DEFENSE NUCLEAR FACILITIES SAFETY BOARD

Washington, DC 20004-2901

May 9, 2012

The Honorable Steven Chu
Secretary of Energy
U.S. Department of Energy
1000 Independence Avenue, SW
Washington, DC 20585-1000

Dear Secretary Chu:

On May 9, 2012 the Defense Nuclear Facilities Safety Board (Board), in accordance with 42 U.S.C. § 2286a(a)(5), unanimously approved Recommendation 2012-1, *Savannah River Site Building 235-F Safety*, which is enclosed for your consideration. This Recommendation identifies the need to execute actions that can reduce the hazards associated with the material at risk that remains as residual contamination within Building 235-F.

After you have received this Recommendation and as required by 42 U.S.C. § 2286d(a), the Board will promptly make it available to the public. The Board believes that this Recommendation contains no information that is classified or otherwise restricted. To the extent that this Recommendation does not include information restricted by the Department of Energy (DOE) under the Atomic Energy Act of 1954, 42 U.S.C. §§ 2161-2168, as amended, please arrange to have it placed promptly on file in your regional public reading rooms. The Board will also publish this Recommendation in the *Federal Register.*

The Board will evaluate DOE's response to this Recommendation in accordance with the Board's Policy Statement 1, *Criteria for Judging the Adequacy of DOE Responses and Implementation Plans for Board Recommendations.*

Sincerely,

Peter S. Winokur, Ph.D.
Chairman

Enclosure

c: Mr. David Huizenga
Dr. David C. Moody, III
Mrs. Mari-Jo Campagnone

RECOMMENDATION 2012-1 TO THE SECRETARY OF ENERGY
Savannah River Site Building 235-F Safety
Pursuant to 42 U.S.C. § 2286a(a)(5),
Atomic Energy Act of 1954, As Amended

Dated: May 9, 2012

Background

The Defense Nuclear Facilities Safety Board (Board) believes that the Department of Energy (DOE) needs to take action to remove and/or immobilize the residual contamination within Building 235-F because of the potential dose consequences to collocated workers and the public. Furthermore, the Board believes that DOE must also take near-term action to more effectively prevent a major fire in Building 235-F.

Building 235-F at the Savannah River Site (SRS) houses several partially deactivated processing lines including the Plutonium Fuel Form (PuFF) facility, Actinide Billet Line, Plutonium Experimental Facility, and the old metallography lab glovebox. Building 235-F no longer has a DOE mission. It is currently operated in a surveillance and maintenance mode and is normally unoccupied.

With the exception of residual contamination, Building 235-F has been de-inventoried of special nuclear material. The remaining residual contamination is the principal hazard posed by Building 235-F and includes a significant quantity of plutonium-238 (Pu-238). More than 95 percent of the Pu-238 is located in the PuFF facility; approximately 82 percent is concentrated in 2 of the 9 PuFF facility cells. It should be noted that the residual Pu-238 contamination is a fine ball-milled powder that is in a highly dispersible form, which increases the potential dose consequences associated with a radiological release.

The responsible SRS contractor, Savannah River Nuclear Solutions (SRNS), has determined that the unmitigated consequences of a seismically-induced full-facility fire are greater than 10 rem offsite and 27,000 rem to the collocated worker at 100 meters. F-Area routinely has more than a thousand site workers who are normally in the facilities, construction sites, and trailers located adjacent to Building 235-F. Some of the trailers that house workers are located within the Building 235-F fence line.

While DOE does not conduct any operations within Building 235-F, fires could start inside the building if energized electrical equipment or wiring failed or was damaged during a seismic or other natural hazard event. Electrical sparks or heat from electrical equipment could ignite adjacent combustible material. Two of the key preventive controls for fire scenarios are eliminating potential ignition sources and controlling the amount of combustibles. In September 2011, during a walkdown of Building 235-F, the Board's staff identified a significant quantity of transient and fixed combustibles and unnecessary electrical equipment that had not been air gapped. DOE has taken action to remove the transient combustible material and to limit access

to Building 235-F. However, no actions are currently planned to remove the fixed combustibles or unneeded electrical equipment.

In the event of a fire, Building 235-F has several vulnerabilities. First, the Building 235-F fire detection system is not credited, does not provide complete coverage, nor is the building normally occupied; consequently, a fire could smolder and burn undetected. Second, Building 235-F does not have a fire suppression system to prevent an incipient stage fire from growing into a room fire. Third, Building 235-F does not have fire barriers with a qualified fire rating to prevent the spread of a fire to adjacent rooms. The Building 235-F Fire Hazards Analysis notes that the subdividing walls and floors are in many places incomplete or penetrated and are not adequately sealed to achieve a qualified fire rating. In addition, some of the existing walls contain cellulose, which is combustible and could allow a room fire to spread to other portions of the building. Fourth, the absence of standpipes or hose connections inhibits the ability of the fire department to fight a fire inside Building 235-F. To combat a fire, firefighters would need to prop open the exterior doors to allow the passage of fire hoses; this would allow smoke and firewater, potentially contaminated with radioactive material, into the environment.

The July 2011 draft of the Basis for Interim Operations (BIO), prepared by SRNS notes that the Building 235-F structure can only provide limited confinement during or following a seismic event because seismically-induced building cracks may develop. Consequently, the building structure cannot be credited as a control to prevent a post-seismic unfiltered release. In 2010, DOE took action to improve the safety posture of Building 235-F by reducing the height of the abandoned stack located adjacent to the building. The contractor's structural analysis indicated that the concrete stack, prior to the height reduction, could have collapsed onto Building 235-F during a seismic event causing significant structural damage.

In addition to fires, loss of confinement accidents could also release radioactive material. For instance, a release could be caused by a breach of the confinement or the ventilation system during a seismic event. However, the Building 235-F confinement ventilation system cannot be relied upon to continue to perform its safety function during or following a seismic event. The draft BIO states that non-load-bearing building elements may fail during a Performance Category-3 seismic event, resulting in impact damage to safety-related structures, systems, and components such as ventilation ducts. The draft BIO states that the metal ventilation ducts may leak after an earthquake because they are not completely welded and that the concrete roof exhaust tunnel may develop cracks.

Loss of confinement can be caused by degraded equipment. The deteriorated condition of the PuFF facility was noted in an October 1991 report by DOE's Office of Nuclear Safety,[1] which identified as an issue the integrity of elastomer seals that form part of the confinement boundaries inside Building 235-F. In addition to degradation with age, these elastomer seals also degrade with exposure to Pu-238. Although identified two decades ago, this issue remains. The cells have numerous penetrations (e.g., glove ports, viewing windows, ventilation supply and

[1] U.S. Department of Energy, 1991, *Report of an Investigation into the Deterioration of the Plutonium Fuel Form Fabrication Facility (PuFF) at the DOE Savannah River Site*, DOE/-NS-0002P, http://www.osti.gov/bridge/servlets/purl/6246281-tBgi3H/6246281.pdf.

exhaust, utility services). In the draft BIO, SRNS stated that "the [elastomer] seals around the cell and glovebox penetrations are expected to be in a degraded condition due to the years of operation in a radiation environment." The continued deterioration of the elastomer seals increases the potential for the spread of the contamination outside of the cells. Even under normal operations, a loss of confinement from these cells would greatly increase the complexity and hazard associated with decontamination and decommissioning of Building 235-F.

DOE conducted a small fire drill at Building 235-F in December 2011, which simulated a minor radiological release. While DOE conducts periodic drills, DOE has not conducted a Building 235-F radiological drill involving the adjacent Mixed Oxide Fuel Fabrication Facility or Waste Solidification Building construction sites to examine how these facilities would respond to a significant radiological release from Building 235-F. In the event of a significant radiological release, the amount of mitigation provided by sheltering in place may not be sufficient to protect nearby workers. This is especially true for seismically-induced fires, since the same seismic event may also damage nearby trailers and administrative buildings.

The Board has previously identified the need to address the residual contamination in Building 235-F. In a June 12, 2003, letter to the Secretary of Energy, the Board noted that the risk associated with several hazards in Building 235-F, including the Pu-238 residual contamination, had been accepted rather than eliminated. The report enclosed with the June letter further noted that DOE should consider decontaminating areas with residual contamination to reduce the risk associated with a potential release. Since that time, DOE has on a number of occasions evaluated options and developed plans to address the residual contamination. However, these efforts have not successfully transitioned from planning to execution, and the residual contamination and the hazard it poses still remain in Building 235-F.

Conclusion

The Board believes that due to the potential dose consequences to collocated workers and the public, it is unacceptable for the residual contamination within Building 235-F to continue to remain unaddressed.

Recommendation

Given the continuing hazard posed by Building 235-F as detailed above, the Board recommends that DOE:

1. Take action to immobilize and/or remove the Pu-238 that remains as residual contamination within Building 235-F.

2. Concurrent with sub-Recommendation 1, take near-term actions and implement compensatory measures to improve the safety posture of Building 235-F and reduce the potential for and severity of a radiological release, including but not limited to the following.

a. To the extent feasible, remove from Building 235-F all transient and fixed combustibles that are not directly necessary for surveillance and maintenance activities and ensure that the transient combustible loading in the facility remains as low as reasonably achievable.

b. Ensure that all electrical equipment not necessary to support facility safety systems, life safety, or surveillance and maintenance activities is de-energized and air gapped. Remove all electrical and support equipment remaining within former process areas that is not necessary for surveillance and maintenance.

c. Evaluate the condition and operability of early detection and alarm systems in the PuFF facility, such as the heat and smoke detectors (with the exception of those located within the PuFF facility cells, if evaluating them would require intrusion into the cells). Take action, as necessary, to ensure that these systems are credited in the safety basis, are remotely monitored, provide reliable detection of hazards, and are maintained in accordance with National Fire Protection Association 72, *National Fire Protection Alarm and Signaling Code.*

3. Concurrent with sub-Recommendation 1, take action to ensure that the SRS emergency response to a radiological release from Building 235-F is adequate and effective, including but not limited to the following.

   a. Ensure that an integrated emergency response plan is in place that considers the collocated workers in facilities, construction sites, and trailers located adjacent to Building 235-F. Development of this plan should include an evaluation of the specific locations where collocated workers are directed to shelter in place to ensure their adequate protection during and following a potential radiological release from Building 235-F.

   b. Ensure that periodic coordinated drills in response to a simulated event at Building 235-F are conducted. Such drills should include appropriate response actions by personnel in the adjacent facilities and construction sites, such as sheltering in place or evacuating depending on proximity to the simulated plume of radioactive material.

The Board urges the Secretary to avail himself of the authority under the Atomic Energy Act (42 U.S.C. § 2286d(e)) to "implement any such recommendation (or part of any such recommendation) before, on, or after the date on which the Secretary transmits the implementation plan to the Board under this subsection."

Peter S. Winokur, Ph.D., Chairman