DEFENSE NUCLEAR FACILITIES SAFETY BOARD

Washington, DC 20004-2901

January 4, 2018

The Honorable James Richard Perry
Secretary of Energy
U.S. Department of Energy
1000 Independence Avenue, SW
Washington, DC 20585-1000

Dear Secretary Perry:

The Defense Nuclear Facilities Safety Board identified a number of safety issues with the Conduct of Operations safety management program at the Savannah River Site (SRS). The safety issues identified in the enclosed report could challenge the ability of operations personnel to ensure SRS defense nuclear facilities operate in compliance with their safety basis through implementation of Technical Safety Requirements (TSR).

TSRs are necessary to ensure the safe operation of nuclear facilities, and to reduce the potential risk to the public and workers from uncontrolled releases of radioactive materials or from radiation exposures due to inadvertent criticality. While the attached report is provided for DOE's use, we continue to evaluate the safety impact of several specific TSR violations at SRS.

Pursuant to 42 U.S.C. §2286b(d), the Board requests a written response and a briefing from DOE within 90 days in response to the safety issues raised in the attached report.

Sincerely,

Sean Sullivan
Chairman

Enclosure

c: Mr. Joe Olencz

DEFENSE NUCLEAR FACILITIES SAFETY BOARD

Staff Issue Report

September 8, 2017

MEMORANDUM FOR: S. A. Stokes, Technical Director

COPIES TO: Board Members

FROM: K. Sullivan

SUBJECT: Conduct of Operations Safety Management Program at the Savannah River Site

EXECUTIVE SUMMARY

Members of the Defense Nuclear Facilities Safety Board's (Board) staff and the Department of Energy (DOE) have identified safety issues with the Conduct of Operations (ConOps) safety management program at Savannah River Site (SRS). The staff identified these safety issues at facilities operated by both Savannah River Nuclear Solution and Savannah River Remediation. These safety issues challenge the ability of operations personnel to operate SRS's defense nuclear facilities in compliance with their safety bases. They also demonstrate the need for improvements in the SRS contractors' corrective action programs to ensure timely and effective resolution of operational issues.

In May 2017, members of the Board's staff completed a ConOps program review focused on implementation of Technical Safety Requirements (TSR) at SRS defense nuclear facilities. The staff review team conducted an independent analysis of events at SRS in 2016 and 2017 that demonstrated less than adequate TSR implementation. Appendix A summarizes these events. TSRs are necessary to ensure the safe operation of a nuclear facility and to reduce the potential risk to public and workers from uncontrolled releases of radioactive materials or from radiation exposures due to inadvertent criticality. The staff review team conducted its independent analysis of the ConOps program through on-site interviews with a representative sample of operations personnel, as well as on-site observations of control room and field activities. The staff review team identified the following safety issues with the ConOps program, as they relate to the implementation of TSRs. DOE and contractor organizations at SRS also have identified similar issues:

1) **Less than adequate rigor of TSR control implementation.**

   Administrative processes relied upon to ensure operations are conducted in compliance with the safety basis require improvement. For example, recent ConOps events revealed weaknesses in status control methods, weaknesses or errors in TSR

implementing procedures, and human performance errors when implementing TSR controls.

2) **Less than adequate operations training on TSR controls and their bases.**

   Operations personnel have exhibited less than adequate knowledge of TSR controls at multiple SRS facilities. For example, operations personnel have failed to enter the correct Limiting Conditions for Operation (LCO) when needed or identify when improper action resulted in a TSR violation. TSR training has not included practical exercises for navigating the TSRs during anticipated and upset conditions. The issue underpinning these observations—less than adequate TSR training—represents a vulnerability to reliable implementation of TSR controls.

3) **Less than adequate work authorization processes in implementing TSR controls.**

   Many recent TSR implementation events occurred, in part, as a result of weaknesses in the identification and implementation of applicable TSR controls prior to conducting work. For example, the work planning process does not require identification of safety system impacts and TSR control applicability prior to work release. Consequently, a single shift operations manager often makes TSR control decisions at the time of work release. Reliance on one individual represents an administrative single point vulnerability to ensuring compliance with the safety basis.

4) **Ineffective corrective action program.**

   The Board's staff found weaknesses in the causal analysis and corrective action processes. For example, some causal analyses and supporting documentation lacked rigor; extent of condition of reviews were often limited; and some corrective actions, particularly those related to TSR training, have not been timely or have been ineffective. Also, the contractors have narrowly scoped some corrective actions, focusing on a one-time fix, rather than a long-term solution institutionalized in site programs and procedures.

While the review team derived these issues in part by focusing on significant operational events that have occurred since 2015, problems with the ConOps program at SRS are not new. For example, in May 2014, the Board sent a letter to DOE expressing concern with the safe performance of work at SRS and highlighting areas of the ConOps program needing improvement. Due to the persistent nature of ConOps issues at SRS, the Board's staff believes that DOE should consider timely and sustainable improvements to the ConOps program, the operations training program, and the corrective action program.

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1. INTRODUCTION

This report documents issues with the Conduct of Operations (ConOps) safety management program at the Savannah River Site (SRS). These issues challenge the ability of operations personnel to operate SRS defense nuclear facilities in compliance with their safety bases. As a result, there is elevated risk associated with operating these facilities.

Members of the Defense Nuclear Facilities Safety Board's (Board) staff completed a review of the ConOps program in May 2017. The staff review team consisted of D. Burnfield, R. Eul, Z. McCabe, M. Sautman, C. Shuffler, and K. Sullivan. The staff's review focused on ConOps program elements that ensure operations personnel operate SRS defense nuclear facilities in compliance with their Documented Safety Analyses through implementation of Technical Safety Requirements (TSR). The review team identified four primary issues with the SRS ConOps program:

1. Less than adequate rigor of TSR control implementation,
2. Less than adequate operations training on TSR controls and their bases,
3. Less than adequate work authorization processes in implementing TSR controls, and
4. Ineffective corrective action programs.

Over the past several years, Department of Energy (DOE) and contractor organizations have identified similar issues related to TSR implementation at SRS, as well as other weaknesses in the ConOps program. The staff review team reviewed corrective action plans developed in response to these previously identified issues and determined that some corrective actions have either been ineffective in addressing the organizational root causes or were not timely.

While the review team derived these issues, in part, by focusing on significant operational events that have occurred since 2015, SRS has had a history of problems with the ConOps program. For example, in May 2014, the Board sent a letter to DOE expressing concern with the safe performance of work at SRS and highlighting ConOps program areas that needed improvement. Due to the persistent nature of these issues, the Board's staff believes that DOE should consider timely and sustainable improvements to the ConOps program, the operations training program, and the corrective action program.

2. BACKGROUND

10 CFR 830.205 requires that contractors responsible for hazard category 1, 2, or 3 DOE nuclear facilities develop TSRs which are: "the limits, controls, and related actions that establish the specific parameters and requisite actions for the safe operation of a nuclear facility" [1]. In establishing a safety basis, there is recognition that safety related structures, systems, and components (SSC) will not always be available, either due to unexpected SSC failures or routine maintenance and surveillance.

To account for the reliability of SSCs, the TSRs contain limiting conditions of operation (LCO), which represent the "lowest functional capability or performance levels of equipment required for safe operation of the facility" [2]. As 10 CFR 830 notes, LCOs "state the action to be taken to address a condition not meeting the limiting conditions for operation section.

Normally this simply provides for the adverse condition being corrected in a certain time frame and for further action if this is impossible" [1]. These actions and completion times are determined during the development of TSRs, and "the safety importance of the lost safety function…and the risk of continued operations while the condition is not met…are important considerations in determining a proper completion time, with the most important required actions or highest operating risk conditions having the shorter completion times" [3].

Compliance with TSRs is inherently administrative, as it is normally incumbent upon nuclear facility personnel to recognize when safety-related SSCs are not available to meet their intended safety function; to ensure entry into the applicable LCO; and to restore operability within the established time frame and/or ensure completion of appropriate actions. The responsibility for maintaining nuclear facilities in compliance with their safety bases at SRS through TSR implementation primarily resides with operations personnel. Therefore operations personnel must have appropriate training on these controls [3]. In addition to training, the ConOps program establishes "administrative controls to ensure proper adherence to operational limits (also known as limiting conditions for operation)" and ensures appropriate operations personnel are directing or are "aware of all actions that are taken in response to the operational limit requirements or actions to mitigate adverse consequences to the facility" [4].

On May 16, 2014, the Board issued a letter to DOE's Office of Environmental Management identifying issues related to the safe performance of work across SRS, including implementation of safety controls [5]. Additionally, the letter noted that while recent work pauses and all-hands briefings had the potential to increase awareness in the short term, the Board was interested in institutional actions taken to sustain long-term performance improvements.

Following issuance of this letter, on July 21, 2014, representatives from SRS contractors Savannah River Remediation (SRR) and Savannah River Nuclear Solutions (SRNS) briefed the Board on the causes of these issues and the corrective actions they were taking to address the issues the Board had outlined in the letter. SRNS noted that inconsistency and lack of rigor managing TSRs were among the causes of the degraded safety performance and that it was addressing these deficiencies through increased staffing and continuing and scenario-based training [6].

SRR reported that poor supervisory judgment and weaknesses in documented safety analyses/TSR content and TSR implementing procedures were the main causes of TSR violations. SRR said it planned to address these issues through hiring six new shift managers; strengthening procedures and training; initiating internal and independent reviews of TSRs and specific administrative controls (SAC), with a focus on SAC implementation; and greater operations involvement in procedure development to help TSR implementation in the field [7].

However, a number of operational events have occurred at SRS since 2015. In response to these events, particularly the violation of criticality safety controls at HB-Line in 2015, SRNS and SRR have taken additional steps to improve operational performance, including work pauses and periods of deliberate operations. Since that event, the Board's resident inspectors have noted improvements in procedure content and quality; procedure use and adherence; and operations

personnel's use of "time outs" when controls were unsafe or uncertain or if procedures contained errors or lacked clarity.

In May 2016, the DOE Savannah River Operations Office (DOE-SR) issued a letter to SRNS identifying a concern with less than adequate safety basis compliance [8]. In response, SRNS in June 2016 completed a TSR common cause analysis (CCA) of some of these events [9], which identified less than adequate rigor with implementation of TSR controls and less than adequate operations training on TSR controls and their bases.

DOE-SR issued a letter to SRR in June 2016 concerning recent operational events and requested a corrective action plan to address the identified issues [10]. In August 2016, SRR completed a Tank Farms ConOps events CCA [11], which identified several common causes, including less than adequate training and less than adequate management reinforcement of standards and expectations. Events that occurred subsequent to the completion of the CCAs had similar causes.

In April 2017, following several TSR violations and other ConOps incidents, the National Nuclear Security Administration – Savannah River Field Office (NNSA-SRFO) sent SRNS a letter of direction [12]. The letter focused on less than adequate performance related to ConOps and directed SRNS to evaluate the root causes of the events and develop a plan to improve.

3. REVIEW SCOPE AND STRATEGY

Prior to the on-site portion of the May 2016 review, the staff review team completed an independent analysis of ConOps events in 2016 and 2017 reported in the Occurrence Reporting and Processing System (ORPS) database listed in Appendix A. This analysis found a pattern of events related to TSR implementation. Therefore, the Board's staff focused its review on elements of the ConOps program relating to TSR implementation.

The staff review team also evaluated efforts by the SRS contractors and DOE to identify and correct the underlying issues with the ConOps program. The analysis focused on available documented causal analyses and corrective action plans developed in response to the events. The on-site portion of the review consisted of discussions with representatives from SRNS, SRR, DOE-SR and NNSA-SRFO; field observations; and interviews.

The staff review team split into three groups to observe operations shift turnovers, as well as other operations activities at the Savannah River National Laboratory (SRNL), K-Area Complex, F/H Laboratory, H-Area Tank Farms, H-Canyon, the Defense Waste Processing Facility (DWPF), H-Area New Manufacturing, and the Tritium Extraction Facility (TEF). The groups observed activities and discussed with available operations personnel processes related to TSR implementation, especially in the areas of LCO entries and exits, mode changes and tracking, watchbill administration, TSR surveillances, and work authorizations.

Each staff review team group conducted level-of-knowledge interviews with shift operations managers (SOM), shift technical engineers (STE), control room operations personnel, and facility operators at SRNL, DWPF, H-Tank Farms, HB-Line, H-Area New Manufacturing,

TEF, and H-Canyon. The staff review team developed questions for each interviewee related to LCO entries and exits, mode changes, work authorization, and training and watchbill administration. Additionally, the staff review team developed a series of scenario-based questions on TSR implementation for control room personnel, SOMs, and STEs. The questions focused on activity restrictions for specific modes, requirements for changing modes, LCO navigation, and recognition of situations that result in TSR violations.

4. RIGOR OF OPERATIONS TSR CONTROL IMPLEMENTATION

Establishing the administrative practices, processes, and procedures that significantly aid operations personnel is as important as operations personnel having sufficient training on TSR controls. DOE has a series of technical standards on ConOps practices that align with each of the DOE order requirements for ConOps programs. The establishment of these administrative elements, in line with the guidance provided in the technical standards, creates a rigorous framework with multiple barriers to preclude human performance errors in TSR implementation.

The staff review team independently identified issues in several of these programmatic elements during the course of the interviews and observations. Additionally, the contractor organizations in performing causal analyses for the TSR implementation events in 2016 and 2017 consistently identified programmatic issues which caused or contributed to inadequate TSR control implementation.

4.1. Analysis of Events in 2016 and 2017

The staff review team determined that the majority of the events identified in Appendix A occurred in some part due to deficient implementation of TSR controls through ConOps processes, procedures and practices. These issues included weaknesses in status control methods (e.g., status boards, LCO tracking programs), weaknesses or errors in TSR implementing procedures (e.g., TSR surveillance procedures), and human performance errors in implementing TSR controls (e.g., failure to maintain minimum TSR staffing levels, failure to perform a SAC). The staff review team noted that these events occurred at both SRNS and SRR facilities owned by both DOE-SR and NNSA-SRFO.

While Appendix A identifies all of these events, three events are described here in detail to illustrate the staff review team's concern.

- On March 16, 2016, at H-Tank Farms, operations personnel transferred the contents of the 25H evaporator to Tank 30. At the time of the transfer, Tank 30 was in an LCO due to an inoperable ventilation system. The LCO prohibits liquid additions into the tank while the ventilation system is inoperable. Following this event, SRR completed an apparent cause analysis [13], which determined that multiple ConOps programmatic barriers to ensure work is conducted in compliance with TSRs failed. These barriers included shift routines and operating practices, procedures (both content and compliance), operations control of equipment and system status, and communications among operations personnel. All of these failed barriers are programmatic requirements for ConOps programs.

- On April 12, 2016, a gas fueled personnel lift at SRNL was left unattended for a short time without a required fire watch present. SRNS completed the causal analysis [14] for this event, which noted the failure of several ConOps programmatic elements, including inadequate communication among operations personnel during the briefing for the operator performing the fire watch and during the work activity. The causal analysis also determined that there was a lack of adequate TSR controls in the procedure controlling minor maintenance activities.

- On January 18, 2017, personnel at 233-H performed a prohibited activity in Environmental Conditioning (EC) on a reservoir containing hydrogen isotopes while the area was in TSR standby mode. The particular activity is only permitted in TSR operations mode. At the time of the event, operations personnel contacted personnel in the control room to verify that EC was in operations mode. Two status boards in the control room had differing information on the modes. Prior to performing the activity, personnel checked the electronic unofficial classified status board, which incorrectly stated EC was in operations mode. EC had been placed in standby mode because a required monthly surveillance test would not be performed before its due date. During the morning of January 18, 2017, operations personnel completed the surveillance test. However, they did not complete the mode change procedure to upgrade EC from standby to operations mode before the activity on the reservoirs was performed.

These three events are representative of human performance errors but also represent failures of ConOps processes, procedures, and practices designed to "minimize the likelihood and consequences of human fallibility or technical and organizational system failures" [15]. For instance, although operations personnel in the Tritium facility incorrectly communicated that EC was in operations mode, the presence of two status boards with differing information is reflective of weaknesses in ConOps practices related to status control methods. These events highlight the importance of administrative ConOps program elements and the potential consequences of less than rigorous implementation of these elements.

4.2. Interviews and Observations

The staff review team identified three significant areas of weaknesses in administrative ConOps practices and procedures, which further illustrate the staff review team's overall concern with the rigor of implementation of TSR controls.

4.2.1. *Implementing Procedures for TSR Modes*

The staff review team evaluated implementing procedures for TSR modes at six facilities, including SRNS and SRR facilities, as well as facilities under DOE-SR and NNSA-SRFO oversight. The staff review team prioritized the review of these procedures after interviews with operations personnel revealed potential weaknesses in the training on operational mode restrictions and the contractors' reliance on these procedures to implement these restrictions.

Mode definitions in the TSRs for the respective facilities are highly variable. However, each facility has procedures for upgrading to operations mode, which focus on ensuring that no active LCO conditions would affect the upgrade, and on verifying applicable surveillance requirements. Mode change procedures are the primary vehicle to ensure all operational restrictions are met, including applicable surveillances. Within these procedures, the staff review team identified a few errors, such as omitted applicable surveillance requirements.

Facilities have operational restrictions for modes other than operations. While some mode change procedures verify these at the time of mode change, most facilities do not have additional administrative controls to ensure that they remain in compliance with these operational restrictions. Some facility operating procedures discuss modes in their prerequisites. However, facility personnel eliminated these in some cases, such as HB-Line, because personnel viewed them as providing little added value. Furthermore, at most facilities, management expects the SOM and STE to ensure these operational restrictions are met.

Recent TSR violations have occurred due to personnel failure to meet mode operational restrictions. For example, on August 4, 2017, at K-Area, personnel initiated measurements of a shipping package in the Neutron Multiplicity Counter (NMC) while the room was in standby mode. Per the TSRs, shipping packages are not permitted in the NMC while the room is in standby. The procedure to do the measurements required verification of the mode of the room prior to conducting the activity, however operations personnel incorrectly stated the room was in operations, and not standby mode [16]. Additional administrative controls (e.g., a posting on the door of the room indicating the mode) could have prevented this event.

4.2.2. *TSR Surveillance Requirements*

Typically, TSRs contain a statement that allows an extension of the time interval for surveillance requirements up to 1.25 times the stated frequency for operational flexibility. However, the TSRs make explicit that the 25 percent extension shall be used on an as-needed basis and shall not be considered as a normally relied upon frequency. In interactions with operations personnel during the on-site review, personnel said that they use a surveillance tracking database to track surveillance requirements and to ensure completion of SRs at the required frequencies.

None of the surveillance tracking databases used by SRS facilities included a mechanism to preclude repeatedly invoking the 25 percent grace period. Over the long term, repeatedly performing a surveillance in the grace period could allow operations to skip a required performance, thereby reducing preventive maintenance and potentially delaying the detection of safety system degradation or an emerging hazard. The impact is higher the more often a surveillance requirement is extended.

The staff review team reviewed surveillance data for H-Canyon, HB-Line, K-Area, and L-Area, and identified more than two dozen cases where surveillances were performed in grace periods 50 percent of the time or more. The staff review team did not identify any cases where a surveillance had been skipped because of the repetitive use of grace periods. However, it may take years for this to occur, and the staff review team only reviewed the past few years of data.

The staff review team did, however, observe cases where the due date had shifted a few months over time.

5. OPERATIONS TRAINING ON TSRs AND THEIR BASES

A robust training program is vital to ensure operations personnel have sufficient knowledge of TSR controls and their bases. The staff review team identified several examples in which operations personnel demonstrated insufficient knowledge in these areas. These examples suggest that the training program needs improvements, particularly as it pertains to TSR controls.

5.1. Analysis of Events in 2016 and 2017

The staff review team found that almost half the events, as noted in Appendix A, are related to weaknesses in operations personnel's knowledge of TSR controls and their bases. The staff review team noted that these events occurred at both SRNS and SRR facilities owned by both DOE-SR and NNSA-SRFO.

While Appendix A identifies all the events that fell within this category, two events are described here in detail to illustrate the staff review team's concern:

- On October 3, 2016, personnel at the H-Canyon facility took the H-Canyon Nuclear Incident Monitor (NIM) units out of service for planned maintenance. After an unexpected alarm activated, H-Canyon operations personnel did not recognize that they were required to enter another H-Canyon LCO condition which contains a note for personnel to notify HB-Line to enter its applicable LCO. H-Canyon operations personnel neither entered this LCO condition, nor provided the required notification. Therefore HB-Line personnel did not enter their LCO condition, which would have involved immediate evacuation and a prohibition on access to the affected portion of the facility.

- On June 17, 2017, ventilation was lost while personnel at DWPF were swapping temporary air compressors. The SOM verbally directed that a local control station for the safety train be placed in bypass to allow restoration of the ventilation system. Bypassing the local control station caused a safety pressure interlock loop to become inoperable. The operations personnel who authorized the bypass did not recognize that the action caused the pressure interlock loop to be inoperable and thus did not enter the required LCO condition. Operations personnel on another shift recognized the error and entered the appropriate LCO condition.

While there were multiple contributing causes for these events, they both demonstrate the impacts of operations personnel not having sufficient training on TSR controls and their bases. In both examples, operations personnel did not understand the impacts of work that rendered safety-related components inoperable and thus required actions in accordance with the TSR.

5.2. Interviews and Observations

The staff review team's interviews of operations personnel provided additional indications of weaknesses in TSR training. In general, those interviewed could accurately describe their processes for implementing TSRs, but the interviewees provided incorrect answers for some scenario-based questions in which they needed to apply those processes and expectations, especially in recognizing when TSR violations had occurred. In addition, the operations staff sometimes exhibited a lack of proficiency with the implementation of TSR modes.

5.2.1. *Operations Training on TSR Modes*

All of the interviews with SOMs, shift managers, STEs, and control room managers addressed TSR modes and included questions on mode-specific activity restrictions and prerequisites for changing modes. The interview responses indicated that operations personnel relied heavily on their facility-specific mode change procedures. These mode change procedures focus on LCO compliance and surveillance requirement verifications but often do not address operational restrictions in standby and other modes. At one facility, the SOM and STE said that they would need to reference their mode change procedure when asked whether an activity was allowed in a particular mode; however their mode change procedures do not address these operational restrictions.

When asked straightforward questions, most operations personnel were able to navigate through their TSR mode requirements. However, some demonstrated little knowledge of TSR mode operational restrictions and little proficiency in using the TSRs to make those determinations. As an example, at one facility, the SOM and STE were not able to identify all the verifications needed per the TSRs to transition from operations mode to standby mode.

The staff review team views this low level of knowledge and familiarity as a safety vulnerability, particularly when combined with the staff review team's analysis of TSR mode implementing procedures, discussed later in this report.

5.2.2. *Operations Training on TSR Compliance*

All of the interviews included questions regarding general TSR violations, as well as scenario-based questions with scenarios that caused a violation of the TSRs. The staff review team gave the scenario-based questions to operations personnel who enter LCO conditions (SOMs, shift managers, and control room managers), as well as control room operators. Some operations personnel demonstrated knowledge deficiencies in response to TSR violation scenario-based questions, as demonstrated by the following examples.

- At one facility, the staff review team presented a SAC scenario-based question to a SOM, STE, control room managers, and control room operators. The SAC gives a transient combustible limit for a certain condition. All operations personnel interviewed incorrectly believed they complied with the SAC if they verified compliance with the limit after the activity was completed. The STE explained that since the SAC did not explicitly state "prior to", they complied with the SAC. The

staff review team prompted the STE to consider the basis for the SAC. Even after prompting, the STE incorrectly maintained that the SAC had not been violated.

- At another facility, when presented in an interview with a scenario where a required action was not completed in time, the SOM and STE entered a subsequent LCO condition that was not applicable to the initial condition and did not declare a TSR violation. In a subsequent interview, the control room manager at the facility did not know what to do in this situation and did not recognize it as a TSR violation.

- During another facility interview, when presented with a scenario in which an LCO completion time was exceeded, the control room manager entered a subsequent condition, but did not declare a TSR violation.

While the number of incorrect answers provided to scenario-based TSR compliance questions was relatively small, perfect compliance with TSRs is expected. The staff review team believes some of the responses to these scenario questions demonstrate a gap in training on navigating through LCO conditions and meeting completion times. Further, the staff review team is concerned that some operations personnel did not recognize when a TSR violation would have occurred.

5.3. Training Program Weaknesses

The scope of the ConOps review did not include detailed analysis of the operations qualification and training program; however, elements of the program fell within the staff review team's analysis. The staff review team identified two weaknesses in the content of the operations training program.

5.3.1. *Effectiveness of Lessons Learned Training*

The staff review team included questions related to lessons learned in every interview. The SRS contractors share lessons learned across facilities following significant events. As an example, following the December 6, 2016, H-Canyon event in which maintenance rendered a safety class component inoperable and the contractor failed to enter the applicable LCO and condition, SRNS took action to share lessons learned site wide [17].

The staff review team noted that operations personnel had limited knowledge and understanding of past safety basis events at their facilities or at other facilities and the lessons learned that were applicable to their positions from these events. During interviews, a significant number of operations personnel could not remember a single event. When operations personnel were able to remember an event, they were able to describe what had happened, but few could discuss what lessons were applicable to their job. ConOps programs are required to "establish and implement operations practices for an effective required reading program to keep operators updated on equipment or document changes, lessons learned, or other important information" [15]. While SRS has established a required reading program that includes lessons learned bulletins, the staff review team is concerned about the long-term effectiveness of required reading based on the interview observations.

5.3.2. *Content of Operations TSR Training Materials*

The staff review team evaluated TSR training material for operations personnel. The TSR training material reviewed often included only the text of LCOs directly copied from the facilities' TSRs. The training material included little discussion on the underlying bases for the LCO conditions and required actions. The training material did not include practical training or guidance on how to use the TSRs for anticipated situations. For example, the training did not include guidance or practical exercises for operations personnel to navigate through linked LCO conditions, information on how to determine equipment operability, or recognition of when a TSR violation had occurred.

The staff review team also reviewed recently completed or ongoing improvements to the training program outlined in various corrective action plans. This analysis is discussed later in this report.

6. TSR CONTROL IMPLEMENTATION IN THE WORK PLANNING PROCESS

The work planning and authorization process must identify applicable controls prior to conducting work in order to ensure that the work is performed within TSR controls. At the time of the review, neither SRR nor SRNS required identification of the appropriate LCO and condition during the work planning process. In practice, procedures, work instructions, or other work package documentation (e.g., lock out/tag out (LOTO) paperwork) sometimes identified the applicable LCO and condition, but this was not required. Therefore at the time of work authorization operations personnel were sometimes relied upon to identify and enter the applicable LCO and condition. The review team concluded that this represented an administrative single point vulnerability in ensuring compliance with the safety basis.

Subsequent to the staff review team's closeout with the site, SRR personnel said that they are revising their work planning process to ensure that LOTO paperwork contains an impact evaluation form which will discuss the need to enter an LCO and specify the anticipated LCO and condition. For corrective maintenance packages without a LOTO, the impact evaluation form will be included in the work package. SRR personnel indicated that routine maintenance or model work orders not containing a LOTO already specify the applicable LCO condition.

6.1. Analysis of Events in 2016 and 2017

The staff review team determined that a significant portion of the events identified in Appendix A occurred, in part, because operations personnel made errors during the work authorization process. These events occurred at both SRNS and SRR facilities. While the events occurred only at facilities under DOE-SR oversight, similar work authorization process vulnerabilities exist in facilities under NNSA-SRFO oversight.

While all of these events are identified in Appendix A, two events are described here in detail to illustrate the staff review team's concern.

- On December 6, 2016, personnel performed maintenance on a safety class water monitor system at H-Canyon. At the time of work release, the SOM responsible for identifying safety system impacts and authorizing entry into the applicable LCO and conditions did not recognize that the scope of work included bypassing a diversion valve timer. Although the SOM entered the correct LCO condition for one water monitor being taken out of service, the SOM did not enter the other applicable condition for the inoperable diversion valve timer.

- On June 18, 2017, a SOM at DWPF authorized work that included locking out two safety class level indicators on a safety class nitrogen purge supply tank. The SOM did not recognize that locking out both indicators rendered the safety grade nitrogen system inoperable and required entry into an LCO condition. As a result, the SOM authorized the work, resulting in a TSR violation.

In addition to indicating weaknesses in the knowledge of operations personnel who authorized the work, as discussed earlier in this report, these examples also demonstrate the vulnerability of relying on a single individual in the work authorization process. At the time of work release, it will always be necessary for operations personnel to perform a final evaluation of safety system impacts, as conditions in the facility may have changed since the work package was developed and approved. However, identifying the applicable safety system impacts, including the appropriate LCO and condition for the scope of work during the work planning process, would provide an additional opportunity for LCO evaluation and input to the SOM and help ensure that the correct decision is made prior to work release.

6.2. Interviews and Observations

All of the staff review team's interviews with operations personnel included questions on the work authorization process, specifically the identification of safety system impacts at the time of work release. In compiling interview responses, the staff review team determined that the methods by which operations personnel evaluate safety system impacts at the time of work release are inconsistent. There is no clear guidance for personnel performing the evaluations to ensure that they review all relevant information in making their determination. The knowledge gaps previously discussed compound these inconsistencies and lack of clear guidance.

For example, some procedures contain a generic statement requiring an evaluation for entry into applicable LCOs. While this may aid the initial screen of work packages, some operations personnel indicated that a generic statement is not helpful and expressed a preference for work packages that point to specific applicable LCOs or conditions.

After the initial screen, the work package goes to the appropriate operations personnel for evaluation. In most facilities, this is the shift manager or SOM. In some cases, the shift managers and SOMs said that they review the associated assisted hazard analysis or the LOTO paperwork to determine the impacted SSCs. Some personnel said that they would discuss the work with maintenance personnel, or with those participating in the pre-job brief, to aid in understanding the scope of the work and potential safety system impacts. In other cases,

operations personnel said that they would discuss the scope of work with other operations personnel for assistance in identifying the safety system impacts.

All facilities with STEs said that they relied on the STE's knowledge to determine safety system impacts and identify the applicable LCO conditions. For instance, at some facilities, the STE said that he or she evaluates impacts and discusses this evaluation with the shift managers and SOMs prior to every entry into LCOs, although this is not required. In some interviews, operations personnel mentioned that they may engage other engineering personnel to identify the potential safety system impacts. In the majority of interviews, the operations personnel also said that they rely heavily on their knowledge and years of experience with the work.

7. CORRECTIVE ACTION PROGRAM EFFECTIVENESS

An effective corrective action program will not only identify issues but will correct them. DOE requires that ConOps programs "establish and implement operations practices for investigating events to determine their impact and prevent recurrence" [15]. None of the TSR implementation events that occurred in 2016 and 2017 resulted in an injury or radiological release at the site. However, all of these events revealed vulnerabilities, which, if uncorrected, may lead to more significant events.

The staff review team's analysis revealed issues in the causal analysis process, as well as issues with both the timeliness and the effectiveness of completed or ongoing corrective actions developed to address the ConOps weaknesses previously discussed. Based on the results of this analysis, the staff review team believes that additional actions are needed to ensure the identified ConOps weaknesses will be resolved.

7.1. Causal Analyses

The staff review team's issues discussed in this section focus specifically on SRNS's casual analysis process and documentation. The focus on SRNS reports was due primarily to the fact that only one TSR implementation event had occurred in 2016-2017 at SRR facilities prior to the staff review team's visit. The staff review team reviewed the apparent cause analysis for the event at SRR and did not identify any issues.

7.1.1. *Documentation/Rigor*

The staff review team identified weaknesses in the documentation and rigor of five SRNS root cause analyses (RCA) [18] [19] [20] [21] [14]. The weaknesses indicate that SRNS may need to improve its RCA processes to ensure that events are thoroughly evaluated and effective corrective actions are implemented to prevent recurrence of similar events.

Several documented root causes were simply a restatement of the event, rather than the cause of the event, or did not address organizational and programmatic causes, which may impact the development and adequacy of subsequent corrective actions.

As an example, in the RCA for ORPS EM-SR--SRNS-SRNL-2016-0007 [20], the documented root cause was "failed to enter the single system Limited Condition of Operability related to the interruption to the SRNL F-Wing Sprinkler System as required by the Facility Safety Basis." This statement simply described the event, rather than a cause. The RCA for ORPS EM-SR—SRNS-SRNL-2016-0006 [14] stated the root cause as an "individual error: did not realize that a liquid fuel vehicle in the truck dock still required a fire watch." This described what occurred, not the root cause.

DOE Handbook 1028 states, "A root cause is that cause that, if corrected, will prevent recurrence of the event. Human error cannot be eliminated completely – inattention will continue to occur despite our best efforts to eliminate it…explaining what people could have or should have done explains nothing about why they did what they did. The challenge for the analyst is to determine why the actions of the individuals made sense to them at the time" [22].

Additionally, RCA documents had precursor event reviews that did not identify any precursor events. By not identifying similar events in the precursor event review, the analyst may miss the opportunity to identify issues with overlapping generic implications that would aid in identifying organizational or programmatic root causes and subsequent corrective actions.

Furthermore, the background description as documented in the RCA reports lacked detail. This impacts the ability of a reader unfamiliar with the event to fully understand the event. Additionally, it may hamper the ability of subsequent analyses to evaluate these events (e.g., performing a CCA). Finally, the team noted several errors in RCA reports that indicate a lack of rigor in preparation and review by SRNS.

7.1.2. *Extent of Condition Reviews*

The staff review team is concerned that extent of condition (EOC) reviews are too limited. The staff review team noted that its analyses of causal analysis documentation showed that the documented EOC reviews were often limited to just the facility at which the event occurred [18] [23] [24] [25]. In some instances, the documented EOC simply stated that lessons learned would be shared with other facilities [19] [20] [21]. The sharing of lessons learned, while valuable, does not meet the intent of an EOC review. Without a broader and formal EOC review, the staff review team believes that similar TSR implementation vulnerabilities may go unaddressed at other SRS facilities.

For example, following the April 26, 2016, event at HB-Line, personnel took corrective actions to improve status control methods and to provide additional training on safety basis and modes. These corrective actions were limited to HB-Line, although subsequent events at other facilities revealed similar issues. A broader approach to EOC reviews may have identified these similar latent weaknesses at other facilities, with corrective actions applied in time to prevent the occurrence of the subsequent events.

7.2. Corrective Actions

The staff review team identified issues with a number of completed or on-going corrective actions, both with the effectiveness of actions to address ConOps issues and with the timeliness of these actions. Furthermore, the staff review team identified opportunities for improving the oversight of the corrective action program to ensure corrective actions are both effective and timely.

7.2.1. *Effectiveness of Training-Related Corrective Actions*

Frequently, contractor personnel identified less than adequate knowledge of the TSRs and their bases as a cause for the events of concern [9] [11]. Appropriately, personnel developed training-related corrective actions for many of these events. The staff review team was encouraged to see that SRR was starting to increase simulator-based training. Additionally, SRR management expressed to the staff review team a desire to add a shift dedicated to training. SRNS has also developed scenario-based training. However, the staff review team has concerns with several of the corrective actions.

- Many of the corrective actions focused on short-term actions in the form of shift orders or one-time discussions to reinforce expectations. These actions often were not accompanied by subsequent actions to address the root of the knowledge deficiency, such as modifying initial and/or continuing training to ensure long-term effectiveness. Examples include an action to conduct one-on-one discussions with current SOMs on expectations for work authorizations [17] and issuance of a shift order requiring SOMs to review the TSRs prior to authorizing work that may be impacted by modes or LCOs [26]. These actions may have been appropriate in the short term to mitigate knowledge deficiencies, but the lack of accompanying longer-term training program improvements challenges their long-term effectiveness.

- When training was identified as a corrective action, it was often in the form of a one-time event. It often was not clear how the lessons would be incorporated into initial training or continuing training to ensure long-term effectiveness. For instance, SRR developed ConOps revival training, which was considered a one-time refresher training, but did not formally incorporate this training into the continuing training program.

- The staff review team observed several instances where training-related corrective actions were limited in scope. For instance, following the October 12, 2016, event at H-Canyon/HB-Line with the NIM system and the SRNL event on April 12, 2016, SRNS developed training corrective actions that focused on the specific control that failed. In the event at H-Canyon/HB-Line, the training corrective action focused on the NIM system [18]. In the event at SRNL, all of the training corrective actions related to fire watches and TSR controls on liquid fueled vehicles [27]. The staff review team believes that while not every event requires broad training actions in

response, the pattern of events related to less-than-adequate knowledge indicates that broader actions were warranted.

- The staff review team also noted that the SRNS 2016 TSR CCA had an action to develop and implement a class for first line managers, SOMs, Operations Managers and Facility Managers, to develop a working knowledge of safety bases documents and their bases. However, SRNS does not anticipate completing development of this course until October 27, 2017, and will track implementation of these classes separately at each facility. The staff review team is concerned with the timeliness of these actions.

The staff review team identified the following weaknesses in corrective actions related to SRNS's development of scenario-based training identified in the June 2016 TSR CCA:

- Implementation of the training is not timely. The June 2016 TSR CCA had an action to develop scenario-based training exercises to evaluate and improve operations personnel's working knowledge of the safety basis. However, each facility had completed only one scenario exercise at the end of June 2017 to close the TSR CCA action.

- Scenario-based training is a philosophical shift in the training method, and its effectiveness will become apparent over time. Therefore, the staff review team believes closing the corrective action after completion of only one scenario is not adequate to address the observed training gaps. SRNS personnel informed the staff review team that they planned to develop additional scenarios going forward; however, the formal corrective action closure documentation does not require this. The staff review team believes a more appropriate method to close this corrective action would have been a revision to the operations training program to institutionalize the need for an appropriate level of ongoing scenario-based training.

- The staff review team reviewed several facility scenario-based TSR training packages and noted inconsistencies in difficulty. For instance, the scenario-based training for 235-F involved the straightforward entry into a single LCO condition, whereas a Tritium facility seminar involved 18 questions and several actions. The staff review team believes scenario-based training exercises need to be sufficiently challenging to address the training deficiencies.

7.2.2. *Effectiveness of Status Control Corrective Actions*

SRNS took corrective actions in response to the April 2016 event at HB-Line to improve "status control methods, such as procedures and Status Boards for Mode restrictions." This action was extended three times, and was not implemented until March 31, 2017, almost a year after the initial event. The causal analysis for the April 2016 HB-Line event stated that lessons learned would be shared with other facilities. The June 2016 TSR CCA [9] had an action to

"develop and implement a standard protocol for LCO management (entering and exiting LCOs and performing mode changes)." This action was completed on February 8, 2017.

On January 18, 2017, an event occurred at the Tritium facility due to two status boards tracking modes in the facility. SRNS took corrective actions after the event to address this issue; however, the event may have been prevented had the previous actions at HB-Line and/or the 2016 TSR CCA corrective action been implemented either more broadly or in a timelier fashion.

The staff review team's May 2017 observations indicate improper status controls continue to be an issue:

- During interviews, the staff review team found that operations personnel are often not checking the official record, but an alternate source, when determining the status of LCOs or modes in a facility. For instance, at one facility, operations management informed the review team that the SOM logbook is the official record for mode changes, and the SOM said that modes were documented once per shift in the SOM logbook. However, when the staff review team reviewed several weeks of log entries, the logbook did not show any entries on current modes. Shift turnover checklists did not document the current facility mode. The facility procedure said to update the mode on the electronic status board or on a form, neither of which the SOM mentioned.

- At one facility, a control room operator asserted to the review team that LCOs did not have to be logged if they were entered and exited within a single shift.

- During observations in the TEF control room, the staff review team saw two visible displays with active LCOs—an electronic panel and an adjacent white board with information to support shift turnover. The white board is not an official LCO record, and the shift manager is not required to update it during a shift. Having two visible and adjacent records of active LCOs in the TEF control room is an opportunity for error if an operator mistakenly relies on the unofficial white board and it does not accurately reflect the active LCOs. Site personnel resolved this observation when the staff review team shared it with them; however, the staff review team is concerned that corrective actions for similar past events, including the January 18, 2017, event at Tritium, did not identify the vulnerability.

7.2.3. *Effectiveness of Work Authorization Corrective Actions*

Several events related to entry of appropriate LCOs and LCO conditions indicate potential weaknesses in the work authorization process. Corrective actions developed in response to these events either did not identify actions to improve the work authorization process, or were limited in scope. However, in March 2017, SRNS developed SRNS-N1000-2017-00014, *Implementation Plan for Environmental Management Operations Technical Work Document Improvement Initiatives* [28]. This recent SRNS initiative is an avenue to potentially address the staff review team's concern with the work authorization and work planning

processes. However, the staff review team had one concern with the plan which may impact its effectiveness.

One of the actions in this initiative requires engineers to develop a Safety System Impact Statement for work instructions. The instructions on developing this statement contain the following statement: "If, in the judgement of the Engineer, there is a potential for a feature to be impacted, that feature will be listed in the Safety System Impact Statement. Note that "potentially impacted," means that the feature is included, directly or indirectly, within the scope of work. The fact that the OPERABILITY of a feature may or may not be changed does not influence whether a feature is considered "potentially impacted." MODE applicability also does not influence consideration of a potential impact. If a feature is "touched," it is considered, "potentially impacted" for this purpose" [29].

The staff review team is concerned with the effectiveness of the impact statement, due to the broad manner in which the procedure defines "potentially impacted." The safety system impact statements may be so broad as to create additional confusion, or not be useful, to SOMs at the time of work release. The staff review team believes there are opportunities to improve this action. The engineer could clarify and provide information on operability and modes. Additionally, the engineer could delineate between equipment that will definitively be impacted by the scope of work and that which is listed as a precaution or is contingent upon other facility conditions.

7.2.4. *Oversight of Corrective Action Program*

There may be opportunities for management oversight to drive more proactive identification of issues. For example, when TSR violations or other significant events occur, a near-term review of past events for similarities might identify emerging trends sooner.

Currently, senior contractor management reviews an analysis of the prior quarter's events. Therefore, it is possible for four to five months to pass before there is any analysis of individual events for trends. Timelier discussions of the analysis of events with senior management could highlight similar past events that may encourage a quicker review of common issues.

Additionally, with more frequent reviews, senior management organizations would have the opportunity and authority to assign EOC reviews to multiple facilities. When assigning EOC reviews to multiple facilities, management could review the results of such reviews to identify opportunities to address deeper programmatic or organizational issues.

The staff review team also identified opportunities for greater senior management oversight to ensure that corrective actions for these issues are effective and timely. For example, the first quarter contractor assurance system analysis in fiscal year 2017 noted that "TSR Knowledge and Navigation" was one of SRNS's top cross-cutting issues, and the 2016 TSR CCA contained the corrective action plan to address the issue [30]. The staff review team reviewed a year of meeting minutes from the Senior Management Review Board (SMRB), and

did not note dedicated periodic briefings to the SMRB on the progress (e.g., schedule and proposed content) of the 2016 TSR CCA actions.

8. CONCLUSIONS

As detailed in this report, the staff review team identified four issues with the ConOps safety management program at SRS. DOE and contractor organizations also have identified some of these issues over the last several years. These issues were identified at SRNS and SRR facilities owned by both DOE-SR and NNSA-SRFO. These issues are:

1. Less than adequate rigor of TSR control implementation,
2. Less than adequate operations training on TSR controls and their bases,
3. Less than adequate work authorization processes in implementing TSR controls, and
4. Ineffective corrective action program.

The staff review team's analysis included an independent evaluation of less-than-adequate TSR implementation events, as listed in Appendix A. These events represent some additional risk beyond that assumed by the safety basis and TSRs. If an accident initiator occurred while a SSC was inoperable, facility personnel would not have known that the SSC might be unable to prevent or mitigate the accident. In addition, the staff review team was concerned about the lack of operational awareness related to TSR compliance. These administrative errors reveal underlying issues in administrative processes and training which bring into question the reliability of the ConOps safety management program to ensure compliance with the safety basis.

The issues, revealed both through the events in 2016 and 2017 and through the staff review team's interviews and observations, are latent organizational weaknesses defined by DOE Handbook 1028 as the "hidden deficiencies in management control processes…that create work place conditions that can provoke errors (precursors) and degrade the integrity of controls" [22]. In much the same way that repeated failures of a specific safety related control would eventually call into question the reliability of the control to perform its intended safety function, the repeated failures in the administrative implementation of TSRs challenge the reliability of the ConOps safety management program to ensure that nuclear facility personnel will operate the facilities within the bounds of their TSRs.

Therefore, the staff review team believes DOE should consider improvements to the ConOps program, the operations training program, and the corrective action program. Subsequent to the staff review team's closeout with contractor and DOE organizations, DOE-SR sent letters to SRR and SRNS directing the contractor organizations to develop corrective action plans to address less-than-adequate knowledge of TSRs and their bases; the rigor of TSR control implementation; and the work authorization process.

Appendix A – Less than Adequate TSR Implementation Events at SRS Facilities
January 2016 – August 2017

Date of Event Discovery	Facility	Event Title	Contractor	Oversight Office	ORPS Reference	Staff Review Team Binning of Common Causes for Events		
						Less than Adequate Operations Personnel Training on TSRs and their Bases	Less than Adequate Rigor of Operations TSR Control Implementation	Errors in the Work Authorization Process
3/16/2016	HTANK	*Emptying the 25H Evaporator to Tank 30 while in LCO 3.8.1 A*	SRR	DOE-EM	EM-SR--SRR-HTANK-2016-0004		X	
4/12/2016	SRNL	*Unattended Liquid Fuel Vehicle in Facility Truck Dock*	SRNS	DOE-EM	EM-SR--SRNS-SRNL-2016-0006	X	X	
4/14/2016	KAREA	*TSR LCO Violation*	SRNS	DOE-EM	EM-SR--SRNS-KAREA-2016-0001		X	
4/19/2016	SRNL	*Failure to Enter the Single System LCO for the 773-A-F-Wing Sprinkler System*	SRNS	DOE-EM	EM-SR--SRNS-SRNL-2016-0007	X		X
4/26/2016	HBLINE	*Failure to Comply with Mode Applicability Restrictions*	SRNS	DOE-EM	EM-SR--SRNS-HBLINE-2016-0002	X	X	X
5/23/2016	LAREA	*Failure to complete mode change procedure*	SRNS	DOE-EM	EM-SR--SRNS-LAREA-2016-0002		X	
5/26/2016	TRIT	*Failure to Obtain and Record Glovebox O2 Concentration from the Alternate Monitor within Required Time*	SRNS	NNSA-SRFO	NA--SRSO-SRNS-TRIT-2016-0009		X	

Date of Event Discovery	Facility	Event Title	Contractor	Oversight Office	ORPS Reference	Staff Review Team Binning of Common Causes for Events		
						Less than Adequate Operations Personnel Training on TSRs and their Bases	Less than Adequate Rigor of Operations TSR Control Implementation	Errors in the Work Authorization Process
7/14/2016	FGEN	*Premature Exit of LCO Condition*	SRNS	DOE-EM	EM-SR--SRNS-FGEN-2016-0006		X	
10/12/2016	HCAN/ HBLINE	*Failure to Enter Appropriate NIIM LCO Conditions for H-Canyon and HB-Line*	SRNS	DOE-EM	EM-SR--SRNS-MOGEN-2016-0009	X		X
12/6/2016	HCAN	*LTA Administration of LCO Entry*	SRNS	DOE-EM	EM-SR--SRNS-HCAN-2016-0015	X		X
1/10/2017	TRIT	*Incomplete Fire Suppression System Surveillance Test*	SRNS	NNSA-SRFO	NA--SRSO-SRNS-TRIT-2017-0001	X	X	
1/18/2017	TRIT	*Prohibited Conditioning of a Reservoir while in TSR Standby*	SRNS	NNSA-SRFO	NA--SRSO-SRNS-TRIT-2017-0002		X	X
3/29/2017	TRIT	*Failure to Meet TSR Minimum Shift Crew Staffing Composition Administrative Control - TSR Violation*	SRNS	NNSA-SRFO	NA--SRSO-SRNS-TRIT-2017-0004		X	
4/26/2017	TRIT	*Violation of LCO 3.1.5A for 238-H (TSR Violation)*	SRNS	NNSA-SRFO	NA--SRSO-SRNS-TRIT-2017-0006		X	

Date of Event Discovery	Facility	Event Title	Contractor	Oversight Office	ORPS Reference	Staff Review Team Binning of Common Causes for Events		
						Less than Adequate Operations Personnel Training on TSRs and their Bases	Less than Adequate Rigor of Operations TSR Control Implementation	Errors in the Work Authorization Process
5/20/2017	WVIT	*SAC 5.8.2.20 Violation - Less Than Adequate Transfer Line Walkdown Prior to Performing a Waste Transfer*	SRR	DOE-EM	EM-SR--SRR-WVIT-2017-0006		X	
6/19/2017	WVIT	*Failure to Enter Limiting Condition for Operation (LCO) 3.1.6 B*	SRR	DOE-EM	EM-SR--SRR-WVIT-2017-0011	X		X
6/20/2017	WVIT	*Administration of Entry into Limiting Condition for Operation (LCO) 3.7.1 did not meet Management Expectations*	SRR	DOE-EM	EM-SR--SRR-WVIT-2017-0010	X		X
8/8/2017	KAREA	*Technical Safety Requirement Mode Violation*	SRNS	DOE-EM	EM-SR—SRNS-KAREA-2017-0002		X	X

Acronyms Used in Attachment A

DOE	Department of Energy
DOE-EM	DOE-Environmental Management
FGEN	F-General
HCAN	H-Canyon
HTANK	H Area Tank Farms
LCO	Limiting condition for operation
LTA	Less than adequate
NIM	Nuclear incident monitor
NNSA	National Nuclear Security Administration
NNSA-SRFO	NNSA-Savannah River Field Office
SRNL	Savannah River National Laboratory
SRNS	Savannah River Nuclear Solutions
SRR	Savannah River Remediation
TRIT	Tritium
TSR	Technical safety requirements
WVIT	Vitrification Facility

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