

Bruce Hamilton, Chairman  
Jessie H. Roberson  
Joyce L. Connery

**DEFENSE NUCLEAR FACILITIES  
SAFETY BOARD**

Washington, DC 20004-2901



The Honorable Dan Brouillette  
Secretary of Energy  
US Department of Energy  
1000 Independence Avenue, SW  
Washington, DC 20585-1000

Dear Secretary Brouillette:

We have completed a review of the Savannah River Site's fire protection program. The Board concludes that the expected elements of the program have been developed, implemented, and are functioning adequately. However, we identified five areas related to the program for which the Department of Energy should consider improvements. Details are discussed in the enclosed report, which is provided for your information and use.

Yours truly,

Bruce Hamilton  
Chairman

Enclosure

c: Mr. William I. White  
Mr. Michael D. Budney  
Ms. Nicole Nelson-Jean  
Mr. Joe Olencz

# DEFENSE NUCLEAR FACILITIES SAFETY BOARD

## Staff Report

June 3, 2020

### Review of the Savannah River Site Fire Protection Program

**Summary.** The goal of this review was to evaluate the adequacy of the Savannah River Nuclear Solutions (SRNS) and Savannah River Remediation (SRR) fire protection programs, currently in place at the Savannah River Site (SRS), against Department of Energy (DOE) and industry standards. The Board's staff team members studied the Savannah River National Laboratory (SRNL) and the Tritium Extraction Facility (TEF) as examples of how the program is implemented.

The Board's staff team concludes that the expected major parts of an acceptable fire protection program are present and functioning as required in the SRS fire protection program. However, the Board's staff team identified several safety items associated with the program<sup>1</sup>:

- The current arrangement of **mobile compact shelving in the SRNL classified document vault** presents a special fire hazard that has not been properly analyzed.
- The **new A-Area water supply** is not completely safety-significant and does not have sufficient technical safety requirement (TSR) surveillances, which may prevent the safety-significant SRNL automatic sprinkler system from meeting its safety function.
- Some **fire protection records** were inconsistent with requirements and standards, or contained inaccuracies, potentially leading to missed problems, missed trends, difficulties in problem resolution, and lack of confidence in operations.
- The **SRS fire department** has had issues with excessive turnout time, a high number of nuisance alarm responses, lack of analysis in the annual fire department report, and radio communications.
- **Formal, site-wide evaluation of fire protection metric data** is limited to impairments, fire protection system uptime, staffing, corrective action tracking, and fire extinguisher inspections. This limitation could lead to missed site-wide issues for other fire protection topics such as fire prevention, life safety, combustible controls, fire watches, hot work, fire barrier inspection, and fire suppression inspection and testing, which are only evaluated on a facility or area basis.

**Background.** The Board's staff team reviewed five primary subjects related to the SRS fire protection program: program management; fire hazards analyses; fire prevention;

---

<sup>1</sup> SRNS and SRR each maintain their own fire protection programs at SRS. The first four listed safety items are specific to the SRNS program because the Board's staff selected facilities for review that happened to be under SRNS jurisdiction and the SRS fire department is managed by SRNS.

**CUI//PRIV**  
**DRAFT-NOT REVIEWED FOR PUBLIC RELEASE**

inspection, testing, and maintenance of fire protection systems; and emergency response. The review began with a general assessment of site-wide fire protection program documentation such as the site policy, site fire protection program plan, and site fire protection program manual. The review then focused on program documentation and records specific to SRNL and TEF, such as fire hazards analyses (FHA) and their assessments, as-built automatic sprinkler drawings, facility fire protection system surveillance records, and combustible control procedures.

The Board's staff team developed lines of inquiry from these documents, then conducted an on-site meeting to discuss these topics. In response to many of the lines of inquiry, SRS provided additional documentation that the Board's staff team reviewed. The Board's staff team conducted a follow-up teleconference to discuss several remaining questions and ensure a correct understanding of the identified safety items described below. Finally, the Board's staff team conducted a close-out briefing to inform SRS of the topics the Board's staff team intended to present to the Board. Key dates associated with this review are as follows:

- February 22, 2019: Staff sent agenda containing lines of inquiry to SRS.
- June 4–5, 2019: Staff held on-site interaction with SRS to discuss the lines of inquiry.
- February 11, 2020: Staff held follow-up teleconference with SRS to discuss remaining questions.
- March 30, 2020: Staff held close-out teleconference with SRS for factual accuracy and to identify topics to be presented to the Board.

**Discussion.** The Board's staff team identified the following safety items, in order of decreasing importance.

*SRNL Classified Document Vault Hazard*—The current arrangement of mobile compact shelving in the SRNL classified document vault presents a special fire hazard that has not been properly analyzed. Without proper shelving design and appropriate sprinkler protection, a fire could spread unchecked through the mobile compact shelving range, potentially overwhelming the sprinkler system and leading to fire spread beyond the vault, including areas containing material-at-risk. An analysis of the compact shelving arrangement versus the provided sprinkler protection could show that additional protection is necessary.

The classified document vault (room A-0260) is located on the service level of SRNL Section A. The documents are stored in mobile compact shelving that runs along the long northwest wall of the space. Mobile compact shelving is a type of storage system where the storage shelves may be moved together, creating a storage array with minimal space between shelving units. Access aisles are created by moving the shelving units, either manually with built-in hand cranks or via electric motor, depending on the system design (see Figure 1). There are about 20 manual mobile compact shelf units in the document vault, each having a length of about 15 ft, a width of 2–3 ft, and a height of 9.5 ft. There are no continuous, metal vertical dividers in any of the shelving units. Documents in the shelving units are stored in banker-style cardboard boxes.



**Figure 1.** *Typical mobile compact shelving arrangement (photo courtesy of Spacesaver Corporation<sup>2</sup>)*

A wet-pipe automatic sprinkler system protects the vault, including the mobile compact storage array. Per discussions with SRNS and information in the SRNL FHA [1], the installed sprinkler system meets the requirements for an ordinary hazard, group 2 (OH2) system, as described in National Fire Protection Association (NFPA) 13, *Standard for the Installation of Sprinkler Systems*, 2002 edition [2]. The design is based on a Class III commodity (paper records stored in cardboard boxes) stored in a miscellaneous storage configuration up to 12 feet tall.

The document vault is constructed with 12-in-thick concrete walls. These walls provide a substantial fire barrier, but are missing two required opening protectives that would allow a fire resistance rating of at least two hours. Specifically, the south wall is missing fire dampers in ducts penetrating the wall, and the document storage vault fire door does not have a self-closing device [1, 3]. SRS adopted an equivalency in 1996 that accepted these deficiencies, as documented by F-ERS-A-00178 [3]. This occurred in 1996, well before installation of the mobile compact storage system in 2005. However, the context of the equivalency was for

---

<sup>2</sup> <https://www.spacesaver.com/>

**CUI//PRIV**  
**DRAFT-NOT REVIEWED FOR PUBLIC RELEASE**

protection of the vital records in the vault from a fire external to the vault, as opposed to a vault fire exposing the rest of SRNL.

SRNS stated that the current arrangement is acceptable as-is because it was compliant at the time of installation, newer versions of NFPA 13 do not retroactively require the mobile compact shelving provisions, SNRL accepted the vault fire barrier deficiencies via the equivalency described above, and the arrangement continues to meet the requirements for miscellaneous storage in newer versions of NFPA 13. As such, SRNS stated that there has been no independent hazard evaluation for the storage arrangement as a mobile compact shelving array.

The 2002 edition of NFPA 13 was the code in effect at the time SRNL installed the mobile compact shelving system (ca. 2005). This edition does not contain provisions for protecting mobile compact shelving arrangements, which did not begin appearing until the 2010 edition of NFPA 13. The storage arrangement most closely related to the vault document storage configuration was that of miscellaneous storage up to a height of 12 ft. At the time, the SRNL design team determined that the existing SRNL sprinkler system would adequately protect the storage arrangement per the applicable NFPA 13, 2002, edition's miscellaneous storage requirements.

SRNS reviewed the currently-adopted edition of NFPA 13 at SRS (2016 edition [4]) for requirements to retroactively apply mobile compact shelving requirements, specifically citing:

*§1.4.1 Unless otherwise specified, the provisions of this standard shall not apply to facilities, equipment, structures, or installations that existed or were approved for construction or installation prior to the effective date of the standard. Where specified, the provisions of this standard shall be retroactive.*

SRNS checked the NFPA 13 (2016) provisions for mobile compact shelving, §20.6 and §20.7, noting that neither section contains retroactive application language. These sections address compact storage of paper files, magazines, books, etc., up to 8 ft high, and high bay records storage from 12 to 34 ft high, respectively.

SRNS provided an explanation to the Board's staff team on the acceptability of the NFPA 13 (2016 edition) miscellaneous storage provisions for the mobile compact storage in the vault. SRNS stated that the stored documents meet the NFPA 13 definition of "Cartons Record Storage" as defined in §3.9.1.2, which also identifies this type of storage as a Class III commodity. This definition is then applied to Table 13.2.1, which identifies appropriate protection schemes for Class III commodities. As shown in Table 1 below for storage heights up to 12 ft, an OH2-designed sprinkler system is appropriate for solid-piled, palletized, bin-box, shelf, single-, double-, and multi-row rack, and back-to-back shelf storage.

**CUI//PRIV**  
**DRAFT-NOT REVIEWED FOR PUBLIC RELEASE**

**Table 1.** *NFPA 13 (2016) Table 13.2.1, Discharge Criteria for Miscellaneous Storage Up to 12 ft (3.7m) in Height (relevant part of table highlighted)*

Commodity	Type of Storage	Storage Height		Maximum Ceiling Height		Design Curve Figure 13.2.1	Note	Inside Hose		Total Combined Inside and Outside Hose		Duration (minutes)
		ft	m	ft	m			gpm	L/min	gpm	L/min	
Class I to Class IV												
Class I	Solid-piled, palletized, bin box, shelf, single-, double-, multiple-row rack, and back-to-back shelf storage	≤12	≤3.7	—	—	O11		0, 50, 100	0, 190, 380	250	950	90
Class II		≤10	≤3.0	—	—	O11		0, 50, 100	0, 190, 380	250	950	90
Class II		>10 to ≤12	>3.0 to ≤3.7	—	—	O12		0, 50, 100	0, 190, 380	250	950	90
Class III		≤12	≤3.7	—	—	O12		0, 50, 100	0, 190, 380	250	950	90
Class IV		≤10	≤3.0	—	—	O12		0, 50, 100	0, 190, 380	250	950	90
Class IV	Palletized, bin box, shelf, and solid-piled	>10 to ≤12	>3.0 to ≤3.7	32	10	O12		0, 50, 100	0, 190, 380	250	950	90
Class IV	Single-, double-, multiple-row rack and back-to-back shelf storage	>10 to ≤12	>3.0 to ≤3.7	32	10	E11		0, 50, 100	0, 190, 380	500	1900	120

The Board’s staff team agrees that the evaluation of the sprinkler system at the time of mobile compact storage installation was correct, based on information in the 2002 edition of NFPA 13. The Board’s staff team also acknowledges that newer versions of NFPA 13 do not retroactively require older mobile compact shelving arrangements to meet the current edition. However, in addition to §1.4.1 cited above, NFPA 13 (2016) states the following regarding retroactivity:

*§1.4.2 In those cases where the authority having jurisdiction determines that the existing situation presents an unacceptable degree of risk, the authority having jurisdiction shall be permitted to apply retroactively any portions of this standard deemed appropriate.*

This suggests that when a new hazard is discovered, it can be appropriate to evaluate the hazard to determine if changes or additional protection are warranted. The Board’s staff team contends that this is such a circumstance.

The miscellaneous storage provisions of NFPA 13 (2002 through 2016), do not specifically address mobile compact shelving. As noted in Table 1 above, the applicable storage arrangements for Class III commodities are solid-piled, palletized, bin-box, shelf, single-, double-, and multi-row rack, and back-to-back shelf storage. Each of these storage arrangements is individually defined in Chapter 3 of NFPA 13 (2016). Chapter 3 also specifically defines compact storage and compact storage module:

*§3.9.1.6 Compact Storage. Storage on solid shelves not exceeding 36 in. (900 mm) in total depth, arranged as part of a compact storage module, with no more than 30 in. (750 mm) between shelves vertically and with no internal vertical flue spaces other than those between individual shelving sections.*

**CUI//PRIV**  
**DRAFT-NOT REVIEWED FOR PUBLIC RELEASE**

*§3.9.1.7 Compact Storage Module. A type of shelving unit consisting of compact storage whereby the units move to allow for storage to be pushed together creating a storage unit with no flues or minimal spaces between units. Aisles are created by moving the shelving unit. Compact storage modules can be manual or electric in operation.*

If the NFPA 13 development committee had intended for compact storage/compact storage modules to be an acceptable storage arrangement for Class III commodities in miscellaneous storage, compact storage would have been listed among the other defined storage arrangements in Table 1. Thus, while an OH2 sprinkler system is appropriate for the storage arrangements identified in the table, it follows that mobile compact shelving is not appropriately protected by such a system as it is not listed.

Other sections of NFPA 13 (2016) identify the protection of specific arrangements involving mobile compact shelving. Section 20.6 addresses the storage of paper products on mobile compact shelving. This section has specific limits and requirements, including limiting the height of shelving units to 8 ft, requiring solid metal dividers in the shelving units, and limiting the overall footprint of the mobile storage array to 250 ft<sup>2</sup>. Arrangements meeting the requirements of Section 20.6 are permitted to use a light hazard sprinkler system, which has a lower density water spray than OH2. Section 20.7 addresses the storage of records in high-bay storage (12 ft to 34 ft high), including mobile compact shelving. Similar to Section 20.6, this section has specific limits and requirements, including installation of an early suppression, fast-response sprinkler system (higher density water spray than OH2), installation of vertical metal barriers in the shelving units, and a power-driven mobile compact shelving system that automatically spreads out all shelving units upon fire detection. The storage arrangement in the SRNL vault does not meet the requirements described in either Section 20.6 or 20.7.

Annex A of NFPA 13 (2016) provides further clarity on the standard's limitations in providing adequate protection for mobile compact shelving arrangements:

*A.20.6.1. NFPA 13 contains protection criteria for **limited configurations of compact mobile storage units and materials stored. Storage arrangements not specifically addressed in NFPA 13 are outside the scope of the standard** [emphasis added] (i.e., protection for commodities other than paper files, magazines, or books in compact mobile storage units does not simply follow high-piled storage protection criteria for shelves or racks). **Where compact mobile storage configurations outside the scope of NFPA 13 are to be utilized, they must be addressed on a case-by-case basis with consideration given to the fact that no known sprinkler protection criteria is currently available** [emphasis added]. Additional protection features, such as rated construction, barriers within the storage, consideration for safe locating away from vulnerable areas, and methods for control or exhausting of the smoke, should be considered.*

As emphasized above, both the physical configuration of the mobile storage units and the materials stored are important factors that must be considered. Relying only on the classification of the stored material does not result in appropriate protection.

**CUI//PRIV**  
**DRAFT-NOT REVIEWED FOR PUBLIC RELEASE**

Based on the above considerations, the Board's staff team concludes that the current sprinkler protection has not been properly evaluated to determine its appropriateness for the hazard presented by the mobile compact storage arrangement in the SRNL classified document vault. This is important because the documented safety analysis (DSA) credits the safety-significant automatic suppression system for preventing a facility-wide fire that results in a high radiological consequence to the co-located worker [5]. The vulnerabilities in the fire barriers around the vault could lead to fire spread beyond the vault if the sprinklers fail to control a fire within the mobile compact shelving system. If fire spread were to occur beyond the vault, additional sprinklers may not have enough remaining pressure or water flow to effectively control fire spread, given the likely large number of sprinklers operating within the vault.

*New A-Area Fire Water Supply Not Fully Safety-Significant*—The newly installed and operating A-Area water supply system, which delivers water to the safety-significant SRNL sprinkler system, is a general service system with one safety-significant feature. As this water supply is a primary support system for the SRNL fire suppression system, the safety function of the suppression system, as required by the safety basis, may not be assured.

In June 2016, the 63-year old 782-A fire protection water tank began leaking from its corroded base plate. After devising and applying temporary patches to the tank, SRNS and DOE deliberated on an appropriate path forward, ultimately electing to build a new fire protection water supply system for A-Area. The SRS Operations Office (DOE-SR) directed SRNS to design and acquire the new system as a general service system, though the previous water supply was classified as safety-significant to support the safety-significant SRNL automatic sprinkler system. DOE and SRNS shared the concern that the existing configuration might lead to a catastrophic tank failure, which would leave A-Area without an adequate fire protection water supply. The M-Area water supply system, which can be realigned to serve A-Area, cannot meet the prescribed water flow and pressure requirements for SRNL. DOE and SRNS deemed the additional time and cost<sup>3</sup> of installing a fully compliant safety-significant system excessive given the risk of tank failure. The primary components of the new system, which began operating in early 2020, are a water tank, pump house with one electric fire pump and one diesel fire pump, underground and aboveground piping, freeze protection system, and a water tank low low level alarm.

DOE and SRNS justified the downgrade of the water supply by citing (1) a Fire Protection Research Foundation report [6] on commercial fire pump reliability and (2) the fact that SRNS would not downgrade the associated monitoring system (i.e., a safety-significant water tank low low level alarm). The February 2017 safety basis strategy for SRNL states the justification as follows [7]:

*A project to design, fabricate, install, and start up a replacement fire water supply system (pumps and tank) has been initiated. The goal is to provide a reliable NFPA compliant fire water supply as soon as possible. To achieve this, **the***

---

<sup>3</sup> SRO believed that downgrading the tank and pumps to general service reduced the schedule by one to two years, and saved between \$1.8M and \$2.4M on a total project cost of ~\$18M.

**CUI//PRIV**  
**DRAFT-NOT REVIEWED FOR PUBLIC RELEASE**

*replacement fire water supply system, except for the monitoring system, will be downgraded in functional classification to General Service (GS) [emphasis added] and will be controlled via the Fire Protection Program and the Memorandum of Understanding (MOU) between SRNL and Site Infrastructure. It has been determined that the design and reliability of a GS NFPA compliant fire water supply system is not significantly different than that of an SS [Safety Significant] NFPA compliant system [emphasis added]. The replacement fire water supply system with a functional classification of GS will be designed to meet applicable building codes and NFPA codes and standards. For SC and SS fire protection systems DOE-STD-1066-2012 [DOE Standard 1066-2012] (Ref. 44) refers to DOE O [Order] 420.1C, Attachment 2, Chapter II (Ref. 45), which requires that fire protection for DOE facilities, sites, activities, design, and construction meet, or exceed, applicable building codes and NFPA codes and standards, which will also be met by the GS system. It is anticipated that by assigning a functional classification of GS versus SS to the new supply system the overall replacement project schedule will be shortened and the overall project cost and schedule risk will be reduced such that a more reliable supply system can be brought on-line sooner. A separate revision to the SRNL DSA and TSRs [technical safety requirements] will be submitted at a later date to incorporate the replacement fire water supply system in accordance with the project schedule.*

In December 2019, the Board's staff team reviewed a draft of the Safety Basis Implementation Plan, which will update the SRNL DSA to revision 19, and the SRNL TSRs to revision 21 [8]. This draft plan confirms the previously discussed plans to remove the fire pump from and add the new tank water level meter to the TSR surveillances. Section 2.9 identifies the changes to the TSR surveillances:

- SR 4.1.1.1 – Deleted (“Perform a FUNCTIONAL TEST on the ST&FP Wireless monitoring System to verify receipt of the 782-A Service Water Storage Tank low level alarm (audible and visual in the C-041 Control Room) when water level is less than 25.8 feet.”)
- SR 4.1.1.4 – Deleted (“Perform a FUNCTIONAL TEST (flow condition) of Fire Pump #3.”)
- SR 4.1.1.10 – Added (“Perform a FUNCTIONAL TEST on the 902-2A Fire Water Storage Tank Low Low Level Alarm to verify receipt of the 902-2A Fire Water Storage Tank Low Low Level Alarm (audible and visual in the C 041 Control Room) when water level is 20.00 feet and less.”)

Section 2.8 confirms that water supply will not be covered as a TSR design feature, as the changes listed in this section do not address any fire protection-related systems. The Board's staff team assumes SRNL will maintain the water supply (tank, pumps, valves, etc.) per NFPA standards, even though only the water level alarm is included in TSR surveillance. DOE-SR stated that the solution met the requirements of DOE Order 420.1C (Change 1) [9] and DOE Standard 1066 (2012) [10], and as a result, an exemption or equivalency to the order and standard were not required.

**CUI//PRIV**  
**DRAFT-NOT REVIEWED FOR PUBLIC RELEASE**

In 2017, the Board's staff team reviewed the 2017 update of the SRNL DSA. A part of this effort included reviewing the path forward for the proposed A-Area water tank replacement, where the Board's staff team identified four concerns that were communicated to the Board [11]:

- The proposal would be inconsistent with DOE standards on functional classification of structures, systems, and components (SSCs), specifically DOE Standard 3009-94, CN3 and DOE Standard 1066-2016.
- The proposal would not include the design requirements of DOE Standard 1066, Appendix A, which include requirements for safety-significant water supplies.
- The proposal would not ensure the quality assurance pedigree required by DOE directives for safety-significant systems.
- The proposal could result in a deviation from developing appropriate technical safety requirements.

At the time of the 2017 review, DOE-SR personnel emphasized that they would evaluate the design criteria for safety-significant fire water supply systems in Appendix A of DOE Standard 1066-2012 for applicability to the project. Concerning TSR coverage, DOE-SR agreed that including operability requirements for the tank and pumps in the TSR would be appropriate, but communicated that decisions on specific TSR decisions would be made during a later phase. The Board's staff team review documented here serves as a follow up to these concerns.

Both in 2017 and now, the Board's technical experts and the Board agreed with the urgency of replacing the A-Area water supply system due the potential for catastrophic failure of the old 782-A water tank. However, the Board's staff team disagrees that the newly-installed A-Area water supply system meets the requirements of DOE Order 420.1C, Change 1, or DOE Standard 1066-2012, which DOE and SRNS applied to this project. The Board's staff team also has concluded that TSR coverage of the new water supply system is necessary, in addition to the water level alarm.

Attachment 3 of DOE Order 420.1C describes the design criteria for safety SSCs with section 3.a.(5) specifically describing support systems. Item (a) in this section states:

*Support [structures, systems, and components (SSCs)] must be designed as safety-class or safety-significant SSCs if their failures prevent safety-SSCs or specific administrative controls from performing their safety functions.*

Failure of the A-Area water supply system would prevent the safety-significant SRNL fire suppression system from performing its safety function, as the required water volume, flow rate, and pressure would not be available. Section 3.b.(8) describes the appropriate design criteria for safety-related fire protection systems:

*DOE-STD-1066-2012, Fire Protection, provides acceptable methods for the design of fire protection systems, including safety-class and safety-significant fire barriers, water supplies, and wet pipe sprinkler systems (see Appendix A of DOE-STD-1066-2012). Fire protection system designs are also required to address the*

**CUI//PRIV**  
**DRAFT-NOT REVIEWED FOR PUBLIC RELEASE**

*applicable design requirements for similar safety systems provided in this attachment.*

Appendix A of DOE Standard 1066-2012 reiterates that water supplies used to support safety-class or safety-significant suppression systems must be appropriately designed and installed:

*A.3.1.1.2 The designer shall assess long term availability and reliability of water supply systems required to support a safety-related suppression system for an enduring mission. **Providing a new, appropriately-designed, safety-related water supply system will be expected**<sup>4</sup> [emphasis added].*

Important support systems specifically for fire protection water supplies, such as freeze protection, are not directly addressed in DOE Standard 1066-2012, but are generally addressed in the Appendix A, Section A.2.3 of the standard as part of a larger discussion of support systems for safety-related automatic sprinkler systems:

*Examples of support systems (beyond the water supply system) may include the freeze protection system, alarm devices and associated trim, and pressure monitoring systems. The general criteria in DOE G 420.1-1A [DOE Guide 420.1-1A] specifies that support systems are to be designed, fabricated, erected, and tested to standards and quality requirements commensurate with their importance to safety. The support systems shall be classified as equal or superior to the classified wet pipe sprinkler system, if they are essential to the sprinkler system performing its safety function.<sup>5</sup>*

While the new A-Area water supply system has positive features such as a safety-significant water tank low level alarm and two fire pumps to increase reliability, the Board's staff team concludes that DOE and SRNS did not meet DOE requirements to properly classify the fire protection water supply, and an exemption or equivalency to DOE Order 420.1C and DOE Standard 1066 would be appropriate. The exemption or equivalency should describe the reasoning for the deviation, and mitigating features, such as dual fire pumps and TSR surveillances.

Section 4.4.14.3 of the SRNL DSA, Revision 18, identifies the required functional characteristics of the safety-significant fire suppression system, including the water supply [5]:

*The Building 773-A Sprinkler Systems rely on the A&M-Area OSUG Fire Water Supply System to supply its water. Consequently for the Building 773-A to function*

---

<sup>4</sup> DOE Standard 1066-2016 clarified this requirement: "The long-term availability and reliability of water supply systems required to support a safety-related suppression system for an enduring mission shall be assessed. For enduring missions, a new, appropriately-designed, *safety-related water supply system shall be provided* [emphasis added]." [12]

<sup>5</sup> DOE Standard 1066-2016 provided clarification that freeze protection systems for water supplies must also be suitably classified and appropriately designed (See §A.3.2.4 in Appendix A of this standard). [12]

**CUI//PRIV**  
**DRAFT-NOT REVIEWED FOR PUBLIC RELEASE**

*[sic], the A&M-Area OSUG Fire Water Supply System must supply the required demand (pressure and flow) for the Building 773-A Sprinkler Systems' demand.*

The DSA also states that the sprinkler system is not required to function after a natural phenomenon hazard event that could impact the sprinkler system, such as a seismic event. This means that three basic functional characteristics of the fire protection water supply system must be protected:

1. Maintain the minimum volume of water needed for the specified fire duration,
2. Provide a sufficient motive force to deliver the water to the suppression system at the required pressure and flow rate, and
3. Maintain an uninterrupted flow path between the water tank and the connection to the suppression system.

As noted above, the only TSR surveillance proposed for the new A-Area water supply system is for maintenance of the safety-significant water tank low level alarm, which addresses functional characteristic #1 above. While the new system uses both an electric fire pump and diesel fire pump for added reliability, neither pump has been proposed for TSR surveillance to address function #2 above. The previous TSR had an annual fire pump surveillance requirement, which the Board's staff team concludes should be retained [13]. Neither the current TSR, nor the proposed TSR revisions, include a TSR surveillance that addresses function #3 above. The Board's staff team concludes that the freeze protection for the above-ground pipes should be subject to an appropriate TSR surveillance that will ensure an uninterrupted flow path during the winter months<sup>6</sup>. The Board's staff team assumes that the fire pumps and freeze protection will be maintained per NFPA standards, but concludes that providing TSR surveillance of these features is appropriate to assure performance of the safety-significant function of the SRNL sprinkler system.

In summary, the Board's staff team concludes the following about the new A-Area water supply:

- An exemption or equivalency to DOE Order 420.1C or DOE Standard 1066 is appropriate because the new A-Area water supply does not meet the requirements in these standards for systems supporting safety-significant SSCs.
- SRNL should include surveillance coverage of at least one of the fire pumps in the TSRs.
- SRNL should include surveillance coverage of freeze protection for the above-ground pipes in the TSRs.

---

<sup>6</sup> The alignment of other water supply isolation valves in the A-Area water supply are covered by surveillance procedure "Operation of 773-A Fire Protection Systems," TO-07-009, although it is not specifically mentioned in the SRNL TSR.

**CUI//PRIV**  
**DRAFT-NOT REVIEWED FOR PUBLIC RELEASE**

*Fire Protection Records Issues*—The Board’s staff team found that some fire protection records were inconsistent with requirements and standards, or contained inaccuracies. Lack of consistent, accurate records can lead to missed problems, missed trends, difficulties in problem resolution, and lack of confidence in operations. Specific examples identified by the Board’s staff team are detailed below.

The record of the 2017 annual periodic testing of the TEF (264-H, 264-1H, and 264-2H) fire protection systems showed that a test/drain assembly was leaking, but it was not identified as either a critical deficiency or non-critical deficiency [14]. This is inconsistent with NFPA 25 (2017), *Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems*, which suggests in Table A.3.3.7 that leaking fire protection valves be considered critical deficiencies [15]. SRNS stated that it believed identifying the leaking valve as a non-critical deficiency was consistent with NFPA 25, and also noted that the repair was completed as part of a routine work order (#163-3486).

The records for the 2016 and 2017 annual surveillances of the electric driven fire pumps serving SRNL [16, 17] did not include voltages or currents from the electric motor at each water flow condition, as required by NFPA 25 (2017) §8.3.3.7.(2).(a). SRNS acknowledged NFPA 25 fire pump inspection record data was missing the required voltage and current readings.

The fire door inspection checklist form (OSR 20-240) attached to the 2016, 2017, and 2018 TEF fire door inspection records contains an error [18, 19, 20]. Specifically, two of the visual inspections for rolling fire doors are incorrectly blocked-out, which promotes incorrectly marking these items as the wrong type of door (see figures 2 and 3). For all of the inspected doors in the 2017 and 2018, inspectors incorrectly checked “satisfactory,” similar to figure 2. Conversely, for most of the inspected doors in 2016, inspectors correctly marked “N/A,” despite the error in the checklist.

OSR 20-240 (Rev 10/17/2016)

### Fire Door Inspection Checklist

[ / ] Satisfactory  
[ x ] Unsatisfactory

Building No: 264-2H Door: 100 Rm: 215 Rating: 1.5  
 Location: Stackwell Procedure No. 116.1  Single  Double

Type Door:  Sliding (SL)  Swinging (SW)  Rolling (R)

	(SL)	(SW)	(R)
1. VERIFY that UL rating on door and frame is present and legible.		/	
<b>9. VISUAL INSPECTION (Both sides of door):</b>			
• No open holes or breaks exist in surfaces of either the door or frame		/	
• Slats, end-locks, bottom bar, guide assembly, curtain entry hood, and flame baffle are correctly installed and intact		/	
• Glazing, vision light frames, and glazing beads are intact and securely fastened in place, if so equipped		/	
• Curtain, barrel and guides are aligned, level, plumb, and true		/	
• No parts are missing or broken		/	

**Figure 2.** Error in fire door inspection checklist (red circled areas)

**CUI//PRIV**  
**DRAFT-NOT REVIEWED FOR PUBLIC RELEASE**

OSR 20-240 (Rev 10/17/2016)

**Fire Door Inspection Checklist**

[ / ] Satisfactory  
 [ x ] Unsatisfactory

Building No: 264-2H Door: 100 Rm: 215 Rating: 1.5  
 Location: Stackwell Procedure No. 116.1  Single  Double  
 Type Door:  Sliding (SL)  Swinging (SW)  Rolling (R)

	(SL)	(SW)	(R)
1. VERIFY that UL rating on door and frame is present and legible.		/	

	(SL)	(SW)	(R)
9. VISUAL INSPECTION (Both sides of door):			
• No open holes or breaks exist in surfaces of either the door or frame		/	
• Slats, end-locks, bottom bar, guide assembly, curtain entry hood, and flame baffle are correctly installed and intact		N/A	
• Glazing, vision light frames, and glazing beads are intact and securely fastened in place, if so equipped		/	
• Curtain, barrel and guides are aligned, level, plumb, and true		N/A	
• No parts are missing or broken		/	

**Figure 3.** Potential correction for fire door inspection checklist (green circled areas)

The fire door inspection records for the 2016, 2017, and 2018 TEF fire doors also contained some incorrect and inconsistent markings [18, 19, 20]. Examples include:

- Checklist marking is incorrect for 264-H, door #12, which is listed as a single-leaf, swinging door in section 5.6 of the inspection procedure. In the 2016 record, this door is correctly marked as “N/A” for proper operation of the door coordinator and presence of an astragal, both of which are only applicable to double-leaf doors. However, in the 2017 and 2018 records, inspectors marked these items “satisfactory.”
- Checklist marking is inconsistent for 264-2H, elevator door at corridor 174. The 2017 record indicated that inspectors deemed the fire door drop testing and release arm or weight position “satisfactory.” In contrast, inspectors marked these items “N/A” in the 2016 and 2018 records, which would appear to be correct as these features are not typically associated with elevator doors.
- The inspection record for elevator door at Corridor 174 in 264-2H was missing from the 2016 record set provided to the Board’s staff team.
- The Board’s staff team reviewed the TEF fire door inspection records on-site in September 2018. In September 2019 as a follow-up activity, the Board’s staff team again reviewed the same records, which SRS provided in response to an information request. The second review found that the 2016 record set contained inspection sheets for additional doors that were not in the original, on-site review set (Doors 70, 81, 88, 89, 90, 93, 100, 103, and elevator doors in corridor 214). SRNS stated that

**CUI//PRIV**  
**DRAFT-NOT REVIEWED FOR PUBLIC RELEASE**

the increase in the number of doors inspected in TEF was attributed to a new provision in the 2015 edition of NFPA 101, *Life Safety Code*.<sup>7</sup>

The records of the 2018 annual surveillance of the SRNL sprinkler system (main drain testing) [21] did not include annotated procedures for Sections E and F, as required by Section 7.0 of the included surveillance procedure (TO-07-011, Revision 12). The records of the 2016 and 2017 annual surveillances of the SRNL sprinkler system (main drain testing) contained annotated procedures that were not from the same inspection year [22, 23]:

- The March 2016 surveillance record contained March 2017 records for the SRNL Section E valve house fire system test, SRNL Section F valve house fire system test, and A-Area fire pump test.
- The March 2017 surveillance record contained a March 2018 record for checking the alignment of the A-Area water supply post indicator valves.

SRNS stated that any information in the surveillance record other than the basic surveillance procedure is not required, with omitted record sheets and extraneous records both considered to be in this category.

The procedure used to document the TSR surveillance of the TEF sprinkler systems (SURV-TRIT-1448) uses action statements such as “IF resuming Periodic Surveillance THEN” or “IF returning to Periodic Surveillance THEN,” without any further guidance on which specific “Periodic Surveillance” is being cited. The Board’s staff team reviewed an example surveillance record for TEF sprinkler systems, which had been performed over the course of two days [24].

Each day, per the procedure, facility personnel made a general building announcement regarding the testing of the 264-H, 264-1H, and 264-2H systems, and fire protection personnel placed the fire alarm into test mode to disable alarm horns/strobes as well as ventilation shutdown interlocks. However, the personnel performing the procedure skipped step 10 each day, following the step 9 instruction: “IF resuming Periodic Surveillance, THEN GO TO step 11.” Step 10 of the procedure restores the fire alarm system to normal operation. The procedure does not state or provide a notation area to record details indicating which surveillance is being completed next. As such, the test record could be interpreted to mean that fire protection personnel mistakenly left the fire alarm in test mode overnight, since the record only included one surveillance per day. The procedure also includes a step to make a general announcement that the fire alarm testing is complete, but the personnel performing the test marked this step “N/A” for both surveillances. It appears that personnel executing the procedure never get to this step because an action statement, “RETURN to applicable Periodic Surveillance,” directs the

---

<sup>7</sup> SRNS provided this explanation after the Board’s staff reviewed TEF records on-site in 2018, but before the Board’s staff requested the records for a follow up review in late 2019. In the follow up review, additional doors were included in the 2016 inspection record set provided to the Board’s staff. While it is true that additional provisions were added to the 2015 edition of the Life Safety Code, these should not have increased the number of doors inspected. All of the doors listed for inspection in 264-H and 264-2H are identified as fire doors. NFPA 80, *Standard for Fire Doors and Other Opening Protectives*, has required annual inspection of fire doors for many years.

**CUI//PRIV**  
**DRAFT-NOT REVIEWED FOR PUBLIC RELEASE**

user elsewhere. SRNS stated the TEF surveillance database is set up to send out reminders (“ticklers”) for all surveillances related to procedure SURV-TRIT-1448, which is supposed to prevent problems with procedure entry/exit points related to other periodic surveillances, though it was not clear to the Board’s staff team how ticklers would address this issue in practice.

The records for monthly fire prevention and life safety inspections of TEF contained some inconsistent marking between the April 2017 and June 2017 inspections [25, 26, 27]. In April, inspectors marked Stairwell 1 and Stairwell 2 locations “N/A”, although the inspectors identified a deficiency with penetration seals in these stairwells. In May and June, inspectors marked the records for these stairwells “satisfactory” instead of “N/A,” without mention of the previous deficiency. In April, inspectors also marked Rooms 202, 205, and the flammable liquid storage cabinets in the truck bay area and crane maintenance area “N/A.” The May inspector marked these locations “satisfactory.” In June the inspector returned to listing Rooms 202 and 205 as “N/A.”

SRNS was able to provide the Board’s staff team with all requested surveillance and inspection records. On this basis, the Board’s staff team concludes that there is no apparent lack of fire protection inspections or test executions. However, given the issues discussed above, the Board’s staff team is concerned about the potential lack of rigor in conduct of operations and record keeping practices.

*SRS Fire Department Issues*—The Board’s staff team identified several issues with the SRS fire department, including excessive turnout time, a high number of nuisance alarm responses, lack of analysis in the annual fire department report, and radio communications. These issues can reduce the effectiveness of response, potentially leading to increased consequences from fires or other emergencies requiring fire department intervention.

The 2018 SRS fire department annual report provided detailed response times associated with all fire and fire alarm events for the year [28]. The average turnout time<sup>8</sup> for the first responding unit to the 216 events listed in the report was approximately 145 seconds<sup>9</sup>. This average is greater than the limit set by the SRS baseline needs assessment (BNA) [29] and NFPA 1710, *Organization and Deployment of Fire Suppression Operations, Emergency Medical Operations, and Special Operations to the Public by Career Fire Departments* [30], which both require a maximum turnout time of 80 seconds. SRNS stated it is starting efforts to improve turnout time. The Board’s staff team agrees that SRNS should improve turnout time to reduce the overall response time to a fire alarm.

---

<sup>8</sup> Turnout time is defined as the time elapsed between receipt of alarm at the fire station and the start of responder travel to the incident location.

<sup>9</sup> The average was based on the data presented in the “Fire” and “Fire Alarms” tables in the “Chronological Listing – Alarm Responses” section of the report. Two of the fires in the table did not include any response data, and are not included here.

**CUI//PRIV**  
**DRAFT-NOT REVIEWED FOR PUBLIC RELEASE**

The 2018 SRS fire department annual report states that the total number of SRS fire department alarm responses during 2018 was 500<sup>10</sup>. Of the 500 alarm responses, the annual report attributed 203 to nuisances, which accounts for approximately 40 percent of the total. The annual report contains a chart entitled “Fire Alarm Causes – 2018,” which identifies the causes of all alarms, including presumed nuisance alarms. Table 2 shows how SRS categorized each of the 203 nuisance alarms.

**Table 2. SRS Fire Department 2018 Report – Causes of Nuisance Alarms [28]**

<i>Cause</i>	<i>Number of Alarms</i>	<i>Cause</i>	<i>Number of Alarms</i>
Dust/Dirty Detector	16	Power Surge/Lightning	3
Cooking	7	Water Surge	14
Heater/Heat Strips	18	Moisture/Humidity	27
Electrical Problems	12	Work	14
HVAC Problem	4	Unknown	38
Bad Detector	10	Other	16
Air Flow	7	Fumes	7
Light Ballast	4	Low Air	4
Pull Station	2		

NFPA collects annual nationwide fire department response statistics, including the number of nuisance alarm responses<sup>11</sup>. Between 1980 and 2018, the percentage of fire department responses attributed to nuisance alarms has varied from 7 percent to 11 percent of all responses in any given year [31]. In 2018, the percentage of alarm responses attributed to nuisance alarms was 7.9 percent, which is less than that observed at SRS.

NFPA also generated a more detailed report of the 2018 fire department response data [32]. This report identifies categories of nuisance alarms as:

---

<sup>10</sup> In 2018, there were 131 responses associated with drills, which are not included in the 500 alarm responses.

<sup>11</sup> NFPA uses the term “false alarms” in its reporting instead of the SRS fire department term “nuisance alarms.”

**CUI//PRIV**  
**DRAFT-NOT REVIEWED FOR PUBLIC RELEASE**

- Malicious, mischievous false calls,
- System malfunctions,
- Unintentional calls, and
- Other false alarms (bomb scares, unclassified false alarms, etc.)

Most of the SRS nuisance alarm causes would fit into the “system malfunction” and “other false alarms” categories above. However, NFPA response statistics also include a broad category entitled “All Other Responses” with examples such as smoke scares and lockouts, which could include some causes listed in Table 2. Between 1980 and 2018, the percentage of fire department responses included in this category has varied from 10 percent to 18 percent of all responses in any given year. In 2018, the percentage of total alarms in the “all other responses” category was 17.3 percent. Though all responses in this category are unlikely to be considered the result of nuisance alarms, adding the “all other responses” to the false alarm responses yields a maximum possible nation-wide nuisance alarm response of approximately 25 percent. This nuisance alarm response rate is still lower than the 40 percent observed at SRS. SRNS stated its desire to better understand this potential issue, but did not suggest further action. The Board’s staff team contends that the topic of nuisance responses should be evaluated to determine if the sources of nuisance alarms may be reduced or the threshold for responding to such events increased, as appropriate, which would allow SRS fire department resources to be applied to more productive endeavors such as training or systems inspections.

NFPA 1710 [30] requires an annual report to be developed regarding fire department performance. Minimally, this report must evaluate the response times (§4.1.2.5, §4.1.2.6) and training activity (§6.3.2) of the fire department. The 2018 SRS fire department annual report is intended to address this requirement, and contains a large amount of informative data. However, the report does not include any significant evaluation of the data to determine if the department is meeting the performance metrics identified in the BNA or NFPA 1710 (such as turnout time). DOE-SR stated that it receives this report annually, and reviews it for any major issues. SRNS stated it is starting efforts to improve this reporting. The Board’s staff team concludes that the annual report should continue to include the current informative data set, but that the report should, at a minimum, include some evaluation of the data associated with response times and training.

SRS fire department radio communication problems are a long-standing issue at the site. The current radio trunking system (RTS) employs a single radio tower to cover the entire site, which uses a frequency band suitable for wide area coverage. An unfortunate side effect of this frequency band can be poor penetration inside some buildings around the site [33]. This can cause intermittent interruptions in communication, leading to potential confusion during an emergency response. As a temporary solution, the SRS fire department can use radio-to-radio communications on two simplex channels that bypass the RTS, although this method can also have difficulties, depending on the structure. SRNS stated that the best solution is to replace the current RTS system with a new site-wide system, but that the cost is likely to be between \$2M and \$10M. In the interim, the site has installed a repeater at the Defense Waste Processing Facility, and is considering additional portable and fixed repeaters to improve communications in other specific locations. The Board’s staff team concludes that SRS should address the SRS fire

**CUI//PRIV**  
**DRAFT-NOT REVIEWED FOR PUBLIC RELEASE**

department radio communication issues as soon as possible. Poor communication capabilities during an emergency may lead to increased damages, loss of mission capability, or loss of life.

*Limited Analysis of Fire Protection Data*—Per discussions with SRNS and SRR, formal, site-wide evaluation of fire protection metric data is limited to several specific topics:

- Fire protection system impairment records,
- Fire protection system uptime data,
- Fire extinguisher inspections,
- Fire protection staffing, and
- Corrective action tracking.

Metric data associated with other fire protection program topics are not evaluated at the site level, including:

- Fire prevention, including combustible controls, fire watches, and hot work activities,
- Life safety,
- Fire barrier inspections, and
- Fire suppression inspection and test records.

The lack of site-wide evaluation may result in missed pervasive issues, and limited resources may not be appropriately directed. The Board's staff team acknowledges that proper activities associated with these topics (such as conducting inspections, performing assessments, and addressing deficiencies) are being completed at the area/facility-level. The Board's staff team's concern is that metric data from these topics are not formally being evaluated at the site level for pervasive issues. A hypothetical example would be an increase in deficiencies associated with blocked egress at both SRR and SRNS facilities. While these deficiencies would likely be found and corrected at individual facilities, there may be a lack of recognition that a site-wide focus on this topic may be necessary to help prevent recurrence.

**Staff Observations.** The Board's staff team identified the following observations, in order of decreasing importance.

*SRNL Improper Space Heater Usage*—In March 2018, the Board's staff team accompanied SRNS staff for observation of a routine SRNL fire patrol. During the fire patrol, the Board's staff team observed portable space heaters in offices throughout the facility, including a couple that were plugged into extension cords in Sections A and C<sup>12</sup>. Portable space heaters must always be plugged directly into a wall outlet to prevent potential electrical overload

---

<sup>12</sup> The SRNL DSA [5] identifies Sections B, C, and E, as those with the highest potential to release material-at-risk that could impact the public.

**CUI//PRIV**  
**DRAFT-NOT REVIEWED FOR PUBLIC RELEASE**

and ignition. SRNS noted that space heater usage is covered in basic fire safety training provided to all staff. In March 2020, SRNS also issued site-wide employee communications on the proper use and electrical connections for space heaters, and included the site-wide procedure reference for the criteria. The Board’s staff team’s limited observations, coupled with SRNS’s issuance of a site-wide reminder, suggests that space heater usage could be a problem at other facilities on the site. However, the site-wide communication also demonstrates that SRNS is aware of the problem and is taking active steps to mitigate the issue.

*Fire System Impairment Increase*—SNRS maintains statistics on impairments of fire protection system impairments at SRS. The glossary for the fire protection program manual defines impaired and impairment [34]:

*Impaired - A condition that can significantly affect the proper performance of a fire protection or life safety system, component, or portion thereof.*

*Impairment - A condition where a fire protection or life safety system, component, function, or portion thereof, is out of service or has a critical deficiency.*

As suggested by the definitions above, maintaining fire protection systems in normal operating condition is very important for the safety of the facilities around the site. Table 3 shows impairment statistics from the site. The number of impairments in 2012 was large, but was reduced significantly by 2016. Recent impairment data suggests that the number of impairments may be rising again. The Board’s staff team acknowledges that the number of impairments can fluctuate on a monthly basis. However, given the increases in current and long term impairments since 2016 and the increase in unplanned impairments since 2018, the Board’s staff team is concerned that a consistent rise in impairments may be occurring, and that closer monitoring of impairments is warranted.

**Table 3. SRS Fire Protection System Impairments**

<i>Date</i>	<i>Current impairments as of the date</i>	<i>Unplanned impairments</i>	<i>Long-term impairments<sup>†</sup></i>
3/5/2012	106	83	25
11/28/2016	35	19	2
5/2018 – 5/2019 (monthly average)	54	12	6
June 2019	53	31	6
10/2019 – 3/2020 (monthly average)	65	24	8

<sup>†</sup>SRS defines long term impairments as those with a duration greater than 180 days.

**CUI//PRIV**  
**DRAFT-NOT REVIEWED FOR PUBLIC RELEASE**

*Various SRS FHA Issues*—The Board’s staff team identified several minor issues associated with FHAs, including assessments, use of administrative controls, misalignment with procedures, and a lack of a definition.

The Board’s staff team reviewed four periodic FHA assessments [35–38]. While each of these assessments covered the minimum common review topics (alignment with the safety bases, review of open findings, and review of equivalencies/exemptions), the method, presentation, and other topics assessed varied considerably. This variation can make comparing different FHA assessments for quality and content more difficult. The Board’s staff team notes that some of the assessments included topics unique to an individual facility FHA, which is an excellent practice.

The SRNL FHA [1] lists an approved equivalency for omitting sprinklers in several locations of Sections B and C where overhead obstructions block sprinkler coverage [39]. Two of these locations are in filter bank rooms, which are posted high contamination areas with controlled access. Three locations are in or near open corridors within the service levels. The Board’s staff team agrees with the equivalency within the filter bank rooms, as access is controlled, the rooms are for a specific purpose with no need for combustible storage, and there are radiological concerns for personnel performing sprinkler work in a high-contamination area. However, the Board’s staff team disagrees with the omission of sprinklers in the corridors. These locations would require a total of three new sprinklers to be installed, rather than relying on the transient combustible control program.

The TEF FHA states the following regarding pyrophoric materials, oxidizers, and organic liquids within hoods and gloveboxes [40]:

*To be in compliance with the NFPA 801 (CoR) [Code of Record], Section 7.4.1, requirement, the facility issued a standing order (5.3.99) (incorporated into ADM TRIT-1489) as a compensatory measure, to remove any pyrophoric materials, oxidizers or organic liquids from the hood or glovebox when not in attendance by an operator [emphasis added].*

The Board’s staff team reviewed ADM-TRIT-1489, *Control of Flammable / Combustible Liquids, Aerosol Products, Compressed Gases and Ignition Sources* [41] as well as ADM-TRIT-1461, *Control of Transient Combustibles* [42]<sup>13</sup>, and did not find the procedure language to be as definitive as the emphasized portion of the FHA quotation above. The Board’s staff team is concerned that this assumption in the FHA may not always be applied in practice within TEF process areas due to how the procedures are written.

The TEF FHA states that the credited fire protection program incorporates “fire response teams.” However, neither the FHA nor the TEF fire protection program plan [43] defines the roles or responsibilities of these teams. SRNS stated that these teams comprise trained operators

---

<sup>13</sup> The Board’s staff team did not review the old standing order, as the FHA language suggests that the standing order was incorporated into ADM-TRIT-1489. The language still should be in the procedure to maintain compliance with NFPA 801.

**CUI//PRIV**  
**DRAFT-NOT REVIEWED FOR PUBLIC RELEASE**

and the facility emergency coordinator, and that they are incorporated into the emergency operating procedures. The Board's staff team reviewed EOP-264-H-6024, *Fire and Fire Alarm Response For Process Buildings 264-H and 264-2H* [44], finding that the role of the facility emergency coordinator role was explained, but that the roles of fire response team members were not further defined. To promote a more complete understanding of the tritium fire response team, the Board's staff team considers it appropriate to identify the roles and responsibilities of this team in an appropriate location, such as the emergency operating procedures.

**Conclusion.** The Board's staff team reviewed five primary subjects related to the SRS fire protection program: program management; fire hazards analyses; fire prevention; inspection, testing, and maintenance of fire protection systems; and emergency response. Based on the information reviewed within these subjects and SRS's answers to lines of inquiry, the Board's staff team concludes that the expected major parts of an acceptable fire protection program are present and functioning as required in the SRS fire protection program. However, the Board's staff team identified several safety items associated with the program:

- The current arrangement of **mobile compact shelving in the SRNL classified document vault** presents a special fire hazard that has not been properly analyzed. Without proper shelving design and appropriate sprinkler protection, a fire may spread unchecked through the mobile compact shelving range, potentially overwhelming the sprinkler system and leading to fire spread beyond the vault, including areas containing material-at-risk.
- The **new A-Area water supply** is not completely safety-significant and does not have sufficient TSR surveillances, which may prevent the safety-significant SRNL automatic sprinkler system from meeting its safety function. The Board's staff team concludes that an exemption or equivalency to DOE Order 420.1C or DOE Standard 1066 would be appropriate, as the system does not meet these standards. The Board's staff team also concludes that additional TSR surveillances would be appropriate to protect the SRNL sprinkler system safety function, including surveillances of at least one fire pump and the freeze protection system for aboveground piping.
- Some **fire protection records were inconsistent with requirements and standards or contained inaccuracies**, potentially leading to missed problems, missed trends, difficulties in problem resolution, and lack of confidence in operations. SRNS was able to provide the Board's staff team with all requested surveillance and inspection records. On this basis, the Board's staff team concludes there is no apparent lack of fire protection inspections or test executions. However, the Board's staff team is concerned about the potential lack of rigor in conduct of operations and record keeping practices.
- The **SRS fire department has had issues** with excessive turnout time, high number of nuisance alarm responses, lack of analysis in the annual fire department report, and radio communications. The Board's staff team concludes the following:
  - Turnout time should be improved to reduce the overall response time to a fire alarm.

**CUI//PRIV**  
**DRAFT-NOT REVIEWED FOR PUBLIC RELEASE**

- Nuisance responses should be evaluated to determine if the sources of nuisance alarms may be reduced or the threshold for responding to such events increased, as appropriate, allowing SRS fire department resources to be applied to more productive endeavors.
- The annual report should continue to include the current informative data set, but the report should, at a minimum, include some evaluation of the data associated with response times and training.
- SRS should execute a plan to permanently address SRS fire department radio communication issues as soon as possible.
- **Formal, site-wide evaluation of fire protection metric data is limited** to impairments, fire protection system uptime, staffing, corrective action tracking, and fire extinguisher inspections. This limitation could lead to missed site-wide issues for other fire protection topics such as fire prevention, life safety, combustible controls, fire watches, hot work, fire barrier inspection, and fire suppression inspection and testing, which are only evaluated on a facility or area basis.

**CUI//PRIV**  
**DRAFT-NOT REVIEWED FOR PUBLIC RELEASE**

**References**

1. Savannah River Nuclear Solutions, *Fire Hazards Analysis for Building 773-A and Associated Structures at the Savannah River National Laboratory*, F-FHA-A-00010, Revision 7, September 23, 2014.
2. National Fire Protection Association, *NFPA 13 Standard for the Installation of Sprinkler Systems*, 2002 edition, National Fire Protection Association, Quincy, MA, 2002.
3. Westinghouse Savannah River Company, *DOE Directive Compliance Assessment and Implementation Report, Equivalency Request for Building 773-A*, Old Report# WSRC-RP-93-668-029R1, New Report# F-ESR-A-00178, Revision 0, 1994.
4. National Fire Protection Association, *NFPA 13 Standard for the Installation of Sprinkler Systems*, 2016 edition, National Fire Protection Association, Quincy, MA, 2016.
5. Savannah River Nuclear Solutions, *SRNL Technical Area Documented Safety Analysis*, WSRC-SA-2, Revision 18, August 2016.
6. Pennel, Gayle, *Fire Pump Field Data Collection and Analysis, Final Report*, Fire Protection Research Foundation, Quincy, MA, April 2012.
7. Savannah River Nuclear Solutions, *Safety Basis Strategy for the Savannah River National Laboratory Safety Basis Upgrade*, U-SBS-A-00003, Revision 3, February 2, 2017.
8. Savannah River National Laboratory, *Safety Basis Implementation Plan for Savannah River National Laboratory*, Revision 0, Draft C, U-SBIP-A-00004, November 2019.
9. Department of Energy, *Order: Facility Safety*, DOE Order 420.1C, Change 1, February 27, 2015.
10. Department of Energy, *Standard: Fire Protection*, DOE-STD-1066-2012, December 2012.
11. Shuffler, C., and R. Wu, *Staff Information Paper: Savannah River National Laboratory Documented Safety Analysis Review*, Defense Nuclear Facilities Safety Board, Washington, DC, June 28, 2017.
12. Department of Energy, *Standard: Fire Protection*, DOE-STD-1066-2016, December 2016.
13. Savannah River Nuclear Solutions, *Savannah River National Laboratory Technical Area Technical Safety Requirements*, WSRC-TS-97-00014, Revision 20, April 2016.
14. Savannah River Nuclear Solutions, *Tritium Surveillance Test - Annual periodic testing of the 264-H, 264-1H, and 264-2H Fire Protection Systems*, Surveillance Test #2005059, May 31, 2017.

**CUI//PRIV**  
**DRAFT-NOT REVIEWED FOR PUBLIC RELEASE**

15. National Fire Protection Association, *NFPA 25 Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems*, 2017 edition, National Fire Protection Association, Quincy, MA, 2017.
16. Savannah River Nuclear Solutions, *Sprinkler System – Functional Test of the Electric Motor Driven Fire Pumps*, SRNL surveillance record ST-SRNL-0073, March 29, 2016.
17. Savannah River Nuclear Solutions, *Sprinkler System – Functional Test of the Electric Motor Driven Fire Pumps*, SRNL surveillance record ST-SRNL-0073, June 12, 2017.
18. Savannah River Nuclear Solutions, *Tritium Fire Door Inspection and Test Record*, performed 9/29/2016, Manual 2Q2-1.1, Procedure 116.1, September 29, 2016.
19. Savannah River Nuclear Solutions, *Tritium Fire Door Inspection and Test Record*, performed 10/2/2017, Manual 2Q2-1.1, Procedure 116.1, October 2, 2017.
20. Savannah River Nuclear Solutions, *Tritium Fire Door Inspection and Test Record*, performed 9/23/2018, Manual 2Q2-1.1, Procedure 116.1, September 23, 2018.
21. Savannah River Nuclear Solutions, *Sprinkler System – Main Drain Flow Test*, SRNL surveillance record ST-SRNL-0074, March 12, 2018.
22. Savannah River Nuclear Solutions, *Sprinkler System – Main Drain Flow Test*, SRNL surveillance record ST-SRNL-0074, March 9, 2016.
23. Savannah River Nuclear Solutions, *Sprinkler System – Main Drain Flow Test*, SRNL surveillance record ST-SRNL-0074, March 8, 2017.
24. Savannah River Nuclear Solutions, *Perform Annual Functional Test of the Main Drain for the 264-H/264-2H and 264-2H Truck Bay Fire Suppression Systems*, Tritium Surveillance Test # 2005063, Performed February 14, 2018.
25. Savannah River Nuclear Solutions, *Monthly fire prevention and life safety inspections for the 264-H and 264-2H facilities*, Surveillance Test #2016086, April 26, 2017.
26. Savannah River Nuclear Solutions, *Monthly fire prevention and life safety inspections for the 264-H and 264-2H facilities*, Surveillance Test #2016086, May 18, 2017.
27. Savannah River Nuclear Solutions, *Monthly fire prevention and life safety inspections for the 264-H and 264-2H facilities*, Surveillance Test #2016086, June 22, 2017.
28. Savannah River Nuclear Solutions, *Savannah River Site Fire Department, 2018 Annual Report*, SRNS-RP-2019-00041, 2019.
29. Savannah River Nuclear Solutions, *Baseline Needs Assessment*, SRNS-RP-2011-00957, Revision 9, May 30, 2017.

**CUI//PRIV**  
**DRAFT-NOT REVIEWED FOR PUBLIC RELEASE**

30. National Fire Protection Association, *NFPA 1710 Organization and Deployment of Fire Suppression Operations, Emergency Medical Operations, and Special Operations to the Public by Career Fire Departments*, 2016 edition, National Fire Protection Association, Quincy, MA, 2016.
31. National Fire Protection Association, “NFPA Statistics – Fire department calls,” *NFPA*, November 2019, [www.nfpa.org/News-and-Research/Data-research-and-tools/Emergency-Responders/Fire-department-calls](http://www.nfpa.org/News-and-Research/Data-research-and-tools/Emergency-Responders/Fire-department-calls), Accessed November 25, 2019.
32. Evarts, Ben, *Fire Loss in the United States during 2018*, National Fire Protection Association, Quincy, MA, October 2019.
33. Savannah River Nuclear Solutions, *Risk / Opportunity / Issue Assessment Form*, “Inability to communicate via SRSFD portable radios deteriorates emergency scene management,” ID # 5642, Identified July 19, 2018, Last review March 18, 2019.
34. Savannah River Nuclear Solutions, *Fire Protection Program, Manual 2Q*, “Glossary,” Revision 17, February 22, 2017.
35. Savannah River Nuclear Solutions, *Assessment Summary*, “CY17 Contractually Required Programmatic Assessment (CRA): Review Fire Hazards Analysis for the Tritium Extraction Facility Buildings 264-H, 264-1H, 264-2H, 264-6H, 254-21H and Support Structures (U (F-FHA-H-00059),” Assessment No. 2017-SA-000287, Closed February 8, 2018.
36. Savannah River Nuclear Solutions, *Assessment Summary*, “Periodic (three-year) Fire Hazards Analysis (FHA) review for F-FHA-A-00010, Fire Hazards Analysis for Building 773-A and Associated Structures at the Savannah River National Laboratory (SRNL),” Assessment No. 2017-SA-000710, Closed January 11, 2018.
37. Savannah River Remediation, *Assessment Summary*, “451-1Z, 451-2Z, 451-3Z, 451-4Z, & 451-5Z FHA Assessment (F-FHA-Z-00003),” Assessment No. 2015-SA-006191, Closed January 20, 2016.
38. Savannah River Remediation, *Assessment Summary*, “FHA Assessment (F-FHA-S-00010),” Assessment No. 2019-SA-000457, Closed February 26, 2019.
39. Savannah River Nuclear Solutions, *Fire Protection Engineering, Engineering Evaluation, Sections B and C Service Floor Duct Obstructions in Building 773-A*, F-ESR-A-00204, Revision 1, January 19, 2017.
40. Savannah River Nuclear Solutions, *Fire Hazards Analysis for the Tritium Extraction Facility, Buildings 264-H, 264-1H, 264-2H, 254-21H and Support Structures*, F-FHA-H-00059, Revision 5, June 9, 2014.
41. Savannah River Nuclear Solutions, *Control of Flammable / Combustible Liquids, Aerosol Products Compressed Gases and Ignition Sources*, ADM-TRIT-1489, Revision 8, June 25, 2019.

**CUI//PRIV**  
**DRAFT-NOT REVIEWED FOR PUBLIC RELEASE**

42. Savannah River Nuclear Solutions, *Control of Transient Combustibles*, ADM-TRIT-1461, Revision 19, August 1, 2018.

43. Savannah River Nuclear Solutions, *Tritium Fire Protection Program Plan*, ADM-TRIT-1460, Revision 14, June 7, 2018.

44. Savannah River Nuclear Solutions, *Fire and Fire Alarm Response for Process Buildings 264-H and 264-2H*, EOP-264-H-6024, Revision 9, July 9, 2012.

**AFFIRMATION OF BOARD VOTING RECORD**

**SUBJECT:** SRS Fire Protection Program

**Doc Control#:** 2020-100-0052

The Board acted on the above document on 07/30/2020. The document was Approved.

The votes were recorded as:

	APRVD	DISAPRVD	ABSTAIN	NOT PARTICIPATING	COMMENT	DATE
Bruce Hamilton	✓	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	07/30/2020
Jessie H. Roberson	✓	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	07/30/2020
Joyce L. Connery	✓	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	07/30/2020

This Record contains a summary of voting on this matter together with the individual vote sheets, views and comments of the Board Members.

*Shelby Qualls*

Executive Secretary to the Board

Attachments:

1. Voting Summary
2. Board Member Vote Sheets

**DEFENSE NUCLEAR FACILITIES SAFETY BOARD**  
**NOTATIONAL VOTE RESPONSE SHEET**

**FROM:** Bruce Hamilton

**SUBJECT:** SRS Fire Protection Program

**Doc Control#:** 2020-100-0052

**DATE:** 07/30/2020

**VOTE:** Approved

**COMMENTS:**

None

*Bruce Hamilton*

**DEFENSE NUCLEAR FACILITIES SAFETY BOARD**  
**NOTATIONAL VOTE RESPONSE SHEET**

**FROM:** Jessie H. Roberson

**SUBJECT:** SRS Fire Protection Program

**Doc Control#:** 2020-100-0052

**DATE:** 07/30/2020

**VOTE:** Approved

**Member voted by email.**

**COMMENTS:**

None

*Jessie H. Roberson*

**DEFENSE NUCLEAR FACILITIES SAFETY BOARD**

**NOTATIONAL VOTE RESPONSE SHEET**

**FROM:** Joyce L. Connery

**SUBJECT:** SRS Fire Protection Program

**Doc Control#:** 2020-100-0052

**DATE:** 07/30/2020

**VOTE:** Approved

**COMMENTS:**

None

*Joyce L. Connery*