Independent Oversight Review of Site Preparedness for Severe Natural Phenomena Events at the Savannah River Site Tritium Facilities

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Acronyms

AC	Alternating Current
AEC	Area Emergency Coordinator
AOP	Abnormal Operating Procedure
BDBE	Beyond Design Basis Event
CAS	Central Alarm Station
DOE	U.S. Department of Energy
DOE-EM	DOE Office of Environmental Management
DOE-SR	DOE-Savannah River Operations Office
DSA	Documented Safety Analysis
EAL	Emergency Action Level
EDO	Emergency Duty Officer
EM-44	DOE-EM Office of Emergency Management
EMG	Emergency Management Guide
EOP	Emergency Operating Procedure
EPHA	Emergency Planning Hazards Assessment
EPHS	Emergency Planning Hazards Survey
EPIP	Emergency Plan Implementing Procedure
ERAP	Emergency Readiness Assurance Plan
ERO	Emergency Response Organization
FEC	Facility Emergency Coordinator
HANM	H-Area New Manufacturing
HAZMAT	Hazardous Material
HSS	Office of Health, Safety and Security
HVAC	Heating, Ventilation, and Air Conditioning
kW	Kilowatt
LCO	Limiting Conditions for Operation
LFM	Lead Federal Manager
m	Meters
MOA	Memorandum of Agreement
mph	Miles Per Hour
NA-43	NNSA Office of Emergency Management Implementation
NFPA	National Fire Protection Association
NNSA	National Nuclear Security Administration
NNSA-SRSO	NNSA-Savannah River Site Office
NPE	Natural Phenomena Event
OFI	Opportunity for Improvement
OSC	Operations Support Center
OSSES	Office of Safeguards, Security, and Emergency Services
OST	NNSA Office of Secure Transportation
PA	Public Address
PAC	Protective Action Criteria
PC	Performance Criteria
PPE	Personal Protective Equipment
psf	Pounds Per Square Foot
RPD	Radiological Protection Department
SAR	Safety Analysis Report
SAS	Safety Alarm System
SIMTAS	Site Integrated Management Total Assessment System
SOM	Shift Operations Manager
SRNS	Savannah River Nuclear Solutions, LLC
SRS	Savannah River Site

SRSOC	SRS Operations Center
SST	Selective Signaling Terminal
STAR	Site Tracking, Analysis, and Reporting System
TEF	Tritium Extraction Facility
TEL	Threshold for Early Lethality
TF	Tritium Facilities
TSR	Technical Safety Requirement
UPS	Uninterruptible Power Supply
WSI-SRS	Wackenhut Services Incorporated-Savannah River Site

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1.0 PURPOSE

The Office of Enforcement and Oversight (Independent Oversight), within the Office of Health, Safety and Security (HSS), conducted an independent review of preparedness for severe natural phenomena events (NPEs) at the National Nuclear Security Administration (NNSA) Savannah River Site's (SRS's) Tritium Facilities (TF). The HSS Office of Safety and Emergency Management Evaluations performed this review to evaluate the processes for identifying emergency response capabilities and maintaining them in a state of readiness in case of a severe NPE.

This report discusses the scope, background, methodology, results, and conclusions of the review and identifies two findings and eight opportunities for improvement (OFIs).

2.0 SCOPE

The scope of this review involves those aspects of the emergency management program that relate to emergency preparedness for a severe NPE. The primary areas of interest are the identification of needed facility response capabilities and their state of readiness. The NNSA manager of the Savannah River Site Office (NNSA-SRSO) has line management oversight responsibility of the SRS Tritium Program operations, which includes the facilities located in the Tritium Complex. The facilities included in this review consist of two main active process buildings:

- H-Area New Manufacturing (HANM)
- Tritium Extraction Facility (TEF).

This review also involved other buildings within the Tritium Complex, including Buildings 234-H, 233-22H, 235-H, 246-H, 247-H, 248-H, and 249-H administrative facilities.

The scope of this review included portions of the following emergency management program elements outlined in DOE Order 151.1C:

- Technical planning basis
- Plans and procedures
- Emergency response organization (ERO)
- Emergency facilities and equipment
- Readiness assurance.

SRS is a 310 square mile (198,344 acres) site, located south of Aiken, South Carolina. SRS encompasses parts of Aiken, Barnwell, and Allendale counties and is bordered on the west by the Savannah River and Georgia. The primary missions performed at the TF are the reclamation of previously used tritium reservoirs; receipt, packaging, and shipping of reservoirs; recycling, extraction, and enrichment of tritium gas in support of the maintenance of the nuclear weapons stockpile, including the U.S. stockpile of tritium; limited-life component exchange reservoir surveillance; and tritium extraction in support of the maintenance of the nuclear weapons stockpile.

Independent Oversight assessed the comprehensiveness of the response capabilities identified by the facilities' analyses, the level of preparedness in terms of attaining and maintaining the needed response

capabilities, and the readiness assurance program. At the site level, line management oversight responsibility for most SRS operations and safety is under the manager of the U.S. Department of Energy (DOE) Savannah River Operations Office (DOE-SR). DOE-SR provides support to the NNSA-SRSO in many technical and administrative areas, including line oversight of emergency management at the SRS TF. DOE-SR, NNSA-SRSO, Savannah River Nuclear Solutions, LLC (SRNS), and Wackenhut Services Incorporated-Savannah River Site (WSI-SRS) have jointly produced the *SRS Emergency Plan* (Manual SCD-7) to provide a consistent, coordinated approach to emergency response and mitigation at SRS. Appendix F of the *SRS Emergency Plan* (Manual SCD-7, Annex F) describes the specific implementation of the emergency plan at the NNSA-SRSO Tritium Programs.

For all safeguards and security events occurring at SRS, DOE-SR provides overall direction and management of response operations and post-incident activities. These operations are closely coordinated with all affected facilities. For events originating in a tritium facility, NNSA-SRSO provides oversight of the TF response operations, in close coordination with DOE-SR and SRNS (emergency support services). Additionally, DOE-SR administers oversight of the TF emergency management program, including readiness assurance. Operationally and administratively, the effectiveness of the Tritium Program emergency management program is reliant upon the integration and cooperation of NNSA-SRSO, DOE-SR, and SRNS.

The scope of the review was consistent with Objectives 1 through 4 of HSS Criteria, Review, and Approach Document 45-54, *Emergency Management Program Inspection Criteria, Approach, and Lines of Inquiry, Review of Preparedness for Severe NPEs at the Savannah River Site Tritium Facility*. As stated in the *Plan for the Independent Oversight Review of Site Preparedness for Severe NPEs at the Savannah River Site Tritium Facility*, dated August 2012, the purpose of the review was to determine whether:

1) Plausible scenarios representing severe NPEs at the TF are analyzed to determine capabilities needed for an effective emergency response.
2) A mechanism is provided for determining quickly whether an event at the TF results in the loss of a significant quantity of hazardous material (HAZMAT) and is beyond the site's capability to respond.
3) The site and TF have the emergency response functions and equipment necessary to maintain a viable, integrated, and coordinated response to plausible NPEs.
4) NNSA-SRSO periodically reviews and evaluates the ability of the contractor-operated TF to meet requirements of the Emergency Management System.

Since DOE-SR and NNSA-SRSO have agreed to provide programmatic oversight of the SRNS emergency management program along the same lines of responsibility defined in the *SRS Emergency Plan*, DOE-SR has assumed primary responsibility for ensuring that an effective readiness assurance program is implemented and maintained. Therefore, DOE-SR program oversight of the TF emergency management program was also addressed in this review.

3.0 BACKGROUND

Numerous examples of severe NPEs and other catastrophic events, such as earthquakes, tornadoes, floods, wildland fires, and manmade disasters, have emphasized the need to adequately plan and prepare for a large-scale event that could degrade or overwhelm a site’s emergency response capability. Emergency planners at NNSA/DOE sites determine needed site emergency response capabilities based on site-specific attributes, such as types and forms of HAZMAT, demographics, and geography, using a variety of deterministic analyses. The primary means for determining needed response capabilities are the emergency planning hazards assessments (EPHAs). The analysis contained in the EPHAs should

describe a spectrum of events that represent plausible HAZMAT release scenarios, such as operator errors, mechanical failures, fires, and explosions from unintentional or intentional initiators.

The facility-specific documented safety analysis (DSA) report contains scenarios used by personnel to reduce risk from operations to acceptable levels; these scenarios are referred to as design basis events. When establishing a facility design, DSAs do not analyze events that exceed in severity the parameters defined for the design basis event. Such "beyond design basis events" (BDBEs) include severe NPEs that represent the upper end of the consequence spectrum for which NNSA/DOE facilities are required to prepare, in accordance with DOE Order 151.1C, *Comprehensive Emergency Management System*.

To prepare for a BDBE, emergency response staff must plan a means to immediately protect personnel, mitigate the consequences of a potential HAZMAT release, and establish appropriate short-term recovery actions. Preparations include designating alternate emergency response facilities, having redundant and diverse communications systems in case an event renders the primary facilities and equipment unavailable, and other specific planning and response capabilities needed for a comprehensive emergency management program.

Some response capabilities that emergency planners may identify as necessary for the most severe and low-probability events would be a financial burden to maintain on site or could be rendered unavailable if such an event occurred. Therefore, emergency planners must pre-determine a means to acquire these necessary capabilities for use in the site's response to operational emergencies.

4.0 METHODOLOGY

Independent Oversight evaluated the processes for identifying emergency response capabilities and maintaining them in a state of readiness in case of a severe NPE. DOE Order 151.1C identifies the functional emergency response requirements for a DOE site/facility, and the emergency management guides associated with DOE Order 151.1C provide guidance for implementing these requirements. The order and associated guides were used to determine whether DOE requirements and expectations are being met. Independent Oversight also referenced applicable DOE, Federal, state, and local requirements when determining compliance with the DOE order.

This review evaluated the comprehensiveness of the response capabilities identified in the EPHA analysis performed by SRNS for the TF. Of particular interest is the facilities' preparedness for responding to plausible severe NPEs. Considerations for this review include:

- The severity of events that serve as the basis for the facilities' emergency response capability
- The timely recognition that an event exceeds the facilities' response capability
- The ability of personnel to perform required emergency response functions during severe NPEs
- The effectiveness of NNSA-SRSO to periodically review and evaluate the SRNS operated TF emergency management system to ensure a state of readiness.

This assessment was accomplished by reviewing the documentation that establishes and governs the SRS/TF emergency management program processes, such as emergency plans, procedures, safety basis documents, program implementing checklists, records of program activities, memoranda of agreement (MOAs); interviewing key personnel; and performing walkdowns of facilities and equipment.

5.0 RESULTS

The following sections discuss the observations made by Independent Oversight during this review, keyed to the objectives in HSS Criteria, Review, and Approach Document 45-51.

5.1 Objective 1: Scenario Analysis

Plausible scenarios representing severe NPEs at the TF are analyzed to determine capabilities needed for an effective emergency response.

Independent Oversight reviewed the process guides that SRNS uses to develop emergency planning hazards surveys (EPHSs) and EPHAs, as well as the EPHS, EPHAs, and safety analysis reports (SARs) for the TF. The EPHS and EPHAs were reviewed to determine the accuracy and adequacy of analyses conducted for severe NPEs. The SARs were reviewed to determine the consistency of the BDBEs identified in the SARs and EPHAs. Additionally, the EPHAs were reviewed to determine whether the documents identified the needed emergency response capabilities for severe NPEs, and served as the basis for event classification and pre-planned protective actions.

Independent Oversight determined that SRNS has mostly analyzed plausible scenarios representing severe NPEs and factored those assessments into the determination of needed ERO capabilities. However, although SRNS adequately analyzed plausible scenarios representing severe NPEs in the EPHAs, the *EPHA for the Tritium Extraction Facility (TEF*) (S-EHA-H-00009) does not contain consequence analyses specific to severe NPEs.

DOE Order 151.1C requires development of an EPHS to examine the features and characteristics of the facilities and activities, and to identify generic emergency events and conditions, including NPEs such as earthquakes and tornadoes, and the potential impacts of such emergencies. This order also requires that if the EPHS identifies specific HAZMAT and quantities that, if released, could result in an operational emergency by causing an airborne health hazard, the potential release of these materials require further analysis in an EPHA. Additionally, DOE Guide 151.1-2, *Technical Planning Basis Emergency Management Guide (EMG)*, recommends that analyses in the EPHA calculate the consequences at specific receptors of interest (i.e., facility boundary, onsite receptor locations, site boundary, and offsite locations of interest) and calculate the maximum distances at which consequences exceed the applicable protective action criteria (PAC) used to develop default initial protective actions.

SRNS EPHSs are developed and maintained per the *Development and Maintenance of an EPHS* (EMPP 6Q-011) procedure. This procedure provides detailed instructions on the methodology, content, roles, and responsibilities for developing the EPHS. The EPHS procedure appropriately identifies SRNS, NNSA-SRSO, and DOE-SR roles and responsibilities for reviewing and approving EPHSs and includes mechanisms for facility/project managers to validate EPHS contents. For NPE consideration, the EPHS development procedure identifies wind, tornados, floods, earthquakes, and wildland fires as potential initiating events. SRNS developed the *Hazards Survey for H-Area* (S-EHS-H-00001) per the *Development and Maintenance of an EPHS* procedure, which includes TF. The EPHS incorporates the provisions of DOE Order 151.1C and DOE Guide 151.1-2 and provides detailed information for each building within the TF. The EPHS adequately identifies HAZMAT that could become an airborne hazard at the respective buildings due to a severe NPE.

Additionally, SRNS considered flooding in the EPHS as a release mechanism, but justifiably did not analyze for flooding in the EPHAs. Flood analyses detailed in the *DSA Support Document – Site Characteristics and Program Descriptions* (WSRC-IM-2004-00008) indicate the H-Area is located on a

relatively elevated region of the SRS and is approximately 125 feet higher in elevation than the analyzed probable maximum flood elevation.

SRNS EPHAs are developed and maintained per the *Development and Maintenance of an EPHA* (EMPP 6Q-001) procedure. This procedure provides detailed instructions on the methodology, content, roles, and responsibilities for developing EPHAs. The EPHA procedure appropriately identifies SRNS, NNSA-SRSO, and DOE-SR roles and responsibilities for reviewing and approving the documents and includes mechanisms for facility/project managers to validate the contents of the EPHAs. The EPHA development procedure adequately serves as an EPHA technical review guideline and generally incorporates the requirements of DOE Order 151.1C and the guidance of DOE Guide 151.1-2; however, the procedure does not identify natural phenomena initiating events or severe NPEs for consideration and consequence assessment analysis during the development of the EPHA. (See Section 8.0, **OFI 1**.)

SRNS developed two EPHAs for the Tritium Complex: *EPHA for the Tritium Extraction Facility (TEF*) and *EPHA for the Tritium Facilities* (S-EHA-H-00006). Although not required by the EPHA development procedure, SRNS developed the *EPHA for the Tritium Facilities* with the inclusion of a consequence analysis for a severe NPE. SRNS appropriately identified the loss of Building 233-H containment and fire with ground-level release of tritium as the most severe NPE for the HANM building in the *EPHA for the Tritium Facilities*. The accident scenario initiator is a severe NPE (i.e., earthquake with greater than 0.2 ground acceleration, high winds greater than 133 miles per hour (mph), or tornado with a 3-second wind speed of 180 mph and atmospheric pressure change of 70 pounds per square foot (psf) at a maximum rate of 31 psf per second). The consequence analysis for this event indicates that the maximum distance from the release point to PAC (1 rem) is 10,700 meters (m) and to the threshold for early lethality (TEL), or 100 rem, is 260 m. SRNS adequately analyzed the severe NPE in the *EPHA for the Tritium Facilities*.

However, SRNS did not consider a severe NPE in the development of the *EPHA for the TEF*; the EPHA unjustifiably bounds the consequences for a severe NPE using the analysis for an extreme malevolent scenario. The malevolent act scenario results in the loss of the Remote Handling Building containment system and a fire causing a ground-level release of tritium. The consequence analysis for this event indicates that the maximum distance from the release point to PAC is 8,300 m and to TEL is 360 m. SRNS adequately analyzed the extreme malevolent act event in the *EPHA for the TEF*; however, because of the weaknesses in the EPHA development procedure (discussed above), the *EPHA for the TEF* does not contain consequence analyses specific to severe NPEs for use in developing EALs. (See Section 8.0, **OFI 1**.)

Overall, SRNS developed an EPHS for the TF that identifies HAZMAT that could result in an airborne release initiated by severe NPEs, as well as EPHAs that quantitatively analyze and document the consequences of these events. SRNS appropriately analyzed a severe NPE at the HANM and adequately analyzed a bounding worst-case scenario representative of a severe NPE at the TEF in their respective EPHAs. SRNS based the TF ERO capability on the consequence assessment results contained in the EPHAs. However, as noted above, the TEF EPHA does not contain consequence analyses specific to severe NPEs or analytical justification that the malevolent act bounds severe NPE.

5.2 Objective 2: HAZMAT Release Determination

A mechanism is provided for determining quickly whether an event at the TF results in the loss of a significant quantity of HAZMAT and is beyond the site's capability to respond.

Independent Oversight reviewed the EAL statements contained in the TF EPHAs to determine whether the EALs are based on the documented consequence analyses. Independent Oversight also reviewed the

Emergency Classification (EALs) (EPIP TRIT-001) and *Emergency Categorization and Classification* (Manual 6Q15.1, Procedure 114) procedures, which the facility emergency coordinators (FECs) use to determine initial protective actions, to ensure that the EALs are based on the EPHA conclusions. Independent Oversight also reviewed the EALs to determine their usability during plausible severe NPEs (e.g., seismic event destroying multiple facilities on site) that would overwhelm the site's response capability. Additionally, Independent Oversight interviewed FECs to discuss the actions they would implement should a severe NPE occur at the TF.

Independent Oversight determined that SRNS has a means for quickly establishing whether a TF event results in the loss of a significant quantity of radiological material that is beyond the facility's capability to respond via EALs. However, SRNS has not included distances to PAC in the TEF EALs to quickly establish the necessary protective actions.

DOE Order 151.1C requires the development of EALs for the potential operational emergencies identified in the EPHA, which must include protective actions corresponding to each EAL. Additionally, DOE Guide 151.1-2 recommends that EALs contain event indicators that are prompt, unambiguous, and reliably associated with the event or condition.

SRNS implemented the *Standards for Development and Maintenance of EAL Procedures* (EMPP-6Q-002) which provides adequate instructions for developing and updating EALs using the EPHA results; however, use of the standard did not result in a complete set of EALs in the *Emergency Classification (EALs)* procedure. For most of the events analyzed in the EPHAs, SRNS developed an appropriate set of EALs based on building- or activity-specific symptoms and event initiators. SRNS based the EALs for the TF on the consequence assessments documented in the respective EPHAs.

Although SRNS developed an EAL for a severe NPE at HANM, which includes a seismic event with follow-on fire, SRNS has not developed an EAL specific to a severe NPE at TEF. Further, SRNS has not analyzed the consequences from multiple facility failures to establish a TF NPE EAL with default protective actions for that case. However, the SRNS emergency director classifies severe NPEs as a general emergency using the site-level general emergency EAL, which is based on DOE G 151.1-2, Section 2.5.1. Neither the TF EPHA nor the TEF EPHA indicates that protective action criteria are exceeded offsite; therefore, TF and TEF have no facility-specific general emergency events requiring protective action recommendations for the public. Protective actions are implemented within a two-mile radius around the incident facility for an alert, extended downwind to the site boundary for a site area emergency or general emergency. It should be noted that SRNS's approach to defining a larger downwind protective action distance is not specifically endorsed by DOE Guide 151.1-4. This guide discourages the use of real-time weather data for initial protective actions and, due to concerns regarding the complexity and timeliness of protective action decision-making, recommends a 360-degree protective action distance utilizing PAC as the initial protective action boundary.

In addition to emergency event classification, the EALs generally provide onsite protective actions for analyzed events. Notably, the HANM EALs identify the impacted tritium inventories by operation, individual room, multiple room, and building, and indicate the maximum distance to PAC associated with each event. The maximum distances to PAC provide the Tritium FECs with important information for determining and implementing appropriate protective actions; however, all HANM EALs include the same default protective actions to evacuate the immediate area and all other personnel remain indoors, which leaves the identification of evacuated areas to the judgment of the Tritium FEC at the time of the event. Further, none of the TEF EALs contain the maximum distance to PAC associated with identified impacted tritium inventories for use in determining where to evacuate and shelter employees. (See Section 8.0, **OFI 2**.)

Overall, SRNS developed EALs for quickly determining whether analyzed events at the TF result in the loss of a significant quantity of HAZMAT and are beyond the site's capability to respond. EALs for events beyond the facility or site's capability to respond are classified as a general emergency as recommended in DOE G 151.1-2, Section 2.5.1. Although TF EALs are based on analyzed event scenarios in the EPHAs, protective actions are not clearly defined. Most EALs provide information to determine the area where protective actions are required, but do not clearly distinguish where evacuations are required based on calculated exposures in the EPHAs. The exception is the TEF EALs, which do not establish where any protective actions are required.

5.3 Objective 3: Emergency Equipment and Facilities

The site and TF have the emergency response functions and equipment necessary to maintain a viable, integrated, and coordinated response to plausible NPEs.

Independent Oversight reviewed the equipment associated with the HANM, TEF, Operations Support Center (OSC), and designated shelter buildings that are among the critical functions needed for a response to an emergency at the TF caused by a severe NPE. The equipment includes:

- Normal and backup power systems
- Emergency response equipment
- Personal protective equipment (PPE)
- Radiation and oxygen detection equipment.

In addition, Independent Oversight reviewed response capabilities at the TF command centers, and at three TF nuclear buildings, 233-H (HANM), 264-H (TEF), and 234-H, as well as the facility's ERO planning for a response to a severe NPE.

TF relies on three emergency response command centers to coordinate and manage the response to an emergency: the HANM control room in Building 233-H, the TEF control room in Building 264-H, and the OSC in Building 248-H. The HANM control room serves as the primary command center for operational emergencies affecting the TF area. The TEF control room serves as command center for operational emergencies only affecting TEF. The OSC is the designated location for dispatching TF emergency response teams and coordinating response activities in the incident facility. A facility-specific FEC staffs each control room continuously and monitors the day-to-day operations at their facility. Workers report onsite emergencies to the affected facility FEC, who gathers specific information relating to the incident; activates the TF ERO; makes operational emergency notifications to the emergency duty officer (EDO), H-Area emergency coordinator (AEC), and the central alarm station (CAS); performs categorization and classification of events originating at and limited to the TF; and implements protective actions within TF.

Independent Oversight determined that the facility's emergency response capabilities are in an adequate state of readiness to perform the required emergency response functions during plausible NPEs. Independent Oversight also identified specific areas for improvement in testing fire alarm monitoring and alarm panel batteries, preparing for a response to an NPE resulting in a tritium release, and resolving differences in the TEF and HANM response procedures. These OFIs are identified in Section 8.0.

Normal and Backup Power Systems

Independent Oversight reviewed normal power to the TF and backup power sources for HANM, TEF, emergency response equipment in the OSC, and badge readers used to perform personnel accountability.

Independent Oversight analyzed the reliability of power supplies by reviewing system design documents and inspection, maintenance, and test program procedures against industry and DOE standards for the design, maintenance, and testing of emergency power supply systems. The review also evaluated the TF capability to provide long-term emergency power by reviewing generator refueling plans. Independent Oversight reviewed battery-backed systems to determine their service times and to identify the equipment lost during a long-term loss of alternating current (AC) power and the resulting potential consequences. Independent Oversight reviewed design, maintenance, and test documents; interviewed personnel; and performed system walkdowns to make its conclusions.

DOE Order 151.1C does not contain prescriptive requirements for normal and backup power systems supporting command systems and response equipment; rather, this order requires provisions for an alternate location if the primary command center is not available. In addition, DOE Order 151.1C requires the site to maintain facilities and equipment adequate to support critical response functions and ensure that the facilities and equipment are available and operable. DOE Guide 151.1-4, *Response Elements EMG*, further recommends that the command center that is intended for the site emergency operations center rather than a facility command center have alternate power supplies and that the alternate command center be located to minimize the risk of losing both facilities from the same event due to habitability concerns. Independent Oversight considered these principles during its evaluation of TF command centers. DOE Guide 151.1-4 defines a habitable command center as one capable of remaining operable and life supporting for an extended period under accident conditions and maintaining its structural integrity under various design basis events, including a severe NPE. A habitable command center must maintain a breathable atmosphere, provide sufficient shielding from radioactive material and other HAZMAT, and have a backup emergency power supply. Additionally, DOE Guide 151.1-4 establishes performance criteria (PC) for equipment to undergo periodic inspections, operational checks, calibration, preventive maintenance, and testing in accordance with the manufacturer's recommendations or applicable industry standards.

Independent Oversight used DOE-STD-3003-2000, *Backup Power Sources for DOE Facilities*, as the benchmark for determining backup power supply reliability. This DOE standard applies National Fire Protection Association (NFPA)-110, *Standard for Emergency and Standby Power Systems*; NFPA-111, *Standard on Stored Electrical Energy Emergency and Standby Power Systems*; and applicable Institute of Electrical and Electronics Engineers standards to engine generators and uninterruptible power supply (UPS) systems for equipment that protects the public, site workers, and the environment. The DOE standard establishes general and detailed requirements for reliable backup and emergency sources, regardless of the type of DOE facility using backup power systems for important equipment. The DOE standard identifies nuclear safety systems, radiation monitors and alarms, fire protection systems, security systems, data processing equipment, and emergency lighting as examples of important equipment. Importantly, the standard's requirements apply only if contractual documents, procurement documents, or the authorization basis for a facility invokes the standard. Per SRNS's *Standards/Requirements Identification Document, Functional Area 12.0, Fire Protection* (SRNS-RP-2008-00086-012-M&O), SRNS did not invoke the DOE standard; however, SRNS has performed and documented an analysis in applicable TF building Fire Hazards Analysis reports of the backup power sources and the equipment powered from them for application of the NFPA-110 standard. SRNS determined that the TF diesel generators do not power life safety equipment and are not required to meet the NFPA-110 standard. In addition, Independent Oversight concluded that TF communications, lighting, monitoring and alarm systems, and personnel accountability systems are not solely dependent on diesel generators. These systems have additional battery-backed power systems capable of lasting a minimum of 20 to 60 minutes, depending on the system, to complete emergency management functions.

Normal Power

Four public utility companies provide normal power to the SRS electrical distribution system through five different substations. The SRS electrical distribution system provides normal power to SRS areas through a dual loop overhead distribution with manual cross-connect capability. SRS areas are letter designated geographical boundaries under a common management structure. TF is a part of H-Area. Area substations further distribute power to individual buildings. Overall, the SRS electrical distribution design provides a reasonably reliable source of offsite power to the TF.

Backup Power

In case of a loss of normal power to the TF, most TF buildings are equipped with a fixed diesel generator that automatically starts as a source of long-term backup power. Buildings with fixed diesel generators do not have a receptacle for installing a portable generator; therefore, mobile generators are not a part of the TF backup power plan. The HANM is equipped with a 750-kilowatt (kW) diesel generator, TEF is equipped with a 1000-kW diesel generator, and the badge readers' backup power is from a 350-kW diesel generator from outside of TF. The building housing the TF OSC (Building 248-H) is not equipped with a diesel generator, so SRNS is prepared to relocate the OSC functions to one of two alternate buildings. Building description discussions later in this section provide details regarding the HANM and TF diesel generators and the OSC relocation plans.

The diesel generator serving as backup power to the badge readers is located outside of the TF and is managed by the SRS protective force organization. This 350-kW diesel generator is adequately tested and maintained as a standby generator by automatically start testing it monthly and by maintaining it in accordance with the sitewide diesel generator predictive and preventive maintenance program for standby generators, as described in procedure *Engine Driven Generator Annual Preventive Maintenance* (10-13018). As a standby generator (rather than an emergency generator), the annual preventive maintenance is performed on a biennial frequency, while predictive maintenance checks are on a semi-annual frequency. The diesel generator's 480-gallon supply tank ensures a minimum of 8 hours of operation without refueling and an annual fuel purity test ensures additional reliability.

During a loss of normal and diesel generator AC power at the TF, battery-backed power provides continuous power to critical loads and consists of central UPS systems; small, dedicated UPS units; and individual batteries (discussed later for the TF nuclear facilities). A central UPS system managed by the protective force organization provides continuous power to the badge readers upon a loss of normal power and provides at least 20 minutes of power if the diesel generator does not start or load. The protective force organization adequately maintains this UPS system via procedure *Annual Preventive Maintenance Powerware Series 9390 UPS* (MI-SS-08-0033). This maintenance procedure requires annual cleanings and inspections, float charge and battery voltage checks, and a 20-minute load test using connected loads.

Batteries provide normal or backup power to emergency lights and fire alarm and monitoring panels. SRNS adequately tests and maintains TF emergency lights via procedure *Emergency Lighting Unit (ELU)/Exit-ELU Combination Unit Inspection/Functional Check* (PP T-774500). This procedure meets NFPA Code 101, *Life Safety Code*, by requiring an annual 90-minute functional check and a monthly 30-second functional check, as well as visual inspections of equipment and operating status indicators.

Although SRNS personnel describe an adequate test program for fire alarm and monitoring panel batteries, test procedures and records do not provide sufficient details on how to perform battery load testing and whether the test results are acceptable. For example, SRNS load tests the batteries for 24 hours when panels are first installed and annually thereafter via procedures similar to *233-000H Facility*

Fire System Test – Annual (TRI-233000H-AN). SRNS also performs semi-annual battery checks and replaces batteries after four years of service. However, the annual load and discharge test procedure, *233-000H Facility Fire System Test – Annual*, does not describe how to perform the load and discharge test, establish test acceptance criteria, or provide a record of test results. SRNS considers this test skill-of-the-craft for test personnel. SRNS test personnel stated that they measure the battery capacity to ensure it is a minimum of 80-percent capacity using special test equipment and the test equipment manufacturer's operating instructions; if not, maintenance personnel replace the battery. (See Section 8.0, **OFI 3**.)

SRNS implements an adequate diesel generator test and maintenance program for TF standby generators via a sitewide program of preventive and predictive maintenance and start and load tests. SRNS personnel perform inspections for leaks and equipment wear, and analyze coolant and oil every six months as part of a predictive maintenance program via checklist *Engine and Generator Predictive Maintenance Check Sheet* (DSL-00023-00). SRNS performs a more comprehensive inspection and cleaning, instrument calibrations, and a 30-minute load test, using maximum available connected loads, via procedure *Engine Driven Generator Annual Preventive Maintenance* on a biennial frequency. SRNS operating personnel also perform monthly start tests as described in later building discussions.

Refueling Plans

SRNS adequately plans for the long-term refueling of diesel generators by maintaining:

- An onsite fuel supply via two 10,000-gallon bulk storage tanks in N-Area
- Two 1000-gallon diesel delivery trucks (two additional trucks are also available from another SRS organization as well as a 500-gallon fuel delivery nurse tanker reserved for emergency diesel generators)
- Contracts with two local suppliers with large fuel reserves to replenish bulk storage tanks or directly to SRNS delivery trucks.

Further, fuel suppliers provide a fuel analysis and SRNS performs additional tests via procedure *Diesel Fuel Tanks 715-N Delivery and Diesel Fuel Sampling* (SOP-DFUEL-01) upon delivery. SRNS also analyzes fuel in supply tanks annually and in SRNS fuel delivery trucks on their first fill after trucks return from maintenance on the truck's tank or piping.

Overall, the TF has an adequate normal power distribution system and capability to provide backup power to important loads from standby diesel generators. Additionally, UPS and batteries provide continuous power for at least 20 minutes to equipment needed to support implementation of protective actions in case diesel generators cannot provide backup power. SRNS adequately tests and maintains these backup power sources as a means to ensure they will perform as expected. Further, SRNS has adequate refueling plans to sustain long-term operations at TF using fixed diesel generators. However, the fire monitoring and alarm panel test procedure does not describe how to perform the required load and discharge test, establish test acceptance criteria, or provide a record of test results.

Emergency Response Equipment

Independent Oversight walked down and reviewed the essential emergency response equipment maintained for use during emergency events or situations, along with the relevant inventory checklists and processes for any required maintenance and periodic testing of equipment.

DOE Order 151.1C requires that adequate emergency response equipment be available and operable to meet the needs determined by the results of the EPHAs. For TF, the only HAZMAT is in the form of

radioactive tritium. In addition, DOE Guide 151.1-4 states that periodic inspections and testing of equipment should be carried out in accordance with the manufacturer's instructions.

TF provides adequate emergency response equipment, and other emergency supplies, necessary to maintain a viable, integrated, and coordinated response to plausible severe NPEs. TF appropriately identified specialized equipment that is essential to emergency response. Emergency equipment cabinets containing equipment, PPE, spill kits, and medical supplies are located in the HANM control room in Building 233-H, the TEF control room in Building 264-H, the OSC in Building 248-H, alternate OSCs in Buildings 249-H and 264-H, and in designated shelter buildings. Additionally, portable oxygen and tritium monitors are readily available in each control room and the OSC. Facility shift operations managers (SOMs) ensure availability and operability of the emergency equipment and conduct monthly audits and quarterly inventories and inspections, operational checks, preventive maintenance, and testing of the equipment per the *Emergency Preparedness Program Administration* (EPAP TRIT-310) procedure and *Emergency Equipment Cabinet Inspection* (OSR-49-802) checklist. Monthly inspections of equipment cabinets are conducted to ensure break-away seals are intact. If the seal is broken, a complete inventory of the cabinet is performed and a new seal installed. Quarterly inventories and inspections are conducted to ensure availability and operability of equipment, replace any out-of-date inventories, and check all rubber or cloth goods for deterioration.

Overall, appropriate emergency response equipment for response to a severe NPE is available in control rooms, the OSC, and designated shelter buildings. Facility SOMs properly maintain the equipment and ensure availability and operability.

Personal Protective Equipment

Independent Oversight reviewed the essential PPE used by the Radiological Protection Department (RPD) inspectors who perform decontamination, and the processes for required maintenance and periodic testing of equipment.

DOE Order 151.1C requires that adequate PPE be available and operable to meet the needs determined by the results of the EPHAs. In addition, DOE Guide 151.1-4 states that periodic inspections and testing of equipment should be carried out in accordance with the manufacturer's instructions.

TF appropriately identified PPE that is essential to emergency response. The RPD inspectors are supplied with plastic suits (tritium suits), negative pressure air purifying respirators, surgical gloves, and emergency supplies to meet the needs identified by the EPHAs. Additionally, the RPD has assembled grab-and-go emergency bags for the RPD inspectors for emergency events. The grab-and-go bags contain supplies needed to conduct surface contamination sampling (e.g., swipes, vials). The RPD inspectors conduct quarterly inventories and inspections, operational checks, preventive maintenance, and testing of the PPE to ensure availability and operability.

Overall, appropriate PPE for response to a severe NPE is available for the RPD inspectors. The RPD inspectors properly maintain their PPE to ensure equipment availability and operability.

Radiation and Oxygen Detection Equipment

Independent Oversight walked down the essential radiation and oxygen detection equipment used by the RPD inspectors and reviewed the relevant inventory checklists and processes for required maintenance and testing of the equipment.

DOE Order 151.1C requires that adequate radiation detection equipment be available and operable to meet the needs determined by the results of the EPHAs. In addition, DOE Guide 151.1-4 states that sites should perform periodic inspections and testing of equipment in accordance with the manufacturer's instructions.

The EPHS and EPHA processes have established radiological exposures from tritium and oxygen deficiencies resulting from releases of inert process gases as the sole respiratory hazards at TF; there are no hazardous chemicals at TF that exceed screening quantities. SRNS has procedures that adequately provide emergency monitoring and radiological control instructions to personnel during normal operations and radiological events or incidents at the TF, as recommended in DOE Guide 151.1-4. The RPD inspectors monitor for radiological airborne and surface contamination hazards, as well as oxygen deficiencies, associated with the most significant scenarios identified in the EPHAs. SRNS tasks the RPD inspectors with facilitating the safe evacuation of employees from the work place and immediate work area using portable oxygen and tritium monitors. RPD inspectors are responsible for monitoring, sampling, and ensuring that the capability (e.g., procedures, equipment) to perform these tasks is maintained in a state of readiness. RPD conducts periodic inspections, operational checks, calibration, preventive maintenance, and testing as required by manufacturer's instructions and industry standards.

Overall, radiological protection processes ensure adequate monitoring of radiological airborne and surface contamination from tritium and oxygen deficiency during emergency events. Additionally, an adequate quantity of operable and calibrated radiation and oxygen detection equipment is available to respond to an onsite radiological release caused by a severe NPE.

TF Command Centers

Independent Oversight reviewed the TF command centers' documented capability to withstand analyzed severe NPEs and their ability to survive and enable the ERO to remain in a safe environment to perform its emergency response functions. Facilities of interest include the HANM control room in Building 233-H, the TEF control room in Building 264-H, and the OSC in Building 248-H. Key systems of interest include alert and warning systems, communication systems, habitability systems, and backup power sources.

Background

For an operational emergency originating in TF, a Tritium FEC leads the TF ERO and communicates event information, including protective actions and classification decisions, to the H-Area AEC and the site-level EDO located in the SRS operations center (SRSOC) in A-Area near the SRS emergency operations center. The SRSOC serves as the SRS 911 emergency call center. The FEC is a qualified ERO employee from the facility in which the event originates unless it affects multiple facilities within the TF. For events affecting multiple facilities, the FEC is at the HANM control room, which serves as the TF central control room. The TF FEC's responsibilities include making operational emergency notifications to the EDO, H-Area AEC, and the TF CAS; performing categorization and classification of events originating at and limited to the TF; and implementing protective actions within TF. The TEF command center has a designated alternate location in HANM, and the OSC has designated alternate locations in TEF and Building 249-H.

H-Area New Manufacturing – Building 233-H

HANM's control room, located in a hardened facility expected to survive all but the most severe NPEs, is TF's central control room serving as the primary command center for operational emergencies affecting the TF area. The HANM FEC resides in the central control room and communicates with the H-Area

AEC via a ring-down phone, and has dedicated communications with the EDO and other SRS stations via a selective signaling terminal (SST). Telephones and radios provide backup means of communications to these systems.

The HANM control room is equipped with a ventilation system, separate from the main building's ventilation system, that draws in outside air to pressurize and recirculate the control room atmosphere, but the system is not capable of removing airborne contaminants. A tritium air monitoring system monitors the HANM control room atmosphere and provides an alarm in the control room for high tritium activity. Similarly, an oxygen monitoring and alarm system alerts control room personnel of low oxygen levels in various process rooms and corridors to alert control room personnel of low oxygen levels. Control room personnel are adequately prepared to evacuate the control room via procedure *Response to 233-H Control Room Abandonment* (AOP 233-61400), detailed later, as this procedure also serves as the 233-H safe shutdown procedure.

As the primary TF emergency command center, the HANM control room is equipped with the following capabilities.

- An SST
- A ring-down phone to the H-Area AEC
- A Safety Alarm System (SAS) (for warning alert tones)
- A public address (PA) system
- A facsimile machine
- Handheld radios for use at the incident command post
- Building ventilation controls
- Control room air recirculation ventilation system controls
- Plant alarm enunciators
- Fixed tritium air monitoring
- Fixed corridor oxygen monitoring (allowing safe building egress from control room)
- TEF monitoring and control (for abandonment of TEF control room to the 233-H control room)
- Central training building ventilation shutdown controls
- Encrypted emergency radio amplifier
- TF abnormal operating procedures (AOPs), emergency operating procedures (EOPs) and TF emergency plan implementing procedures (EPIPs).

HANM FECs and radiological support personnel are normally in the HANM control room.

Tritium Extraction Facility – Building 264-H

TEF's control room, located in a hardened building expected to survive all but the most severe NPEs, serves as the command center for operational emergencies only affecting TEF. The HANM control room serves as TEF's alternate command center. Because the TEF FEC uses the same TF EPIPs as the HANM FEC, is part of H-Area, and has the same type of hazards as HANM, an emergency response at TEF is very similar to a response at HANM. Differences in responses at the facilities are due to differences in operations, facilities, equipment, and the function of the HANM control room as the TF central control room.

The TEF control room is equipped with a ventilation system, separate from the main building's ventilation system, that draws in outside air to pressurize and recirculate the control room atmosphere, but the system is not capable of removing airborne contaminants. A tritium air monitoring and alarm system monitors the TEF control room atmosphere and provides an alarm in the control room for high tritium

activity. Similarly, an oxygen monitoring and alarm system alerts control room personnel of low oxygen levels in various process rooms and corridors. Control room personnel are adequately prepared to evacuate the control room via procedure *Response to 264-H Control Room Abandonment* (AOP 264-H-6013), detailed later as this procedure also serves as the 264-H safe shutdown procedure.

To serve as the TEF command center, the TEF control room is equipped with the following capabilities.

- An SST
- A facsimile machine
- Encrypted emergency radio base station and amplifier
- Control room air recirculation ventilation system controls
- Plant alarm enunciators
- Fixed tritium air monitoring
- Fixed corridor oxygen monitoring (enabling safe building egress from control room)
- Central training building ventilation shutdown controls
- AOPs, EOPs, and EPIPs.

The TEF FEC and radiological support personnel are normally in the TEF control room.

Operations Support Center – Building 248-H

The OSC building is a non-process building built to a standard building code and is not expected to survive severe NPEs. OSC alternate locations are in hardened buildings – Buildings 264-H and 249-H. The OSC is a designated location for dispatching TF emergency response teams and coordinating response activities in the incident facility. The OSC has access to emergency supplies needed during emergency mitigation, including encrypted radios and base station and non-encrypted handheld radios and base station to serve as secure and unsecure mobile communications. The OSC backup power consists of a small UPS for the encrypted and non-encrypted radio base stations. All other equipment is portable battery-powered equipment, such as handheld radios and radiation detectors.

Emergency Response Implementation

The TF FEC implements the *SRS Emergency Plan, Tritium Facilities Annex* via a set of operating procedures, AOPs, EOPs, and TF EPIPs. Implementing mechanisms include fixed and portable equipment in the command centers and dedicated storage cabinets, and buildings and equipment within and near the TF fence. Key TF equipment and facilities include communications to the EDO, H-Area AEC, incident commander, TF CAS, TF employees, and between TF control rooms; designated buildings for shelters; controls to shut down heating, ventilation, and air conditioning (HVAC) systems at shelters; designated rally points for evacuation; badge readers and printers for personnel accountability protocols; emergency egress lighting; and fixed and portable radiation and oxygen detection equipment. At TF, the primary respiratory hazards are from fire, tritium, and displacement of oxygen from process nitrogen or argon.

The TF FEC activates the TF ERO and provides alerts and protective action implementing instructions using the SAS and PA system. Telephones, portable speakers, and the H-Area PA system serve as backup communication systems to the TF PA system. Procedure *Emergency Preparedness Program Administration* requires the PA system to be inspected and tested on a semi-annual frequency and is used during drills and exercises. The *Emergency Preparedness Program Administration* requires each facility within Tritium Programs to conduct a minimum of four drills per year with each shift; further, TF uses the

PA system daily during normal operations so there are frequent mechanisms that functionally test the system.

TF uses designated buildings for tornado and airborne HAZMAT shelters that were established via a sitewide evaluation of SRS buildings, as documented in *Evaluations of SRS Buildings for Tornado Protection* (T-TRT-G-00001), because they are hardened facilities expected to survive at least an F-1 tornado. TF has five designated shelters inside the TF Limited Area and three outside of the Limited Area that provide adequate shelter capacity. Tritium emergency response maps, posted in all occupied TF buildings, appropriately identify these shelters in addition to signage on the exterior of the buildings. The TF *FEC Response Actions* (EPIP-TRIT-111) procedure identifies the location and method of shutting down HVAC to non-process buildings to improve the shelters' effectiveness in protecting personnel from airborne contaminants. For process buildings, the FEC directs HVAC operations using the applicable process building operating procedure.

TF uses a primary rally point outside the TF fence on the southeast side of the facilities and an alternate rally point outside the fence on the northwest side of the facilities for TF evacuations. The primary rally point is equipped with four badge readers, and the alternate rally point is equipped with two badge readers. The TF CAS personnel activate these badge readers to enable badge reading for personnel accountability purposes. The rally point coordinator commands the rally point and ensures the rally point badge readers are activated, personnel badges are read, potentially contaminated and clean personnel are segregated, an RPD inspector is dispatched to the rally point, and data is collected. The rally point coordinator reports completion of badge reading to the accountability officer via procedure *Rally Point Coordinator Response Actions* (EPIP-TRIT-117). For building evacuations, the TF accountability coordinators obtain a printout of a missing persons report from the applicable building control room and the visitor entry logbook at the entry control facility via procedure *Accountability Coordinator Response Actions* (EPIP-TRIT-116). If needed, the missing persons report is reconciled with the accountability coordinator's report to further establish personnel accountability. Differences may occur because the missing persons report is based on the badge reader data and evacuees may "crash out" of buildings rather than badge out. If the control room requires evacuation or the building has no power, missing persons reports can be obtained from other control rooms or the TF CAS. The accountability coordinator reconciles the missing persons report with the rally point coordinator report to identify personnel unaccounted for and directs further follow-up regarding their whereabouts, such as contacting their supervisor or using the Area PA system. These rally points will work for many TF operational emergencies but are not used for the TF planned response to an NPE because the emergency operations center will direct a TF evacuation using the site-level general emergency EAL for severe NPEs.

SRNS activates the site ERO to provide overall management of a response to a severe NPE, because the consequences are likely to extend beyond the TF ERO capability. Locally, TF has adequately prepared to respond to NPEs via procedure *Response to Severe Weather and Natural Disasters* (AOP TRIT-6122). This procedure addresses high winds, severe storms, lightning, tornado warnings, imminent hurricanes, earthquakes, and wildland fires. The procedure adequately integrates TF FEC actions with the actions of the H-Area AEC and the site EDO and TF EPIPs to provide shut down instructions and initiate planned TF protective actions during certain conditions. The TF severe weather procedure addresses automatic and operator actions for actuation of the earthquake confinement system and tornado dampers, as applicable.

Nuclear Facilities

Independent Oversight reviewed the documented capability of HANM, TEF, and Building 234-H to withstand analyzed severe NPEs and their ability to receive protective action information, implement planned protective actions, and conduct personnel accountability after an evacuation. Key systems of

interest included communications, power supplies, and facilities and equipment used to perform protective actions, such as assembly stations, shelters, accountability mechanisms, ventilation system controls, AOPs, EOPs, and safe shutdown protocols.

HANM

HANM is a hazard category 2 nuclear facility because of the significant quantities of tritium in the facility. The primary mission of HANM is to safely unload tritium reservoirs, purify tritium, and load tritium reservoirs. The HANM building is an underground reinforced concrete structure, designed and constructed under an E. I. DuPont specification that pre-dates PC, but is similar to PC-3. A July 2012 SRNS structural evaluation of SRS buildings, documented in *Evaluation of SRS Buildings for Tornado Protection*, concluded that the HANM facility could survive a design basis earthquake having a 0.2 gravitational force peak horizontal acceleration. The HANM underground construction further protects the facility from tornados. SRNS personnel conduct biennial evaluations of the HAMN structure using procedure *Tritium Facilities Structural Integrity Program* (SOP-TRIT-5027) to maintain the PC-3 equivalent rating.

The highest consequence HANM emergency is a site area emergency resulting from a ground-level release of tritium oxide during a building fire. SRNS developed an adequate EAL for this event as described in Section 5.2. Such a release could result from a fire involving a large quantity of tritium and a breach in the building. HANM design features to preclude this event include primary confinements, such as process piping and vessels, and secondary confinements, in the form of gloveboxes. To prevent flammable and explosive mixtures forming in gloveboxes due to primary confinement leaks, the gloveboxes are inerted with nitrogen. A closed stripper system circulates the nitrogen and removes tritium and other impurities. The HANM building is also equipped with a ventilation system to keep building pressure lower than outside pressure, and building differential pressures are controlled to ensure building air cascades from office areas to process areas and out of the building exhaust stack. To alert personnel of the dangers of a tritium or a nitrogen release, HANM has tritium air monitors and oxygen monitors throughout the building to detect the condition and actuate alarms. HANM is also equipped with seismic monitors that will close designated tritium mix tanks and some tritium bed isolation valves if the monitor's ground acceleration setpoint is exceeded. Furthermore, the HANM ventilation system is equipped with tornado dampers to isolate the facility during the design basis tornado. Barometric pressure switches actuate the tornado dampers for low pressure conditions created during a tornado or hurricane NPE.

High tritium activity and low oxygen levels cause alarms to activate in the HANM control room to alert personnel of hazardous conditions. In accordance with procedure, *Response to 233-H Control Room Abandonment*, SRNS provides appropriate instructions for notifying the site EDO of the situation, evacuating nonessential building occupants to a designated shelter (Building 235-H), and relocating control room personnel to a designated building room, if safe to do so. The alternate location is equipped with phone and distributed control system capabilities that enable operators to monitor process parameters. Control room personnel can shut down facility operations under emergency conditions using either of two shutdown switches, if necessary. If the control switches do not work, the procedure details breakers to open to shut down equipment. Furthermore, the *Tritium Facilities Technical Safety Requirements* (WSRC-TS-96-17) specifically addresses HANM tritium air monitoring and oxygen monitoring systems, and has limiting conditions for operation (LCOs), including required actions for inoperable equipment and periodic surveillances to demonstrate operability.

The essential HANM equipment needed to implement employee protective actions are adequately equipped with backup power sources. HANM backup power sources consist of a diesel generator and two central UPS systems. The diesel generator or one of the UPS systems provides backup power to:

- Detection and alarm systems for alerting operators of decreased oxygen or increased tritium in rooms, corridors, and gloveboxes
- Seismic monitors and seismic confinement isolation valves for the seismic confinement system
- UPS room ventilation dampers for purging hydrogen from battery charging operations
- Barometric pressure switches for tornado damper automatic operations
- SAS, PA system, SST, a secure telephone unit, encrypted radio amplifiers, facsimile machine, building intercom systems, and telephones to provide diverse communications
- A printer to support personnel accountability
- Other important facility equipment and spare receptacles.

Additionally, HANM emergency lighting and badge readers are on backup power as previously described.

HANM is equipped with a 750 kW standby generator on the roof of the building in a robust concrete structure; however, no PC rating is associated with the generator or its structure. The diesel generator will automatically start upon loss of normal power or by operator actions, and provides power through automatic transfer switches to power HANM equipment, including both central UPS systems. A dedicated 800-gallon diesel fuel tank provides sufficient fuel to run the diesel generator in excess of eight hours without refueling. The 233-H *Diesel Generator Operation* (SOP 233-20012) procedure requires operators to replenish the tank to full when it drops to 600 gallons to ensure eight hours of operation. SRNS performs adequate testing and maintenance of the 233-H standby generator via the SRNS predictive and preventive maintenance programs previously described and monthly run tests performed by TF operations. SRNS performs an annual fuel purity test of the fuel tank contents to provide additional reliability of the diesel generator.

SRNS was replacing the 233-H central UPS systems (UPS-DCS and UPS-1) during the Independent Oversight review. SRNS had completed the UPS-DCS system installation and initial testing at the conclusion of Independent Oversight's site visit, and the test results were in the review and approval process. SRNS performed the initial test using procedure *UPS-DCS Battery Surveillance Test* (SURV 233-59015) to power a 65 kW test bank load for at least 40 minutes. The preliminary results indicate acceptable performance at nearly 50 minutes when test personnel terminated the test. The test results conservatively establish a minimum 40-minute duty cycle because actual connected load to this 72 kW rated system is approximately 36 kW.

TF operators are prepared to respond to a total loss of power via procedure *Response to Total Loss of Power233-H* (AOP 233-61200). This procedure provides adequate direction to ensure the safety of building personnel by:

- Directing all non-essential personnel to evacuate the building
- Conducting building sweeps by personnel equipped with oxygen and tritium monitors and extra flashlights to give to personnel they may find
- Advising that emergency lighting is available for 90 minutes
- Integrating the loss of power response with the loss of ventilation response procedure
- Directing operators to isolate the building nitrogen supply
- Directing operators to evaluate applicable *Technical Safety Requirements* LCOs (air monitoring, glovebox oxygen monitoring, and conditioning systems)
- Directing operations to restore power.

The loss of all AC power results in fail-safe alignments of process and ventilation systems, and tritium beds will absorb tritium upon loss of power to furnaces; however, the capability to monitor for oxygen and tritium with fixed instrumentation is lost and the loss of building ventilation systems could result in a hazardous atmosphere from the buildup of tritium or nitrogen inside the building. For this case, TF personnel are prepared to monitor for tritium and oxygen using portable instrumentation, as described in the Emergency Response Equipment and Radiation and Oxygen Detection Equipment write-ups of this section.

For a partial or full loss of HANM ventilation, procedure *Response to Loss of 233-H Ventilation* (AOP 233-61300) provides adequate instructions for either condition with a complete loss being the most restrictive. In case all HANM ventilation fails, process rooms are evacuated, nonessential personnel are evacuated from the building, and a two-man rule is implemented (requiring one person to be specially qualified and equipped with portable tritium and oxygen detectors). Additionally, personnel must barricade the exterior building doors to prevent personnel from entering the building.

For oxygen deficiency conditions, procedure *Response to O2 Deficiency or N2 Leak In 233-H* (AOP 233-62400) has operations dispatch an RPD inspector with an oxygen monitor, using a two-man rule, to verify alarm conditions, warn employees via PA announcements, notify the H-Area AEC and EDO, barricade room doors, and provide detailed instructions for isolating nitrogen to each room or by closing the building main cutoff valve.

HANM is prepared for a fire response via procedure *Fire and Fire Alarm Response for Process Buildings* (EOP 264-H-1468) that is consistent with TF EPIPs for implementing evacuations. To support external responders, SRNS has developed pre-fire plans for the HANM that provide important information needed for a safe and effective response.

Overall, construction of the HANM is adequate to survive all but the most severe NPEs. SRNS provides the HANM with sufficient backup power and a long-term refueling capability. SRNS also has adequate capabilities to protect HANM employees during operational emergencies, and adequate procedures to respond to operational emergencies and place the HANM in a safe shutdown condition.

TEF

TEF is a hazard category 2 nuclear facility because of the significant quantities of tritium in the facility. The primary mission of TEF is to safely handle commercially irradiated tritium-producing burnable absorber rods, extract tritium and associated gases from the rods, and remove contaminants from the extracted gases. The TEF building is a reinforced concrete structure, designed and constructed to PC-3. The TEF design basis earthquake and tornado is an earthquake causing a 0.2 gravitational force peak horizontal acceleration and an F-2 tornado, respectively. To maintain this rating, SRNS personnel conduct biennial evaluations of its structure using procedure *Tritium Facilities Structural Integrity Program.*

The highest consequence TEF emergency is a site area emergency resulting from a ground-level release of tritium from the remote handling building during a building fire. Such a release could result from a fire involving a large quantity of tritium and a breach in the building. SRNS has partially addressed this event in a TEF EAL, as described in Section 5.2. TEF design features to preclude this event include primary confinements, such as process piping and vessels, and secondary confinements in the form of gloveboxes. To prevent flammable and explosive mixtures forming in gloveboxes due to primary confinement leaks, the gloveboxes are inerted with nitrogen. TEF also uses argon for the same reason when transporting tritium producing burnable absorber rods. A closed stripper system circulates the nitrogen and removes tritium and other impurities. The TEF building is also equipped with a ventilation system to keep

building pressure lower than outside pressure, and building differential pressures are controlled to ensure building air cascades from office areas to process areas and out of the building exhaust stack. To alert personnel of the dangers of tritium and nitrogen, TEF has tritium air monitors and oxygen monitors throughout the building to detect the condition and cause an alarm. Further, the TEF ventilation system is equipped with tornado dampers to isolate the building during a design basis tornado. Barometric pressure switches actuate the tornado dampers for low pressure conditions created during a tornado or hurricane NPE.

High tritium activity and low oxygen levels cause alarms to activate in the control room to alert personnel of hazardous conditions. SRNS procedure, *Response to 264-H Control Room Abandonment*, provides appropriate instructions for notifying the site EDO of the condition, activating the TF ERO, warning employees via a PA announcement, evacuating designated TEF personnel to the 233-H control room, and relocating other designated control room personnel to a room, if safe to do so, equipped with phone and distributed control system capabilities that enables operators to monitor process parameters. TEF tritium air monitoring and oxygen monitoring systems are addressed in the TEF *Technical Safety Requirements* (S-TSR-H-00005), and have LCOs if equipment is not operable and periodic surveillances to demonstrate operability.

The essential TEF equipment needed to implement employee protective actions are adequately equipped with backup power sources. TEF backup power sources consist of a diesel generator and two central UPS systems. The diesel generator or one of the UPS systems provides backup power to the SAS, a facsimile machine, a printer, encrypted radio amplifiers, the SST, oxygen monitors, and tritium monitors, as well as other important facility equipment. TEF emergency lighting and badge readers are also on backup power as previously described.

TEF is equipped with a 1000 kW standby generator with a PC-2 rating housed in a PC-2 enclosure near TEF. The diesel generator automatically starts upon loss of normal power or by operator actions, and provides power through automatic transfer switches to power TEF equipment, including both central UPS systems. A dedicated 1,700-gallon diesel fuel tank provides a substantial capability to run the diesel generator in excess of eight hours. The *TEF Diesel Generator Operation* (SOP 264-H-2200) procedure requires operators to notify Centralized Trucking for refill whenever the fuel oil tank is less than 59 percent (1000 gallons). The tank is required to be 50-80 percent full to ensure ten hours of diesel generator operating time.

SRNS performs adequate testing and maintenance of the TEF standby generator via the SRNS predictive and preventive maintenance programs previously described and by monthly run tests performed by TF operations. SRNS performs an annual fuel purity test of the fuel tank contents to provide additional reliability of the diesel generator.

The TEF is equipped with two 130 kilovolt-ampere central UPS systems (UPS-1 and UPS-2) to serve as continuous backup power to essential TEF equipment. The TEF safety analysis credits the UPS-2 system to operate for ten minutes to power the area radiation monitoring system, tritium air monitoring system, and glovebox oxygen monitoring system, and has LCOs and surveillance requirements. Although SRNS tests both systems similarly, the technical safety requirement (TSR) requires the following surveillance on the UPS-2 system.

- Operability checks every 72 hours
- Functional tests annually
- Output voltage and frequency displays calibrated annually
- Rated load test every 36 months.

The TSR surveillance requirements for the annual functional test and the rated load test are met by:

- Procedure *TEF Annual UPS Surveillance* (SURV 264-H-5904), which tests the shift of the UPS to battery mode upon loss of normal power and powers connected loads for at least ten minutes.
- Procedure *36-Month UPS Surveillance, Building 264-H* (PP T-710514), which tests the UPS system to provide power at rated capacity for ten minutes using a load bank. The most recent test, performed in 2010, successfully tested UPS-2 for 60 minutes and operating procedures reflect this time.

Similar to HANM, TEF personnel are prepared to respond to fire, tritium activity, low oxygen levels, loss of power, and loss of ventilation by implementing the following procedures (differences from the HANM procedures are noted).

- *Fire and Fire Alarm Response for Process Buildings 264-H and 264*-2H (EOP 264-H-6024).
- Pre-fire plan *Fire Hazards Analysis for the Tritium Extraction facility, Buildings 264-H, 264-1H, 264-2,264-2H, 264-6H, 254-21H, and Support Structures* (F-FHA-H-00059).
- Procedure *Response to 264-H Control Room Abandonment* is consistent with the similar procedure for 233-H, previously described, and directs some TEF control room personnel to the HANM control room. TEF is not equipped with shutdown switches; therefore, TEF shutdown is not performed in this manner.
- Procedure *Response to Oxygen Deficiency In 264-H or 264-2H (U)* (AOP 264-H-6022) provides many of the same instructions as the similar 233-H response procedure, but does not require the two-man rule, an RPD inspector, or provide the same level of detail for isolating inert gas supplies.
- Procedure *Response to Total Loss of Power in TEF* (AOP-H-6003) directs operators to enter an LCO for UPS-2, glovebox oxygen monitors, tritium area monitors, and area radiation monitors, and opens a breaker to secure power to the elevator to preclude movement and possible injuries when power is restored (the HANM UPS is not addressed by the TSR and does not address elevator power supplies).
- Procedure *Response to Reduced or Total Loss of TEF Ventilation* (AOP 264-H-6006) directs the use of temporary fans to ventilate the UPS room or disconnecting UPS to prevent an explosive mixture buildup from hydrogen caused by charging the batteries. The temporary fan is installed at a receptacle that is powered by the TEF standby generator. Ventilating TEF's UPS room is necessary because its UPS system consists of lead-acid batteries that generate hydrogen while charging, while 233-H uses sealed gel-type batteries that do not produce hydrogen.

Independent Oversight observed differences in the TEF and HANM response procedures that should likely be the same, such as whether and how to isolate nitrogen supplies in case of oxygen deficiencies. SRNS has self-identified differences in response procedures that should be similar but has not completed a full assessment of the condition for appropriate procedure revisions. Additionally, the 233-H diesel generator operating procedure states that the generator powers fans and lights for safe and orderly egress from the building, which conflicts with the fire hazards analysis that concludes that the generator is a standby generator based on no life safety code loads. (See Section 8.0, **OFI 4**.)

Overall, construction of the TEF is adequate to survive all but the most severe NPEs. SRNS provides the TEF with sufficient backup power and a long-term refueling capability. TEF also has adequate capabilities to protect TEF employees during operational emergencies and sufficient procedures to respond to operational emergencies and place the TEF in a safe shutdown condition. However, Independent Oversight and SRNS have identified inconsistencies among the TF response procedures that

represent incomplete or incorrect instructions that SRNS should address in further improving TF's emergency preparedness.

Building 234-H

Only portions of Building 234-H are rated to survive an F-2 tornado (winds 113-157 mph), so emergency planners assume that the building will be lost in a severe NPE. The primary function of Building 234-H is the storage of tritium. Tritium is stored in a vault within highly invulnerable encased safes, which are designed to maintain structural integrity and protect tritium stored in containers during compressed gas cylinder impacts, stack collapse events, or seismic events. The worst-case scenario results in a site area emergency from a stack release of tritium in oxide form. An adequate EAL for this event is available for the FEC's use. Personnel in Building 234-H evacuate to a designated shelter or to a rally point in accordance with the TF emergency plan for this event.

Tritium Facilities Emergency Response Organization

Independent Oversight reviewed the TF ERO capabilities that are critical for the local response to an emergency caused by a severe NPE.

DOE Order 151.1C requires that an ERO be established and maintained for each facility/site. This order also requires that the ERO establish effective control at the scene of an emergency event and integrate ERO activities with those of local agencies and organizations that provide onsite response services. Additionally, DOE Guide 151.1-3, *Programmatic Elements EMG*, recommends developing emergency management training and drill programs to ensure that personnel are prepared to respond to, manage, mitigate, and recover from HAZMAT emergencies on site.

The *SRS Emergency Plan, Tritium Facilities Annex* provides the framework for the TF ERO with overall responsibility for initial and ongoing emergency response and consequence mitigation and determination at TF. For operational emergencies, the TF FEC classifies the event and initiates staffing of the applicable TF control room. TF has designated the FEC, with assistance from the shift technical engineer, with full authority and responsibility for coordinating all aspects of the facility emergency response. The TF ERO is composed of the following specifically designated positions.

- FEC for each process facility (for multiple facility impacts, the HANM H-Area SOM is the FEC in command)
- Incident scene coordinator
- Communicator/recorder
- Rally point coordinator
- RPD inspector
- OSC coordinator
- OSC communicator/recorder
- OSC RPD coordinator.

The *SRS Emergency Plan* adequately defines roles and responsibilities, qualification requirements, and response expectations for each ERO cadre position. The *Emergency Preparedness Program Administration* provides specific guidance for the selection and qualification of candidates for the TF ERO. Position-specific procedures, job aids, and checklists provide adequate guidance to TF ERO personnel for making required emergency notifications, determining event categorization and classification, and communicating information. Independent Oversight determined that the ERO meets order requirements for initial training, annual refresher training, and drill participation requirements. TF

has an adequate number of trained ERO members to provide coverage 24 hours a day/7 days a week as established by a duty roster with designated alternates for each position. Further, TF dispatches a radio-equipped ERO member to the incident command post to support the incident commander and communicate with the FEC.

Overall, TF plans and procedures clearly establish TF ERO positions, and all positions are adequately staffed with appropriately trained personnel, including alternate personnel to provide continuous emergency response coverage.

5.4 Objective 4: Readiness Assurance

The NNSA-SRSO periodically reviews and evaluates the ability of the NNSA contractor-operated TF to meet requirements of the Emergency Management System.

5.4.1 Discussion

Independent Oversight examined the processes by which NNSA-SRSO and DOE-SR provide guidance and direction to, and maintain operational awareness of, the SRS emergency management program. The review included an assessment of the NNSA-SRSO and DOE-SR emergency management program oversight processes, and selected aspects of the SRNS emergency management self-assessment process. Independent Oversight determined that NNSA-SRSO periodically reviews and evaluates the ability of SRNS to meet requirements of the Emergency Management System. However, Independent Oversight identified some issues in DOE-SR implementation of oversight processes and SRNS processes for performing internal evaluations (self-assessments) of essential emergency management program elements.

SRS Emergency Management Program Oversight

DOE-SR and the NNSA-SRSO have appropriately established the concept of operations for directing, documenting, and overseeing implementation of the emergency management program at SRS through a compilation of several documents; however, a single document does not exist that describes the all-inclusive processes, as discussed further in the following section. The physical and programmatic boundaries controlled by NNSA determine the division of responsibility between DOE-SR and NNSA-SRSO oversight. For the purposes of this review, Independent Oversight limited its review of the NNSA emergency management responsibilities to the Tritium Programs operations, excluding Defense Programs pit disassembly and conversion and Defense Nuclear Nonproliferation operations (mixed oxide fuel fabrication and waste solidification).

DOE-SR Emergency Management Program establishes the processes for DOE-SR to provide direction and oversight for the SRS emergency management program, including Tritium Programs operations. The procedure requires full implementation of all program elements contained in DOE Order 151.1C. DOE-SR provides further inter-office guidance on how to implement *DOE-SR Emergency Management Program* requirements such as EPHS and EPHA development and review, emergency plan reviews, and emergency readiness assurance plan (ERAP) preparation. Further, DOE-SR recognizes that the *SRS Emergency Plan* serves as the principal document to establish the framework of the SRS emergency management program. *SRS Emergency Plan Tritium Facilities Annex* describes the Tritium Programs specific implementation of the SRS emergency plan. Appropriately, the DOE-SR manager, NNSA-SRSO manager, SRNS president, and WSI-SRS general manager have approved the *SRS Emergency Plan*.

Notably, the TF emergency management program is not stand-alone and is very dependent on having effective SRS sitewide emergency management support services. SRNS has documented the importance

of this dependence in the *Tritium Facilities Safety Analysis Report (SAR) Chapter 15*; *Emergency Preparedness Program* (WSRC-SA-1-2-Vol-2), information specific to TF that is not discussed in the *SRS Emergency Plan* is detailed in this section.

Overall, a compilation of NNSA-SRSO, DOE-SR, and SRNS documents establish the concept of operations for implementing and maintaining emergency management policy and requirements at SRS.

NNSA-SRSO and DOE-SR Emergency Management Oversight

To comply with DOE Order 151.1C, Chapter 1 NNSA-SRSO and DOE-SR must conduct assessments of facility emergency management programs at least once every three years, review SRNS self-assessments annually to ensure compliance with DOE directives and policy, and provide assessment results and conclusions to the Program Secretarial Officer(s) and the NNSA Associate Administrator for Emergency Operations. NNSA-SRSO and DOE-SR have established several appropriate procedures and processes for performing contractor oversight and have implemented an assessment program that establishes their responsibilities in conducting both contractor oversight assessments and self-assessments; however, a comprehensive and integrated description of all processes does not exist. In general, DOE-SR and NNSA-SRSO have divided programmatic oversight along the same lines of responsibility as the construct of the *SRS Emergency Plan.* Specifically, DOE-SR has oversight responsibility for the SRS emergency management program elements described in the *SRS Emergency Plan*, and NNSA-SRSO has oversight responsibility for the Tritium Programs emergency management program described in the *SRS Emergency Plan Tritium Facilities Annex*. The *Integrated Performance Assurance Manual* (SRM 226.1.1D) provides the appropriate structure for planning, scheduling, and implementing the principal DOE-SR assessment program, and the Site Tracking, Analysis, and Reporting System (STAR) supports the assessment tracking process.

NNSA-SRSO and DOE-SR generally perform their SRNS oversight in accordance with their prescribed procedures, but these procedures lack sufficient depth and scope to be very effective. NNSA-SRSO and DOE-SR conducted a suitable number of programmatic assessments and operational awareness activities during the last three years, with no identified findings or OFIs during the previous two years of oversight activities. Additionally, DOE-SR and NNSA-SRSO oversight activities appropriately include frequent observation of facility drills and exercises, participation in the evaluation of the annual site exercise, technical review and approval of EPHSs and EPHAs, and review and approval of the *SRS Emergency Plan* and SRS ERAP. NNSA-SRSO and DOE-SR personnel used a suitable set of objectives and criteria to perform the assessments, but in some areas, the reviews lacked sufficient depth of inquiry to identify issues that might lead to program improvements. Furthermore, the reduced scope and detail of the SRNS self-assessment program, discussed later in this report, diminished the effectiveness of the DOE-SR functional area programmatic assessments. DOE-SR has been concerned about SRNS assessment scope reductions and has made SRNS aware of their concern; however, the desired improvements to the SRNS self-assessment program are not currently in place.

NNSA-SRSO and DOE-SR have received appropriate oversight support from the NNSA Office of Emergency Management Implementation (NA-43) and the DOE-EM Office of Emergency Management (EM-44). The NA-43 and EM-44 oversight activities include regular observation of site exercises, technical review of emergency planning documents, and review of the *SRS Emergency Plan* and SRS ERAP. As required, the ERAP appropriately summarizes the oversight and assessment activities of the SRS emergency management program. Additionally, NA-43 and EM-44 provide overall support to DOE-SR and NNSA-SRSO through frequent telephone contact with respective site offices that includes assistance by addressing specific technical questions and guidance for the general direction of the program.

DOE-SR personnel are also involved and familiar with the site contractors' program activities through a variety of mechanisms, including operational awareness activities during site drills, evaluation of site exercises, participation in the SRS ERO, review of technical planning documents, and involvement in periodic meetings and interactions with SRNS and WSI-SRS emergency management personnel. Furthermore, the implementation of the SRS Emergency Management Integration Council in 2011 promotes the exchange of information between sitewide stakeholders and the Tritium Programs emergency management program.

Although *DOE-SR Emergency Management Program* includes guidance on the emergency management program direction and oversight, the procedure lacks detailed descriptions on how DOE-SR implements oversight requirements, which may result (in some instances) in inconsistent oversight due to reliance on an expert-based process. For example, the procedure lacks detail on the implementation and coordination of oversight activities between DOE-SR and NNSA-SRSO and the process on how DOE-SR and NNSA-SRSO conduct oversight of OST emergency planning, preparedness, and response at SRS. (See Section 8.0, **OFI 5**.)

DOE-SR and NNSA-SRSO effectively manage the issues and corrective actions identified through external and internal assessments. Until recently, the Site Integrated Management Total Assessment System (SIMTAS) supported the DOE-SR corrective action process; currently DOE-SR is transitioning to the STAR system, which provides a much-improved tool for tracking and closing corrective actions and the associated issues. Additionally, the implementation of the STAR system addresses several weaknesses of SIMTAS identified by SRNS and DOE-SR. DOE-SR and NNSA-SRSO are also effective in tracking and verifying the corrective actions resulting from oversight assessments of the contractors' emergency management program. Furthermore, DOE-SR and NNSA-SRSO personnel conduct follow-up assessments to validate the closure of the actions, including follow-on actions and interactions with contractor personnel, as a means to verify the effectiveness of completed actions. Lastly, e-Pegasus, an NNSA tracking system, currently supports the NNSA-SRSO corrective action process for issues they identify during emergency management self-assessments. However, at the time of the Independent Oversight review, NNSA-SRSO indicated that e-Pegasus should soon be replaced by STAR to improve their process for tracking and closing of emergency management corrective actions and the associated issues.

Overall, NNSA-SRSO and DOE-SR have appropriately established procedures and processes for implementing their contractor oversight program and self-assessments. Supported by NA-43 and EM-44, NNSA-SRSO and DOE-SR personnel actively engage in oversight of the site's emergency management program. During the last three years, DOE-SR has published an appropriate schedule of assessments and improved the overall execution of the assessment process. Additionally, NNSA-SRSO and DOE-SR have effectively managed the corrective actions that address weaknesses identified from internal and external program assessments and are further improving the process with the implementation of the STAR system. Nonetheless, the readiness assurance program warrants continued improvement in the depth of the DOE-SR contractor oversight assessments and self-assessments to promote the identification of issues that will lead to continued improvements in the site program.

SRNS Self-Assessment Program

DOE Order 151.1C requires that DOE/NNSA contractors conduct an annual self-assessment of their emergency management programs based on specific standards and criteria issued by the DOE Office of Emergency Operations, that are published in the DOE Guide 151.1-3, Appendix D. Further, DOE clarifies the intent of the self-assessment requirement in their response to the DOE Order 151.1C frequently asked questions dated August 8, 2008, *Annual Self-Assessments and Exercises* and *The Role of Evaluation Criteria in Annual Self-Assessment*. Notably, it states that a true determination of the

readiness of the overall emergency management program requires the combination of effective programmatic and exercise evaluations. Additionally, the cognizant DOE/NNSA field element manager is required to review contractor self-assessment programs annually to ensure compliance with DOE/NNSA directives and policies.

Although SRNS has implemented a self-assessment process for the SRS emergency management program, the SRNS self-assessment program does not include an appropriate combination of programmatic and exercise evaluations to effectively self-identify program deficiencies. SRNS has inappropriately evaluated several functional areas only through drills and exercises, which resulted in some emergency management elements not being subjected to the more rigorous programmatic assessments. For example, SRNS takes significant credit for the identification and correction of issues identified through the drill and exercise program with input from NNSA-SRSO and DOE-SR. However, the self-assessment program has not examined the effectiveness and completeness of only using facility and site drill and exercise evaluations with no complementing program element review of essential emergency management program elements, such as offsite response interfaces, categorization and classification, notification and communications, consequence assessment, protective actions and reentry, emergency medical support, termination and recovery, and emergency public information. (See Section 8.0, **OFI 6**.) In addition, the assessment criteria contained in the SRNS source and compliance document, *Emergency Preparedness Assessment Performance Objectives and Criteria* (Manual SCD-4), are significantly less inclusive and do not align with the criteria issued by the DOE Office of Emergency Operations, and used by DOE-SR and NNSA-SRSO. As a result, this significantly reduces the scope and detail from that expected by DOE of the SRNS self-assessments. (See Section 8.0, **OFI 7**.)

Finding F-1: SRNS has not fully developed a self-assessment process for the emergency management program, as required by DOE Order 151.1C, *Contractor Requirements Document,* Section 7.

Overall, SRNS does not include an appropriate combination of programmatic and exercise evaluations for its self-assessment process, and relies almost solely on the drill and exercise evaluation process to identify and facilitate improvements in the site emergency management program. DOE-SR has made SRNS aware of the need to improve the self-assessment program; however, the desired improvements to the SRNS process are not currently in place. Additionally, SRNS self-assessment criteria are not as inclusive as or equivalent to the criteria issued by the DOE Office of Emergency Operations, and used by DOE-SR and NNSA-SRSO, which significantly reduces the scope and detail of the SRNS self-assessments.

SRNS Site Activities Assessments

This review assessed selected aspects of the SRNS emergency management self-assessment process, including whether SRNS is assessing site activities adequately and self-identifying deficiencies.

DOE Order 151.1C requires that each site "must assess its emergency management needs to plan and implement a comprehensive emergency management program commensurate with the hazards present (i.e., consistent with a graded approach)." OST activities present unique emergency management challenges to the TF and Host Sites because its activities may introduce hazards that are not normally present at the Host Site. Therefore, Host Sites are expected to review the OST EPHA to identify HAZMAT and emergency conditions associated with OST activities at their site that require specific emergency planning.

In April 2005, the NNSA Associate Administrator for Emergency Operations issued further guidance for NNSA Host Sites and OST to coordinate, communicate, and integrate the applicable aspects of emergency planning, preparedness, and readiness into a workable process to establish effective control for

an event scene on an NNSA Host Site. The memorandum identified that OST and SRS (Host Site) are responsible for writing and maintaining emergency plans and procedures for their respective activities and that current emergency plans and procedures do not address actions and responses specific to the joint operating environment among SRS, OST, and other potential responding agencies for an NNSA Host Site event.

Independent Oversight determined that SRS has not conducted combined coordination and planning meetings with OST to establish an appropriate integrated response to an OST event at SRS as well as to resolve joint emergency operational issues. Furthermore, SRNS has not validated through the SRS exercise program the effectiveness of the SRS response with OST for an OST emergency event at SRS. (See Section 8.0, **OFI 8**.)

Finding F-2: SRNS has not coordinated emergency response plans and procedures with OST and validated through the SRS exercise program the effectiveness of SRS to respond to an onsite OST emergency event, in accordance with DOE Order 151.1C, *Comprehensive Emergency Management System,* and the NNSA Associate Administrator for Emergency Operations guidance dated April 2005.

Overall, SRNS has not implemented the emergency planning and preparedness requirements expected of an OST Host Site. Furthermore, the SRS exercise program has not validated affected elements of the SRS emergency management program in responding to the spectrum of potential onsite OST events.

6.0 CONCLUSIONS

Independent Oversight reviewed select emergency management programmatic elements, with an emphasis on SRNS and NNSA-SRSO efforts to ensure preparedness for severe NPEs at TF and their ability to identify needed emergency management program improvements. However, since DOE-SR and NNSA-SRSO have agreed to provide programmatic oversight along the same lines of responsibility as specified in the *SRS Emergency Plan*, DOE-SR program oversight of the TF emergency management program was also addressed in this review. Operationally and administratively, the effectiveness of the Tritium Program emergency management program is dependent upon the broader emergency management program implemented by SRNS, and the integration and cooperation of NNSA-SRSO, DOE-SR, and SRNS.

Independent Oversight determined that SRNS, NNSA-SRSO, and DOE-SR generally met the objectives stated in the scope of this review. Although the necessary emergency management framework is firmly established, Independent Oversight identified two findings signifying that some specific requirements are not being met. In addition, several OFIs are offered, suggesting approaches to further strengthen the emergency management program.

Independent Oversight determined that SRNS sufficiently developed an EPHS for the TF that identifies HAZMAT that could result in an airborne release initiated by severe NPEs. Independent Oversight also determined that SRNS adequately analyzed plausible severe NPEs in the *EPHA for the Tritium Facilities* and factored those assessments into the determination of needed ERO capabilities. Although facility-specific EALs do not include severe NPE EALs, SRNS correctly classifies these events as a general emergency using sitewide EALs.

The construction of the HANM and TEF is adequate to survive all but the most severe NPEs. Both have sufficient backup power and long-term refueling capability, adequate protection for employees during operational emergencies, and procedures to respond to operational emergencies including placing both facilities in a safe shutdown condition. The TF has an adequate normal power supply and is capable of

providing backup power to important loads from standby diesel generators. UPS and batteries can also provide continuous power to equipment needed to support implementation of protective actions if diesel generators cannot provide backup power. SRNS adequately tests and maintains these backup power sources, and has adequate refueling plans to sustain long-term operations at TF using the fixed diesel generators.

The emergency response equipment is appropriate for response to a severe NPE in each control room and designated shelter buildings. Facility SOMs properly maintain the equipment and ensure availability and operability. Radiological protection processes ensure adequate monitoring of radiological airborne and surface contamination and oxygen deficiency during emergency events. An adequate quantity of operable and calibrated radiation and oxygen detection equipment and PPE is available to respond to an onsite radiological release. The procedures used by the TF ERO adequately augment the *SRS Emergency Plan*, provide guidance, define roles and responsibilities for facility emergency response personnel, and outline processes used to assess emergency events.

In addition to the positive program aspects mentioned above, the Independent Oversight review team identified several areas warranting at least some degree of attention. Two finding were identified during this review. First, SRS has not conducted combined coordination and planning meetings with OST to establish an appropriate integrated response to an OST event at SRS as well as to resolve joint emergency operational issues. Additionally, SRNS has not validated through the SRS exercise program the effectiveness of the SRS response with OST for an OST emergency event at SRS.

Second, although SRNS has implemented a self-assessment process for the SRS emergency management program, the SRNS self-assessment program does not include a combination of programmatic and exercise evaluations to effectively self-identify program deficiencies. SRNS does not conduct programmatic self-assessments of several emergency management program elements, specifically offsite response interfaces, categorization and classification, notification and communications, consequence assessment, protective actions and reentry, emergency medical support, termination and recovery, and emergency public information. Further, for the program elements that are subjected to programmatic review, the assessment criteria are significantly less inclusive than and do not correlate to criteria used by DOE-SR and NNSA-SRSO. This significantly reduces the scope and detail of the SRNS self-assessments.

Further, the EPHA development procedure does not identify natural phenomena initiating events or severe NPEs. Although SRNS included consequence analyses for severe NPEs in the *EPHA for the Tritium Facilities*, SRNS did not include consequence analyses for severe NPEs in the *EPHA for the TEF*. Further, TEF EALs do not contain default protective actions.

7.0 FINDINGS

Findings indicate significant deficiencies or safety issues that warrant a high level of attention on the part of management. If left uncorrected, such findings could adversely affect the DOE mission, the environment, the safety or health of workers and the public or national security. Findings may identify aspects of a program that do not meet the intent of DOE policy.

Finding F-1: SRNS has not fully developed a self-assessment process for the emergency management program, as required by DOE Order 151.1C, *Contractor Requirements Document,* Section 7.

Finding F-2: SRNS has not coordinated emergency response plans and procedures with OST and validated through the SRS exercise program the effectiveness of SRS to respond to an onsite OST

emergency event, in accordance with DOE Order 151.1C, *Comprehensive Emergency Management System,* and the NNSA Associate Administrator for Emergency Operations guidance dated April 2005.

8.0 OPPORTUNITIES FOR IMPROVEMENT

This Independent Oversight review identified the following OFIs. These potential enhancements are not intended to be prescriptive or mandatory. Rather, they are offered to the site to be reviewed and evaluated by the responsible line management organizations and accepted, rejected, or modified as appropriate, in accordance with site-specific program objectives and priorities.

Savannah River Operations Office

OFI 5: Enhance the readiness assurance program by integrating and describing the all-inclusive processes used by DOE-SR and NNSA-SRSO to facilitate improvement of the site program. Specific actions to consider include:

- Summarizing in *DOE-SR Emergency Management Program* the concept of operations for directing, documenting, and overseeing implementation of the emergency management program at SRS with all Federal and contractor entities considered stakeholders (i.e., NNSA- SRSO, DOE-SR, OST, SRNS, and WSI-SRS).
- Revising *DOE-SR Emergency Management Program* to provide detailed descriptions on how DOE-SR implements and coordinates oversight activities between DOE-SR and NNSA-SRSO.
- Revising *DOE-SR Emergency Management Program* to define how DOE-SR and NNSA-SRSO provide emergency management oversight of OST emergency planning, preparedness, and response at SRS.
- Improving lines of inquiry to increase the depth of the investigation for both contractor oversight assessments and self-assessments that focus on program implementation and program products.
- Reviewing the results of the contractor self-assessment program in depth each year to verify that it is effective in finding and correcting deficiencies.

Savannah River Nuclear Solutions, LLC

OFI 1: To improve the EPHA development procedure and to ensure consistency between TF EPHAs, consider:

- Revising the *Development and Maintenance of an EPHA* procedure to require analysis of scenarios initiated by NPEs.
- Revising the *EPHA for the TEF* to include consequence analyses for HAZMAT releases initiated by severe NPEs.

OFI 2: To improve specific planning for implementing protective actions at the TF, consider:

- Including event-specific EALs for severe NPEs in the *Emergency Classification (EALs)* procedure that provides protective action instructions based on quantitative analyses.
- Developing an event-specific EAL for a severe NPE in the TEF EPHA.
- Including the maximum distance to PAC associated with identified impacted inventories in the TEF EALs.
- Revising situation-specific EALs to indicate where appropriate initial protective actions (sheltering or evacuation) are implemented.

OFI 3: To ensure fire alarm monitoring and alarm panel batteries are tested appropriately and an adequate record of tests results is maintained, consider revising the applicable test procedures to:

- Describe how a battery load and discharge test is performed.
- Establish acceptable test results.
- Require a record of empirical data used to meet the test acceptance criteria.

OFI 4: To more fully describe the desired response and attain consistency among documents, consider updates to the following response procedures:

- Expedite the cross walk between HANM and TEF response procedures and appropriate updates.
- Revise the TEF EALs to add maximum distance to PAC information.
- Update the 233-H diesel generator operating procedure to reflect the conclusions of the fire hazards analysis regarding life safety code loads.

OFI 6: To improve the ability of the assessment program to identify program deficiencies, consider revising the SRNS self-assessment program to require programmatic reviews of all emergency management program elements, supplemented with drill and exercise performance evaluations.

OFI 7: To improve the assessment criteria in the source and compliance document and to establish a basis for the included and excluded criteria, consider the following actions:

- Reconcile the existing criteria in the source and compliance document with those published in DOE Guide 151.1-3.
- Revise the source and compliance document to more closely reflect the criteria in the guide.
- Incorporate criteria from DOE Order 151.1C frequently asked questions and DOE/NNSA policy memorandum into the source and compliance document, as appropriate.
- Incorporate the EMG assessment criteria (or equivalent) into the assessment program, and provide a rationale for those criteria not adopted.

OFI 8: When planning for OST shipment events occurring at SRS, consider:

- Acquiring copies of applicable OST hazards assessments that pertain to “generic” OST shipments.
- Verifying that the site training program includes hazards introduced during routine OST deliveries/pick-ups.
- Joint planning with OST to establish an appropriate integrated response to an OST event at SRS and resolve joint emergency operational issues, including coordination of public information.
- Determining the process for acquiring specific quantitative information from the OST EOC on safe haven shipments to support SRS consequence assessment and follow-on protective actions decision-making.
- Verifying that an OST event at SRS is appropriately classified using EALs (reference S-EHA-G-00003, *Emergency Planning Hazards Assessment for Transportation of Hazardous Materials)* based on source materials, hazard releases, and impacts that provide appropriate protective actions.
- Validating the effectiveness of the joint SRS and OST response to an onsite OST emergency event through the SRS exercise program.

9.0 UNRESOLVED ITEMS

A March 24, 2003, memorandum from the Deputy Secretary of Energy designated the DOE SRS Manager as the lead Federal manager (LFM) for situations involving SRS, with the intention of eliminating confusion among state and regional officials regarding who represents DOE/NNSA during emergencies. DOE-SR and NNSA-SRSO have not adopted the LFM concept into their emergency response plans as directed. HSS Independent Oversight has documented the LFM issue in prior 2012 site assessment reports. NA-40 is aware of this issue, and Independent Oversight recommends that DOE-SR consult with their line management to resolve the applicability of this memo to SRS.

10.0 ITEMS FOR FOLLOW-UP

As part of its oversight activities, Independent Oversight will follow the closure of the findings identified in Section 7.0 and monitor the disposition of the OFIs, particularly those concerning protective actions, offsite planning, and radiological field monitoring. Because this review encompassed only selected emergency management elements identified in DOE Order 151.1C, future assessments should consider focusing, in part, on other elements of the emergency management program, including readiness assurance, exercises, and termination and recovery.

Appendix A
Supplemental Information

Dates of Review

Scoping/Onsite Data Collection Visit 1:	August 27-30, 2012
Onsite Data Collection Visit 2:	September 10-13, 2012
Validation and Outbrief:	September 13, 2012

Office of Health, Safety and Security Management

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Appendix B
Referenced Documents and Interviews

Referenced Documents

- 10-13018 Engine Driven Generator Annual Preventive Maintenance (U), Rev. 8, 6/8/06
- AOP 233-61200, Response To Total Loss Of Power 233-H (U), Rev. 18, 06/18/12
- AOP 233-61300, Response to Loss of 233-H Ventilation (U), Rev. 29, 3/9/09
- AOP 233-61400, Response to 233-H Control Room Abandonment, Rev. 12, 6/4/04
- AOP 233-62400, Response to O2 Deficiency or N2 Leak In 233-H, Rev. 15, 5/30/12
- AOP 264-H-6003, Response To Total Loss Of Power In TEF (U), Rev. 4, 12/08/10
- AOP 264-H-6006, Response to Reduced or Total Loss of TEF Ventilation (U), Rev. 16, 6/22/11
- AOP 264-H-6013, Response to 264-H Control Room Abandonment, Rev. 3, 5/28/09
- AOP 264-H-6022, Response to Oxygen Deficiency In 264-H or 264-2H, Rev. 4, 11/28/11
- AOP TRIT-6122, Response to Severe Weather and Natural Disasters, Rev. 20, 10/26/10
- DOE Guide 151.1-2, Technical Planning Basis Emergency Management Guide, 7/11/07
- DOE Guide 151.1-3, Programmatic Elements, 7/11/07
- DOE Guide 151.1-4, Response Elements, 7/11/07
- DOE Memorandum, SRSO Adoption of Department of Energy, Savannah River Operations Office (DOE-SR) Manuals, Procedures, and Policies, Dearolph to Moody, 4/22/11
- DOE Order 151.1C, Comprehensive Emergency Management System, 11/2/05
- DOE Order 151.1C Frequently Asked Questions – Annual Self-Assessments and Exercises, 8/8/08
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Interviews

- DOE-SRS Emergency Management Specialist
- NNSA-SRSO Emergency Management Specialist
- NNSA-SRSO Nuclear Safety
- NNSA-SRSO Safety Advisor
- SRNS Contractor Assurance Processes Manager
- SRNS Electrical Engineer
- SRNS Emergency Management Administrator
- SRNS Emergency Management Manager
- SRNS Emergency Management Supervisor
- SRNS Facility Emergency Coordinator
- SRNS Fuel Administration Manager
- SRNS Fleet and Fuel System Manager
- SRNS Maintenance Manager

- SRNS Site Maintenance Manager
- SRNS TEF Electrical Design Authority
- SRNS TEF Shift Manager
- SRNS Tritium Facilities Building 233 Electrical Engineer
- SRNS Tritium Facilities Emergency Planning Manager
- SRNS Tritium Facilities Emergency Preparedness Coordinator
- SRNS Tritium Facilities Engineer
- SRNS Tritium Facilities Fire Protection Engineer
- SRNS Tritium Facilities Manager, Training, Procedures, and Emergency Preparedness
- SRNS Tritium Facilities Radiological Protection
- SRNS Tritium Facilities Shift Operations Manager