiency** and see **Finding F-SRNS-03** and **OFI-SRNS-11**.)

Overall, corrective action implementation for the previous EA findings resulted in improvements to the SRNS emergency management program, most significantly, the development and implementation of a comprehensive set of lines of inquiry for use during programmatic evaluations and a five-year schedule to validate that all response elements during exercises. However, during this exercise, there was recurrence of several performance issues observed in the 2014 full-scale exercise and subsequently documented as corrected findings. The reduced level of rigor used to address Finding F-SRNS-2, which resulted from the risk-based approach to this finding, did not lead to fully adequate corrective actions, and SRNS closed 2015 Finding F-SRNS-2 without fully resolving the underlying issues and verifying or validating the effectiveness of the corrective actions. Consequently, SRNS has not effectively addressed the issues management process to prevent recurrence of emergency management findings.

6.0 FINDINGS

Findings are deficiencies that warrant a high level of attention from management. If left uncorrected, findings could adversely affect the DOE mission, the environment, the safety or health of workers and the public, or national security. DOE line management and/or contractor organizations must develop and implement corrective action plans for EA appraisal findings. Cognizant DOE managers must use site- and program-specific issues management processes and systems developed in accordance with DOE Order 227.1A to manage these corrective action plans and track them to completion. In addition to the findings, deficiencies that did not meet the criteria for a finding are listed in Appendix C, with the expectation from DOE Order 227.1A for site managers to apply their local issues management processes for resolution.

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Finding F-SRNS-01: SRNS did not effectively implement PA requirements, neglecting to identify predetermined PAs for responders consistent with the hazards based on the results of EPHAs and evaluate incidents in which combinations of PAs may apply. (DOE Order 151.1D, Attachment 4, paragraphs 9.a & b)

Finding F-SRNS-02: SRNS did not effectively communicate among SRS response facilities and responders and offsite command centers to provide a full common operating picture and shared situational awareness of the emergency response. (DOE Order 151.1D, Attachment 3, paragraph 11.b.(6))

Finding F-SRNS-03: SRNS corrective actions did not fully address one of the findings from EA's 2015 assessment report and the corrective actions did not include validation of the effectiveness of corrective actions in resolving the original finding; during the 2018 exercise there was recurrence of several performance weaknesses observed and documented as findings during the 2014 full-scale exercise. (DOE Order 151.1C, Attachment 2, paragraph 7.b.(1)(b)) and (DOE Order 151.1D, Attachment 4, paragraph 15.j.(3))

7.0 OPPORTUNITIES FOR IMPROVEMENT

EA identified some OFIs to assist cognizant managers in improving programs and operations. While OFIs may identify potential solutions to findings and deficiencies identified in appraisal reports, they may also address other conditions observed during the appraisal process. EA offers these OFIs only as recommendations for line management consideration; they do not require formal resolution by management through a corrective action process and are not intended to be prescriptive or mandatory. Rather, they are suggestions that may assist site management in implementing best practices or provide potential solutions to issues identified during the assessment.

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OFI-SRNS-01: To better incorporate specific, attainable, and measurable criteria in EEGs, consider:

- Reviewing *Office of Enterprise Assessments Lessons Learned from the 2014 Emergency Management Reviews*, April 2015, Lessons Learned Statement "Site exercise evaluators do not evaluate performance critically."

- Reviewing *Office of Enterprise Assessments Lessons Learned from the 2015 Emergency Management Assessments*, May 2016, Lessons Learned Statement "Some exercise evaluations do not provide the sites with an effective and reliable assessment of ERO performance."

- Enrolling key exercise design personnel in the following courses: Federal Emergency Management Agency IS-120.c, *An Introduction to Exercises*; Federal Emergency Management Agency E0131, *Exercise Evaluation and Improvement Planning*; NNSA Emergency Operations Training Academy EXR131DW, *Fundamentals of Exercise Design*; or Emergency Operations Training Academy EXR 231, *Exercise Design.*

OFI-SRNS-02: In order to improve SRTE PA implementation, consider:

- Revising appropriate facility checklists, including EPIP TRIT-111, Attachment 6, and EPIP TRIT-115, Attachment 1, with reminders to establish routine communications via the SRS EOC phone in order to provide current status on incident progression.

- Revising EALs in EPIP-TRIT-001 to give better guidance on implementing PAs for the "immediate area."

- Conducting a review of all EPIPs providing PAs to minimize potential conflicts and prioritize actions to address any conflicts that could result from multiple incidents.

- Revising EPIP TRIT-111, *FEC Response Actions,* Attachment 6, to provide guidance on initiating PAs that are incident driven when there are multiple incidents.

- Revising EPIP TRIT-111, Attachment 6, to provide reminders to the FEC to ensure that routine communications with the ISC provide information on environmental conditions.

OFI-SRNS-03: To improve the catastrophic incident EAL, consider adopting the Federal Emergency Management Agency *National Response Framework* definition that states, "Catastrophic incidents are any natural or manmade incident, including terrorism, that results in extraordinary levels of mass casualties, damage, or disruption severely affecting the population, infrastructure, environment, economy, national morale, and/or government functions. A catastrophic incident could result in sustained nationwide impacts over a prolonged period of time; almost immediately exceeds resources normally available to state, tribal, local, and private-sector authorities in the impacted area; and significantly interrupts governmental operations and emergency services to such an extent that national security could be threatened."

OFI-SRNS-04: To improve field responder awareness of potential HAZMAT exposures and associated PAs under complex meteorological conditions, such as nearby buildings and light, variable winds, consider:

- Reviewing *Independent Oversight Lessons Learned from the 2012 Targeted Reviews of Emergency Preparedness for Severe Natural Phenomena Events at Select Department of Energy/National Nuclear Security Administration Nuclear Facilities*, April 2013, Section 2.1.2, Lessons Learned Statement "DOE Guide 151.1-4, Response Elements EMG, recommends that DOE/NNSA sites not use real-time meteorological conditions as a factor in determining initial event classification (and initial protective actions)."

- Reviewing DOE Guide 151.1-2, *DOE Guide 151.1-4 and the Emergency Response Guidebook (e.g., How to Use Table 1 – Initial Isolation Distances and Protective Action Distances),* discussions of initial PAs and PAs for responders.

- Using the EPHAs as the basis to define a conservative 360-degree area (independent of wind direction) for the initial PA area for field responders for HAZMAT releases.

- Defining response zones (isolation zones, PA zones, etc.) for field responders so that responders can quickly communication levels of personal protective equipment and access requirements for certain distances from a HAZMAT release.

- Defining distances at which the PAC and thresholds of early lethality would be exceeded, using a local area map showing facility boundary, security boundary, and adjacent facilities receptors of interest.
- Using the analysis to determine the monitoring and detection instruments that are necessary for protection of responders in the anticipated affected adjacent facilities.

- Including the primary and alternate ICP locations from fire control preplans as receptors of interest in the EPHAs and CAR procedures for timely initial assessment.

OFI-SRNS-05: In order to ensure that the tasks assigned to the SRTE and H-Canyon TSRs (and other applicable venues) are completed, consider:

- Aligning the tasks assigned to the TSR in the TSR Pre-Canned Tasks with *Technical Support Staff Operations.*

- Reviewing the positions assigned to the TSR, defining their respective responsibilities and requirements, and updating the attached checklists.

- Emphasizing the need for timely completion of certain tasks and how the results are used by other members of the ERO.

- Further defining the specific TSR objectives in correlation with the TSR's respective responsibilities, as defined in exercise objectives, response procedures, and checklists.

OFI-SRNS-06: In order to improve the facility and first responder interoperability, consider:

- Predefining the areas of responsibilities between the FEC/AEC and IC for liquid releases as it relates to the mitigation of environment impacts and facility operations.

- Revising and aligning the SRNS emergency plan and facility-level and area-level EROs, Centerra-SRS, and SRSFD response procedures to account for implementation of an incident complex involving multiple facilities within an area, assigned to a single IC, and managed under a single incident command system

- Revising and aligning the SRNS emergency plan and facility-level, area-level, and site-level EROs, Centerra-SRS, and SRSFD response procedures to account for a NIMS-defined area command that would be anticipated with a catastrophic event affecting multiple areas within the site and the surrounding community and overwhelming the capabilities of the site and the surrounding offsite mutual aid organizations (e.g., a major ice storm or earthquake with a GE).

OFI-SRNS-07: In order to improve the completeness, accuracy, timeliness and sharing of consequence assessment information, consider revising the *Consequence Assessment Operations* manual by:

- Removing the use of "should" in procedure steps for the tasks that users are expected to perform promptly.

- Describing source terms used as data inputs for default, refined, and corroborating dispersion model projections.

- Adding steps to distribute NARAC products to the appropriate onsite and offsite decision makers.

- Adding information to identify PA zones.

OFI-SRNS-08: To improve interoperability among ERO elements, consider:

- Conducting additional drills and exercises involving severe incidents affecting multiple facilities and areas.

- Reviewing *Independent Oversight Lessons Learned from the 2013 Targeted Reviews of Emergency Preparedness for Severe Natural Phenomena Events at Selected Department of Energy/National Nuclear Security Administration Nuclear Facilities*, February 2014, Section 2.3, Lessons Learned Statement "Most of the sites' training and drill programs do not address NPEs affecting multiple facilities, and some sites have not provided adequate EAL training to all ERO personnel."

OFI-SRNS-09: While updating the SRS technical planning basis to meet DOE Order 151.1D requirements, consider ensuring that EPHA assumptions are properly documented and results are properly incorporated to the applicable EAL and that dispersion modeling default parameters are consistent with the EAL technical basis when unknown. Consider expediting revisions to correct PA information in EPIP-TRIT-001 for the building 234-H ground fire and stack release EALs.

OFI-SRNS-10: To improve interoperability among the SRS response facilities and to provide a full common operating picture and shared situational awareness during an emergency, consider implementing the best practice identified in the *Office of Enterprise Assessments Lessons Learned from the 2014 Emergency Management Reviews*, including:

- Acquiring and implementing the DOE-owned EMInS from the NNSA Production Office as the site's primary incident management tool to replace the cost prohibitive WebEOC software.

- Installing Emergency Management Information System© (EMInS) in all site response facilities, including area control rooms, SRSOC, EOC, TSRs, and CAR, and at the ICP to foster interoperability with the field and response centers.

- Using EMInS for daily automated log keeping in the SRSOC (EDO and SRSFD dispatch).

- Providing unclassified EMInS access to offsite EOCs (local, state, and DOE Headquarters) to provide a full common operating picture of the emergency response and shared situational awareness, by providing access to unclassified emergency response information, such as notification forms, emergency status updates, plume projections, significant incident data, and field monitoring data.

- Integrating EMInS with the SRNS web-based geographical information system to provide the ERO with maps, data, and analysis tools for the site, the surrounding area, and interiors of many onsite buildings.

- Adding other EMInS supported response tools, such as the NNSA Production Office's automated damage assessment process that incorporates prioritized damage assessment analyses and mapping to assist the ERO in effectively using available resources.

- Adapting the information flow structure developed for the NNSA Production Office, which assigns specific responsibility for and ensures verification and validation of essential incident information, into a similar structure for the control rooms/SRSOC/EOC/TSR/CAR configuration.

- Integrating EMInS into the ICP in order to permit access to key response information, such as maps with all responder locations, isolation zones, and plume projections.

OFI-SRNS-11: To improve the emergency management issues management validation and verification process, consider:

- Assigning the emergency management program manager overall responsibility for corrective action implementation on all of the SRNS corrective actions that originate from drill and exercise findings.

- Revising the emergency management corrective action implementing procedure to incorporate verification and validation steps for all drill and exercise performance findings and externally identified programmatic findings.

- Incorporating a summary of finding validation into drill and exercise after-action reports.

Appendix A
Supplemental Information

Dates of Assessment

Onsite Assessment: April 24-26, 2018
May 15-17, 2018
June 19-21, 2018

Office of Enterprise Assessments (EA) Management

William A. Eckroade, Acting 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, Director, Office of Worker Safety and Health Assessments
Gerald M. McAteer, Director, Office of Emergency Management Assessments

Quality Review Board

Steven C. Simonson
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Michael A. Kilpatrick
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EA Site Lead for SRS

Jeff Snook
Kevin Witt

EA Assessors

Randy L. Griffin – Lead
Anthony D. Parsons
John D. Bolling
Dirk Foster
Frank A. Inzirillo
Thomas Rogers
William J. Scheib

Appendix B
Key Documents Reviewed, Interviews, and Observations

Documents Reviewed

- EPIP-HSEP-001, *Emergency Classification*, Rev. 32, 6/22/2017
- EPIP-HCP-002, *H-Area Material Disposition Project Emergency Response*, Rev. 11, 4/17/2018
- EPIP-TRIT-001, *Emergency Classification*, Rev. 29, 5/1/2017
- EPIP TRIT-111, *FEC Response Actions*, Rev. 35, 4/24/2018
- EPIP TRIT-115, *Communicator Recorder Response Actions*, Rev. 15, 9/28/2010
- EPIP 6Q15.1-103, *Protective Actions*, Rev. 16, 9/28/2017
- EPIP 6Q15.1-120, *SRS Notifications*, Rev. 19, 9/14/2017
- EPIP 6Q15.1-800, *Logistic Support Operations*,
- EPIP 6Q15.1-825, *Consequence Assessment Operations*, Rev. 9, 9/28/2017
- EPIP 2Q2-1.1-701, *HAZMAT Response*, Rev. 15, 5/19/2016
- EPIP 2Q2-1.1-702, *HAZMAT Incident Command*, Rev. 8, 6/4/2013
- F9611048.DRSC000100, *2018 SRS Emergency Preparedness Evaluated Exercise*, Rev. 0, 4/16/2018
- SCD-7, *SRS Emergency Plan, Section 2, ERO (Internal)*, Rev. 14, 3/15/2018
- SCD-7, *SRS Emergency Plan, Section 13, Drills and Exercises*, Rev. 14, 8/15/2017
- SCD-7, *SRS Emergency Plan, Annex D, H-Area Environmental Management Annex*, Rev. 15, 10/24/2017
- SCD-7, *SRS Emergency Plan, Annex F, Tritium Facilities Annex*, Rev. 19, 3/8/2018
- SCD-7, *SRS Emergency Plan, Annex L, Biomass Cogeneration Facility Annex*, Rev. 4, 10/23/17
- SRNS-IM-2018-00006, *SRS 5-Year Site/Facilities Exercise Schedule & Assessment Plan*, 2/21/2018
- S-EHA-H-0006, *EPHA for the Tritium Facility*, Rev. 10, 3/23/2016
- 6Q-006, *Standards for the Development and Conduct of Drills and Exercise*, draft

Interviews

- Consequence Assessment Modelers (2)
- Consequence Assessment Controller/Evaluator
- Drill and Exercise Team Manager
- EOC Command Room Lead Evaluator
- Exercise Builder Specialist
- Front Line Supervisors (2)
- H-Canyon Lead Evaluator
- H-Canyon Incident Scene Evaluator
- Issues Management Representative (2)
- Shift Operations Manager (2)
- Site Training Manager
- DOE-SR Emergency Management Program Manager
- DOE-SR Consequence Assessment Evaluator
- SRSFD ICP Lead Evaluator
- SRSFD IC
- SRSOC Lead Evaluator
- SRTE Shift Manager/FEC
- SRTE Shift Technical Engineer
- SRTE Lead Controller

- SRTE Incident Scene Coordinator
- SRTE TSR Controller

Observations

- 2018 Full-Scale Exercise

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.

- DOE-SR did not provide effective oversight by thoroughly reviewing and evaluating the exercise plan (specifically the five-year exercise schedule), or validating that corrective actions for external findings ensured programmatic effectiveness (corrective actions did not prevent recurrence) as required by DOE Order 151.1D, Appendix A, paragraphs 10.f, 4 & 5 and DOE Order 226.1B paragraphs 4.b. and 5.e. (Section 5.1, page 4 and Section 5.4, page 23)

- SRNS has not conducted an exercise with the OST in the last four years, and the current five-year schedule does not include an exercise with OST, as required by DOE Order 151.1D, Attachment 4, paragraph 15.f. (Section 5.1, page 4)

- SRNS has not developed effective EEGs to test and validate emergency plans and procedures during exercises, contrary to DOE Order 151.1D, Attachment 3, paragraph 14. (Section 5.1, page 5 and Section 5.4, page 23)

- SRNS has not established a complete communications protocol between SRS response facilities and offsite command centers to provide a full common operating picture of the emergency response and shared situational awareness, by providing access to unclassified emergency response information, such as notification forms, emergency status updates, plume projections, significant incident data, and field monitoring data, contrary to DOE Order 151.1D, Attachment 3, paragraph 11.b.(6). (Section 5.2.8, page 16)

- SRNS has not established mechanisms, consistent with NIMS, for expanding the initial response capability and establishing control at an incident complex, contrary to DOE Order 151.1D, Attachment 3, paragraphs 3.g. (Section 5.3.1, page 19)