

Joyce L. Connery, Chair
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**DEFENSE NUCLEAR FACILITIES
SAFETY BOARD**

Washington, DC 20004-2901



November 13, 2024

The Honorable Jennifer M. Granholm
Secretary of Energy
U.S. Department of Energy
1000 Independence Avenue, SW
Washington, DC 20585-1000

Dear Secretary Granholm:

The Defense Nuclear Facilities Safety Board (Board) is concerned that the design of the Savannah River Plutonium Processing Facility (SRPPF) limits the coverage of the criticality accident alarm system (CAAS) to just four of fourteen major processing areas. A CAAS provides prompt notification of a criticality accident by detecting bursts of gamma radiation, undetectable to workers, which can save lives and prevent large radiation exposures. Criticality accidents in areas without CAAS coverage can result in excessive facility worker radiation exposure.

For the reasons outlined in the attachment to this letter, the Board concludes it would be prudent to extend CAAS coverage beyond the four proposed processing areas. However, the Board recognizes that the consensus standard used to determine CAAS coverage relies on qualitative judgment. Therefore, a broader-based consensus opinion is warranted for determining the necessary extent of CAAS coverage at SRPPF. The Board understands that SRPPF project personnel have engaged the Department of Energy's Criticality Safety Support Group to assess CAAS coverage at SRPPF and that its review is underway. This group, formed in response to Board Recommendation 97-2, *Criticality Safety*, consists of personnel with the necessary experience and expertise for the review. The Board applauds this safety initiative and awaits completion of the safety group's review ahead of upcoming project design and procurement milestones.

Sincerely,

A handwritten signature in black ink that reads "Joyce L. Connery". The signature is fluid and cursive.

Joyce L. Connery
Chair

Enclosure

- c: The Honorable Jill Hruby, Administrator, National Nuclear Security Administration (NNSA)
- Mr. Mike Mikolanis, Manager, NNSA Savannah River Field Office
- Mr. Joe Olencz, Director, Office of the Departmental Representative to the Board

Enclosure

Reasons to Expand Coverage of the Criticality Accident Alarm System (CAAS) at the Savannah River Plutonium Processing Facility (SRPPF)

In accordance with the governing consensus standard used for SRPPF, American National Standards Institute (ANSI)/American Nuclear Society (ANS) standard ANSI/ANS-8.3-1997, *Criticality Accident Alarm System*), determination of the need for a CAAS relies on the judgment of nuclear criticality safety professionals. SRPPF personnel completed a CAAS needs assessment that recommended coverage for four of the fourteen nuclear material processing areas. The needs assessment concluded the benefit of a CAAS for the non-covered areas is judged to be minimal because the criticality accident likelihood is extremely low in those areas.

The Defense Nuclear Facilities Safety Board (Board) is concerned with some of the mitigating factors that SRPPF project personnel used to support their decision of only providing CAAS coverage for a subset of the processing areas. Criticality events in non-covered areas can result in excessive worker radiation exposure due to the lack of prompt notification of a criticality accident. The SRPPF design lacks CAAS coverage in some high mass plutonium processing areas, such as disassembly and machining, and in areas with processing characteristics that may increase the risk of a criticality accident (e.g., compact shapes, multiple material forms, or material form changes).

SRPPF project personnel note in their needs assessment that a strong commitment to formality of operations and a strong safety culture have significantly reduced the likelihood of a criticality accident compared to historical frequencies. However, significant, unanticipated violations of criticality safety controls have occurred in defense nuclear facilities during the 1990s to present. The Board concludes that qualitative workforce characteristics such as a strong safety culture or strong conduct of operations performance may change over the lifetime of the facility based on unknown circumstances and events—these characteristics are also unknown for a facility that is in design and years away from operation. Therefore, it is inappropriate to rely on such characteristics during the design phase of a new facility, especially one that will have an enduring production mission.

The needs assessment states that a “CAAS only reduces the risk due to radiation dose after the initial excursion (or pulse) that initiates the alarm. In some cases, a criticality accident will self-terminate after one pulse.” Los Alamos National Laboratory compiled lessons learned of historical process accidents (LA-13638) and one of these lessons is to consider a criticality accident not a momentary pulse of radiation, but rather a continued danger to workers and first responders. Most of the compiled process criticality accidents involved excursions that were not terminated after a single pulse. In addition, the American Nuclear Society has provided a clarification to ANSI/ANS-8.3 in response to an inquiry regarding the need for a CAAS in the case of a single, short duration pulse and stated “For a single pulse criticality, evacuation might help avoid additional personnel dose due to residual fission product activity.”

Further, designers should never assume the safety analyses considered all potential scenarios. DOE Standard 3007-2017, *Preparing Criticality Safety Evaluations at Department of*

Energy Nonreactor Nuclear Facilities, states “the NCS [nuclear criticality safety] engineer should not assume that safety analysis documents identify all potential changes in process conditions that may diminish criticality safety.”

SRPPF project personnel note in their CAAS needs assessment that a CAAS could pose an additional risk due to potential injuries from responding to false alarms. The nuclear criticality safety community discussed this topic at recent workshops and largely dismissed this risk. In 2020, the Criticality Safety Support Group reviewed the SRPPF design and noted that “[t]he concern for false alarms with state-of-the-art systems seems to be unwarranted.” The Board notes that SRPPF project personnel plan to use a modern CAAS design. Additionally, DOE Handbook 1224-2024, *Hazard and Accident Analysis*, states “Competing risks associated with the response to false alarms may rarely modify the decision as to when a criticality accident alarm should be installed.”

The needs assessment states “CAAS installation and maintenance is costly....” However, SRPPF will be a new facility with an enduring production mission and a design life of at least 50 years. Expanding CAAS coverage after the introduction of radioactive materials and accompanying contamination of processing systems would be difficult and costly. Operations can change and expand over time. There are also unallocated areas in SRPPF that may be used for future projects that may benefit from preliminary preparation while such areas are readily accessible. ANS-8.3 states “In a new facility, provision for potential installation of a CAAS should the facility mission change may be a consideration.”

Lastly, the Board views SRPPF’s current design with limited CAAS coverage to be an outlier relative to other prominent defense nuclear facilities that perform similar fissionable material processing activities and have complete CAAS coverage of fissionable material processing, handling, and storage areas. These facilities include plutonium facilities at Los Alamos National Laboratory and Lawrence Livermore National Laboratory, as well as Buildings 9212, 9215, 9998, 9204-2E, 9720-82 (Highly Enriched Uranium Materials Facility), 9720-5, 9206, 9995, and the Uranium Processing Facility at the Y-12 National Security Complex.