DEFENSE NUCLEAR FACILITIES SAFETY BOARD

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July 10, 2003

The Honorable Jessie Hill Roberson
Assistant Secretary for Environmental Management
U.S. Department of Energy
1000 Independence Avenue, SW
Washington, DC 20585-0113

Dear Ms. Roberson:

Enclosed for your consideration and action, as appropriate, are observations developed by the members of the staff of the Defense Nuclear Facilities Safety Board (Board) concerning the electrical and lightning protection systems for the K-Area Material Storage (KAMS) Facility, FB-Line, and Building 235-F at the Savannah River Site. This review is part of an overall safety assessment undertaken in response to Public Law 107-314, Section 3183, *Study of Facilities for Storage of Plutonium and Plutonium Materials at Savannah River Site.*

The staff's review identified issues related to electrical and lightning protection systems in each facility. Specifically, the issues concern the capability of electrical equipment in KAMS to perform a safety function, the adequacy of the lightning protection system and aging electrical cables in Building 235-F, and the potential need for applying ampacity derating factors to certain cables in FB-Line. The Board asks to be informed of DOE's actions to address the issues discussed in the enclosed report.

Sincerely,

John T. Conway
Chairman

c: Mr. Jeffrey M. Allison
Mr. Mark B. Whitaker, Jr.

Enclosure

DEFENSE NUCLEAR FACILITIES SAFETY BOARD

Staff Issue Report

June 24, 2003

MEMORANDUM FOR: J. K. Fortenberry, Technical Director

COPIES: Board Members

FROM: A. K. Gwal

SUBJECT: Review of Electrical and Lightning Protection Systems for K-Area Material Storage Facility, FB-Line, and Building 235-F at Savannah River Site

In Public Law 107-314, Section 3183, *Study of Facilities for Storage of Plutonium and Plutonium Materials at Savannah River Site,* Congress tasked the Defense Nuclear Facilities Safety Board (Board) to conduct a study of the adequacy of the K-Area Material Storage Facility (KAMS) and related support facilities, such as Building 235-F (235-F), at the Savannah River Site (SRS) for the storage of defense plutonium and defense plutonium materials in connection with the Department of Energy's (DOE) fissile materials disposition program. This report documents a review by the Board's staff of the electrical and lightning protection systems for KAMS, FB-Line, and Building 235-F at SRS conducted as part of that overall study. This review was conducted by staff members A. Gwal, B. Broderick, C. March, and T. Davis during May 6–8, 2003.

KAMS. The Board's staff made the following observations with respect to KAMS.

Electrical Distribution System—In general, the staff found the electrical distribution system to be adequate since the system is currently not credited with any safety function. However, in a letter dated June 12, 2003, the Board noted that the ventilation system for KAMS was not designated as safety-class consistent with DOE requirements to preclude unacceptable off-site consequences during certain accidents. Such a designation would require reclassification of the existing electrical system and significant enhancements to the present emergency power capability.

Electrical Calculations—The short-circuit analysis for KAMS is based on the short-circuit currents from the original electrical calculations for K-Reactor. Because there have been major equipment modifications, including removal of many of the electrical loads, the short-circuit analysis needs to be reevaluated using short-circuit currents based on the existing configuration of the electrical distribution system. Such an evaluation would verify the capability of the electrical equipment to perform safely without initiating a fire or an explosion.

Building 235-F. The staff's observations regarding Building 235-F are detailed below.

Lightning Protection System—The current lightning protection system is intended to provide protection via the partial Faraday cage that is established by the building's interconnected structural steel rebar. However, the existing arrangement is rendered ineffective by unbonded metallic penetrations that breach the cage boundary. By attaching to an unbonded rooftop or high-elevation penetration, lightning energy (capable of igniting in-situ combustibles) could couple directly into the facility, bypassing the rebar cage altogether. Given the lack of viable fire suppression capabilities in 235-F, it would be prudent to install a lightning protection system compliant with National Fire Protection Association (NFPA) Standard 780, *Standard for the Installation of Lightning Protection System.*

National Electric Code (NEC)-Type Assessments—The electrical distribution system in 235-F was installed in accordance with the 1957 version of the NEC. Facility personnel were unaware of any assessments performed in recent years to ensure compliance with either the current NEC or the code of record. Such assessments are performed routinely for the commercial nuclear industry by NEC-qualified inspectors and have been performed for other facilities at SRS to evaluate electrical systems for compliance with the NEC. The staff believes it would be beneficial to assess the existing electrical system for 235-F against current code requirements to identify potential fire hazards and understand latent system vulnerabilities.

Calibration of Protective Devices—To ensure reliable operation, Institute of Electrical and Electronics Engineers (IEEE) Standard 242-2001, *IEEE Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems*, recommends that electrical protective devices be maintained and calibrated in accordance with manufacturer's recommendations. The 235-F circuit breakers and relays are maintained on a 5-year calibration frequency. Representatives of 235-F could not verify whether this calibration frequency is consistent with the manufacturer's recommendation. The Board's staff believes the calibration tests on the breakers and relays should be in accordance with the manufacturer's recommendation to ensure that the equipment will operate as designed.

Electrical Cables—The majority of the electrical cables in 235-F are approximately 50 years old and have exceeded their estimated design life. Power, instrumentation, and control cables can deteriorate during service. When cable jackets and insulating materials age, they become brittle and may crack. Because a number of facility safety systems rely on the working condition of these cables, continued monitoring of their condition is an essential part of effective preventive maintenance. Such monitoring of the condition of the cables improves the service life and reliability of electrical equipment by detecting damaged and deteriorating power and instrumentation and control cables prior to equipment failure.

Several techniques for this type of monitoring exist; for example, the Defense Waste Processing Facility at SRS uses an Electronic Characterization and Diagnostics (ECAD) system for monitoring the condition of cables. The types of degradation and problems that can be detected by the ECAD system are changes to dielectric materials, deterioration of circuit insulation, high-resistance connections, short circuits, open circuits, moisture intrusion, circuit

noise, and development of conducting paths. The condition of safety-related cables needs to be determined using a suitable system for monitoring the condition of the cables to support a long-term storage mission in this building.

FB-Line. The staff made the following observations with regard to FB-Line.

Ampacity Derating of Fire-Protected Cables—In one of the stairwells, the power, instrumentation, and control cables routed through the cable trays are coated with a protective material (Flammastik) to prevent the initiation and rapid propagation of fire. Such protective coatings may reduce the heat transfer characteristics associated with the ampacities codified in industry standards. Hence, ampacity testing to determine whether the coating has affected the rating of fire-protected cable systems is necessary. The Board's staff believes IEEE Standard 848-1996, *IEEE Standard Procedure for the Determination of the Ampacity Derating of Fire-Protected Cables*, should be used to evaluate the adequacy of the coated cables in the stairwell, as well as in other locations where such coated cables exist.

NEC-Type Assessments—As discussed above for Building 235-F, it would be beneficial to assess the existing electrical system against current code requirements to identify potential fire hazards and understand latent system vulnerabilities.