DEFENSE NUCLEAR FACILITIES SAFETY BOARD

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August 23, 2004

Mr. Paul M. Golan
Acting Assistant Secretary for
Environmental Management
U.S. Department of Energy
1000 Independence Avenue, SW
Washington, DC 20585-0113

Dear Mr. Golan:

Enclosed for your consideration and action, as appropriate, are observations developed by members of the staff of the Defense Nuclear Facilities Safety Board (Board) concerning the electrical and ventilation systems for the high-level waste Concentration, Storage, and Transfer Facilities at the Savannah River Site. The Board believes three of the issues discussed in the enclosed report warrant priority attention:

- Cabinets housing a safety-significant automatic transfer switch and motor control center, which are relied upon to provide power to safety-significant loads, have large openings directly under sprinkler heads of the fire suppression system. Water spray from activation of the sprinkler system could initiate short-circuiting that would leave safety-significant loads without power.

- The majority of the safety-class electrical breakers and disconnects are installed in non-safety-rated buildings. As a result, although the Documented Safety Analysis takes credit for the safety-class electrical breakers and disconnects, there is no assurance that these breakers can be relied upon to perform their safety function during a seismic event.

- After a seismic event, portable purge ventilation systems are relied upon to prevent accumulation of hydrogen gas in excess of the lower flammability limit. However, the ability of such portable systems (generator and blower assembly) themselves to remain operable after a seismic event is uncertain.

The Board asks to be kept abreast of actions taken regarding these and other issues discussed in the enclosed report.

Sincerely,

John T. Conway
Chairman

c: Mr. Mark B. Whitaker, Jr.

Enclosure

DEFENSE NUCLEAR FACILITIES SAFETY BOARD

Staff Issue Report

August 2, 2004

MEMORANDUM FOR: J. K. Fortenberry, Technical Director

COPIES: Board Members

FROM: A. K. Gwal

SUBJECT: Review of Electrical and Ventilation Systems for High-Level Waste Concentration, Storage, and Transfer Facilities at the Savannah River Site

This report documents observations resulting from reviews of the electrical and ventilation systems for high-level waste Concentration, Storage, and Transfer Facilities (CSTF) at the Savannah River Site (SRS). These on-site reviews were conducted by members of the staff of the Defense Nuclear Facilities Safety Board (Board) A. Gwal, A. Matteucci, L. Zull, and M. Moury on November 4–6, 2003 and July 13–15, 2004.

CSTF consists of the waste evaporators and 49 operational underground waste storage tanks in H-Area and F-Area that together perform the storage and handling functions for liquid radioactive waste. The waste evaporators remove excess water from the CSTF process. The other tank farm systems are the waste storage tanks and associated subsystems and the waste transfer systems, consisting of diversion boxes, valve boxes, pump tanks, and connecting transfer lines.

The Board's staff reviewed and walked down a portion of CSTF, including priority 1 & 2 waste tanks at F- and H-Area Tank Farms, one evaporator, diversion box #8, switchgear, motor control centers (MCC), a safety-significant diesel generator, and a control room in H-Area. Detailed observations are presented below.

Unprotected Automatic Transfer Switch and Motor Control Center. A safety-significant automatic transfer switch (ATS) and MCC, which are relied upon to provide power to safety-significant loads, have large openings on the top of the cabinets. These openings are located directly under sprinkler heads of the fire suppression system. Water spray from activation of the sprinkler system would penetrate the ATS and MCC and could initiate short-circuiting, a common-cause failure that would leave safety-significant loads without power. Similar situations were noted by the Board's staff in the case of two non-safety distributed control system cabinets that are constructed with wire mesh openings at the top of the panel to aid in heat dissipation.

Safety-Class Electrical Breakers and Disconnects Installed in Non-Safety-Related Structures and Buildings. The Documented Safety Analysis (DSA) identifies the need for safety-class electrical breakers and disconnects. Electrical breakers/disconnects provide for the shutdown of waste tank mixing devices should high hydrogen concentrations or low ventilation flow occur in a waste tank. The electrical breakers/disconnects for transfer pumps mitigate a radiological release to the environment by providing a means for manual shutdown in the event of a leak or overflow. The majority of these safety-class breakers and disconnects are installed in non-safety-rated structures and buildings. Therefore, there is no assurance that they will perform their intended function during a seismic event given the anticipated failure of the supporting building or structure. Relocating the safety-class breakers and disconnects to a safety-grade structure or building would eliminate this vulnerability. Representatives of Westinghouse Savannah River Company (WSRC) agreed to evaluate this issue.

Waste Tank Purge Ventilation Systems. Many of the waste tank purge ventilation systems are classified as safety-class systems. Their major components are an exhaust fan, duct, and associated power supply. However, the DSA for CSTF acknowledges that these components (excluding Tanks 48 and 49) were neither designed nor installed to meet the safety-class requirements delineated in Department of Energy Order 420.1 A, *Facility Safety*.

Because of the time delay before the tank vapor space builds up unsafe hydrogen concentrations, the DSA offers compensatory actions, such as restoring normal power to the ventilation system, providing power from an alternative source to the installed fan, or installing and operating a portable purge ventilation system, to support accepting the waste tank purge ventilation systems as safety-class. After a seismic event, portable purge ventilation systems are relied upon to ensure that the vapor space of some waste tanks will be adequately purged to prevent accumulation of hydrogen gas in excess of the lower flammability limit.

These portable purge ventilation systems consist of a blower, a fan and a high-efficiency particulate air (HEPA) filter mounted on a skid. Power for these portable units is to be provided by any of the numerous portable generators at the site. Four other portable exhaust blowers, consisting of a frame-mounted assembly with exhaust blower, gasoline engine driver, and gasoline tank with separate dedicated HEPA filter housing, are to be used to purge the vapor space of Tanks 48 and 49. These units can also be used for other tanks if needed. All of these purge ventilation systems are stored on site in a seismically qualified facility, and deployment of the system is exercised periodically in preparatory drills.

However, the ability of the portable ventilation systems and generators to withstand a seismic event is uncertain. In addition, while the portable ventilation blowers are carefully controlled to ensure that they are always available, the same is not true for the portable generators. Although there appeared to be a sufficient number of generators in each tank farm, there is no process or method to ensure that the appropriate number of generators is always available.

Lightning Protection System. Chapter 3, "Hazard and Accident Analysis," of the DSA identifies and assesses potential hazards associated with the operation of CSTF. However, Section 1.5, "Natural Phenomenon Threats," of the DSA does not include lightning as a potential accident initiator.

During the walkdown of the H-Area tank farm, the Board's staff observed that some of the buildings and structures had elements of a lightning protection system, including lightning terminals and grounding conductors. However, WSRC personnel indicated that the components are not maintained. It may be appropriate to install or repair a lightning protection system in accordance with National Fire Protection Association 780, *Standard for the Installation of Lightning Protection Systems*, for CSTF.

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 the manufacturer's recommendations. During a walkdown of the H-Area electrical room, the Board's staff observed that the calibration date had expired for some of the protective devices. WSRC personnel stated they would verify that required calibrations had been performed or perform the calibration tests on the expired relays to ensure that they will operate within allowable limits.

Self-Assessment. Facility personnel were unaware of any assessments performed in recent years to ensure compliance with either the current National Electric Code (NEC) or the code of record. Such assessments are performed routinely for the commercial nuclear industry by NEC-qualified inspectors. The staff believes it would be beneficial to assess the existing electrical system for CSTF against current NEC requirements to identify potential fire hazards and understand latent system vulnerabilities.

Monitoring of Cable Condition. Many of the electrical cables used in CSTF are approaching or past their intended service life. As cables age, their electrical characteristics may degrade to an unacceptable level, thereby decreasing the reliability of both the cables and the systems they support. Because these aged cables provide power for a number of facility safety systems, it may be prudent to establish a baseline for the remaining life of the cables and consider incorporating a capability to monitor the condition of cables into the existing CSTF preventive maintenance regime. Monitoring of cable condition could improve the service life and reliability of electrical equipment by detecting damaged and deteriorating power and instrumentation and control cables prior to equipment failure. The Board's staff was briefed on the program being developed for the management of aging electrical equipment for 105-K and 235-F facilities at SRS. Although this program is in its early stages of development, it appears to incorporate many best practices from industry and to provide a good model for the rest of the site's defense nuclear facilities.