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**DEFENSE NUCLEAR FACILITIES
SAFETY BOARD**
Washington, DC 20004-2901



September 13, 2017

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 safety bases for several defense nuclear facilities at the Savannah River Site rely on programmatic administrative controls to perform credited safety functions in lieu of specific administrative controls. This practice is inconsistent with the Department of Energy's requirements and expectations for specific administrative controls, and can lead to inadequate safety controls for nuclear hazards.

The enclosed report prepared by our staff offers details and is provided for your use as appropriate.

Sincerely,


Sean Sullivan
Chairman

Enclosure

c: Mr. Joe Olencz

DEFENSE NUCLEAR FACILITIES SAFETY BOARD

Staff Issue Report

May 8, 2017

MEMORANDUM FOR: S. A. Stokes, Technical Director

COPIES: Board Members

FROM: C. Shuffler

SUBJECT: Designation of Specific Administrative Controls at the Savannah River Site

This report documents an issue with the designation of specific administrative controls (SACs) at the Savannah River Site (SRS). The concern stems from a series of reviews completed by staff members of the Defense Nuclear Facilities Safety Board (Board) from 2014–2017. During the reviews, the staff members observed that the safety bases for several SRS defense nuclear facilities rely on programmatic administrative controls (i.e., safety management programs) to perform credited safety functions in lieu of SACs. This practice is inconsistent with requirements and expectations in Department of Energy (DOE) standards and can lead to inadequate design, implementation, and maintenance of safety-related administrative controls.

Specifically, without designation as SACs, the requirements and guidance promulgated by DOE pertaining to providing assurance of the reliability and effectiveness of these important administrative controls do not apply. The requirements and guidance address pertinent aspects of control development and implementation such as specification of safety margins, application of defense-in-depth, verification and validation, training and qualification, and evaluation of human performance factors. The pervasive nature of the concern at SRS suggests that improvements are warranted at the site-level in the designation of SACs to ensure adequate safety controls are implemented for nuclear hazards.

Background. On December 11, 2002, the Board issued Recommendation 2002-3, *Requirements for the Design, Implementation, and Maintenance of Administrative Controls*, to the Secretary of Energy [1]. In the recommendation, the Board identified a need for DOE to promulgate requirements to ensure the effectiveness and reliability of administrative controls performing safety-class and safety-significant functions at DOE's defense nuclear facilities. The Secretary accepted the recommendation, and DOE created DOE Standard 1186-2004, *Specific Administrative Controls*, in response. The standard provides requirements and guidance for the selection, design, and maintenance of safety-related administrative controls. The standard created the SAC designation for these controls.

In letters to the DOE Office of Environmental Management dated August 3, 2015, and October 20, 2015, the Board identified that the respective safety bases for the Defense Waste

Processing Facility and L-Area Facility relied upon safety management programs to perform safety-significant functions in lieu of SACs [2, 3]. The Board's January 7, 2016, letter to the National Nuclear Security Administration communicated the same issue with the Tritium Extraction Facility safety basis [4]. Most recently, members of the Board's staff reviewed a proposed revision to the Savannah River National Laboratory (SRNL) documented safety analysis (DSA). As detailed in this report, the staff members identified additional examples in which safety management programs are inappropriately relied upon to perform safety-significant functions.

SAC Designation Criteria. Section 2.1 of DOE Standard 1186-2004 requires that an administrative control be designated as a SAC when the control:

- Is identified in the DSA as a control needed to prevent or mitigate an accident scenario, and
- Has a safety function that would be safety-significant or safety-class if the function were provided by a structure, system, or component (SSC).

DOE Standard 1186-2016¹ contains similar requirements. DOE Standard 3009-94, CN3, *Preparation Guide for US Department of Energy Nonreactor Nuclear Facility Documented Safety Analyses*, includes language cautioning against the use of programmatic administrative controls to perform safety-significant or safety-class functions. While DOE's standards recognize the importance of programmatic controls in providing for a safe operating envelope, they reserve the SAC designation for those actions warranting enhanced assurance of effectiveness and reliability due to their role in preventing or mitigating potential accidents, and their relative importance in providing for the protection of workers and members of the public.

SRNL DSA Revision. In August 2015, members of the Board's staff reviewed a proposed revision to the SRNL DSA and technical safety requirements. During the review, the staff members identified that the DSA inappropriately credited safety management programs with protecting facility workers from accidents leading to high consequence injury due to radiological exposure, prompt fatality, or serious injury. In response, DOE Savannah River Operations Office (DOE-SR) personnel reviewed the site's use of administrative controls with the SRS DOE Nuclear Safety Council. DOE-SR's review affirmed the site's practices. In a January 2017 follow-up review of the DSA revision, the staff members continued to identify examples where the DSA inappropriately credited safety management programs. As detailed below, the examples are binned into two categories—facility worker protection from high-consequence accidents and protection of the functionality of safety-significant engineered controls.

Facility Worker Protection—In accordance with DOE Standard 3009-94, CN3, SSCs are generally designated as safety-significant when their “failure is estimated to result in a prompt worker fatality or serious injuries or significant radiological or chemical exposures to workers.” SRS procedures invoke these criteria for identifying safety-significant controls [5]. In

¹ DOE Standard 1186-2004 is included in SRS contracts. DOE Standard 1186-2016 is referenced to highlight that DOE revised the standard and the revision includes similar requirements for SAC designation.

accordance with DOE Standard 1186-2004, administrative controls relied upon to perform safety-significant functions are required to be designated as SACs. The safety management programs identified below are credited in the proposed SRNL DSA revision with performing safety-significant functions for worker protection in lieu of SACs. As highlighted in italicized text, the DSA identifies explicit actions and functions under many of the programs that could be formulated into SACs. Without designating these actions as SACs, the requirements and guidance in DOE Standard 1186-2004 pertaining to providing assurance of the reliability and effectiveness of these important administrative controls do not apply. Where the DSA does not identify explicit actions, the SAC designation process would drive a focused evaluation of the actions being relied upon for worker protection and the measures necessary to ensure their effectiveness and reliability.

- The **Flammable Gas Control Program** is credited to prevent an explosion from a large flammable gas cylinder leak. The explosion would result in a high radiological consequence to facility workers. The program requires the *installation of flow restricting devices on large flammable gas cylinders* and *periodic ventilation system inspections*, such as flow rate verifications, to prevent the accumulation of a flammable mixture following a flammable gas leak.
- The **Radiation Protection Program** is credited to mitigate a tritium gas release during container loading activities. The release would result in a high radiological consequence to facility workers. The program establishes requirements for the proper *use of portable tritium air monitors* to ensure prompt detection and notification of a tritium release.
- The **Nuclear Material Maintenance Program** is credited to prevent a flammable gas explosion during maintenance activities in radiological areas of the laboratory. The explosion would result in a high radiological consequence to facility workers. The program prevents explosions by controlling the use of flammable gas cylinders during maintenance activities, though the DSA does not specify the actions relied upon to perform this function. Designating a SAC for this event would drive the specification and analysis of these explicit actions.
- The **Tritium Handling Program** is credited to prevent a loss of tritium gas confinement during normal handling and storage activities. The release would result in a high radiological consequence to facility workers. The program governs the handling and storage of tritium gas through controls such as requiring the *use of safety-significant containers for large tritium samples handled in areas without tritium air monitors* and requiring *coverage with monitors when workers open containers with large tritium samples*.
- The **Energetic Container Control Program** is credited to prevent explosion of a radioactive sample container. The explosion would result in high radiological and physical consequences to facility workers. The program requires *venting of radioactive material sample containers with a potential explosive energy exceeding 10 grams of trinitrotoluene*. The program also *restricts the handling of sample*

containers with the potential for flammable gas accumulation that exhibit visual signs of over-pressurization (e.g., bulging, swelling).

- The **Radioactive Waste Program** is credited to prevent explosion of a transuranic waste container. The explosion would result in a high radiological consequence to facility workers. The program *controls the amount of volatile flammable liquids and gases in transuranic waste containers to limit the potential generation of flammable gases.* The program also requires the *installation of filtered vents on waste containers.*

Safety Management Programs Supporting Engineered Safety Controls—In accordance with DOE Standard 3009-94, CN3, SSCs whose failure would result in a safety-significant SSC losing the ability to perform its required safety function “would also be considered safety-significant SSCs for the specific accident conditions or general rationale for which the safety-significant designation was made originally.” DOE Standard 1186-2004 states that the “[c]lassification of Administrative Controls as SACs shall use the same criteria as used for Safety SSCs in STD-3009, *Preparation Guide For U.S. Department of Energy Nonreactor Nuclear Facility Documented Safety Analyses.*” These excerpts support the conclusion that administrative controls whose failure would result in a safety-significant SSC losing the ability to perform its required safety function should also be considered for SAC designation. DOE Standard 1186-2004 provides the following additional guidance to support this conclusion:

If a facility’s fire protection system design assumes that the combustible loading does not exceed a certain level, then required controls to ensure this level is not exceeded are expressed as an AC [administrative control]. Because these instances represent bounding conditions for the safety basis, these ACs should be designated as SACs, following the guidance given in this Standard for improving the dependability of these controls.

As detailed below, the proposed SRNL DSA revision relies upon safety management programs to protect the functionality of safety-significant controls, without designating administrative controls within the programs as SACs. As highlighted in italicized text, the DSA identifies explicit actions and functions under many of the programs that could be formulated into SACs. Where the DSA does not identify explicit actions, the SAC designation process would drive a focused evaluation of the actions being relied upon to protect the functionality of safety-significant controls.

- The **Traffic Control Program** is credited to protect the safety function of the safety-significant fire water supply and sprinkler systems by requiring a *fire watch when large liquid fueled vehicles are within the SRNL boundary*, and by *prohibiting the staging of liquid fueled vehicles within the boundary for an extended duration without authorization by the facility manager.*
- The **Fire Protection Program** is credited to:
 - *Limit transient combustible materials in areas of the laboratory without sprinkler*

coverage to protect the ability of the safety-significant fire water supply and sprinkler systems to control the spread of a fire that initiates in those areas.

- *Control transient combustible and flammable substances within or near the safety-significant shielded hot cells* to protect the hot cells' ability to limit the quantity of radioactive material involved in a hot cell fire (i.e., prevent the fire from spreading and involving radioactive material beyond the hot cell).
- The **Explosive Control Program** is credited to *limit the quantity of explosives in the laboratory* sufficiently to prevent damage to the safety-significant fire water supply and sprinkler systems in the event of an explosion. Because an explosion is a potential fire initiator, the program protects the systems' abilities to perform their required safety functions of controlling the spread of fire.
- The **Energetic Container Control Program** is credited to prevent radioactive sample container explosions that could initiate a fire and compromise the safety function of the safety-significant fire water supply and sprinkler systems.
- The **Tritium Handling Program** is credited to prevent a tritium gas explosion resulting from the improper handling of a safety-significant tritium container.

Conclusion. Recent staff reviews and Board correspondence have identified a persistent issue with the designation of SACs at SRS. Specifically, the safety bases for several SRS defense nuclear facilities rely on programmatic administrative controls to perform safety-significant functions in lieu of designating specific administrative actions under the programs as SACs. This practice is inconsistent with the requirements and guidance governing the selection and development of SACs in DOE standards. Identifying and managing the key program elements as SACs, as required by DOE nuclear safety standards, would improve the reliability of administrative controls credited in nuclear facility safety bases at SRS.

References

- [1] Defense Nuclear Facilities Safety Board, *Requirements for the Design, Implementation, and Maintenance of Administrative Controls*, Recommendation 2002-3, December 11, 2002.
- [2] J. H. Roberson, *Defense Waste Processing Facility Safety Basis Review*, Board letter with enclosure, August 3, 2015.
- [3] J. L. Connery, *Savannah River Site L-Area Safety Basis*, Board letter with enclosure, October 20, 2015.
- [4] J. L. Connery, *Tritium Extraction Facility Safety Basis Review*, Board letter with enclosure, January 7, 2016.
- [5] Savannah River Site Manual E7, *Conduct of Engineering*, Procedure 2.25A, "LW Functional Classifications," Revision 1, March 10, 2016.