DEFENSE NUCLEAR FACILITIES SAFETY BOARD

625 Indiana Avenue, NW, Suite 700, Washington, D.C. 20004-2901
(202) 694-7000

March 1, 2004

The Honorable Everet H. Beckner
Deputy Administrator for Defense Programs
National Nuclear Security Administration
U.S. Department of Energy
1000 Independence Avenue, SW
Washington, DC 20585-0104

Dear Dr. Beckner:

Enclosed is a report containing observations of members of the staff of the Defense Nuclear Facilities Safety Board (Board) concerning the design of the electrical system for the Highly Enriched Uranium Materials Facility (HEUMF) at the Oak Ridge Y-12 National Security Complex. These observations are based on reviews of available documents, as well as discussions with representatives of the National Nuclear Security Administration and contractor personnel at Oak Ridge on November 19–20, 2003 and February 2, 2004. The Board appreciates the prompt action taken by the HEUMF project team to resolve some of these issues in a timely manner.

The enclosed staff report is forwarded for your information and use as appropriate.

Sincerely,

John T. Conway
Chairman

c: Mr. William J. Brumley
Mr. Mark B. Whitaker, Jr.

Enclosure

DEFENSE NUCLEAR FACILITIES SAFETY BOARD

Staff Issue Report

February 12, 2004

MEMORANDUM FOR: J. K. Fortenberry, Technical Director

COPIES: Board Members

FROM: A. Gwal

SUBJECT: Review of Electrical Systems for Highly Enriched Uranium Materials Facility at Y-12 National Security Complex

This report documents observations resulting from a review of the electrical system for the Highly Enriched Uranium Materials Facility (HEUMF) at the Y-12 National Security Complex. This review was conducted by members of the staff of the Defense Nuclear Facilities Safety Board (Board) A. Gwal, W. Linzau, C. March, and M. Moury on November 19–20, 2003. This report also documents the results of a review of supporting documentation received on January 28, 2004, related to the issues raised by the Board's staff, as well as subsequent discussions with site representatives on February 2, 2004. In general, the electrical design work is proceeding in a logical manner, and the HEUMF project team has been responsive to issues raised by the staff. Detailed observations are presented below.

Rating of the Safety-Significant Diesel Generator. According to its initial design, the Secondary Confinement Isolation System (SCIS) was to be a fail-safe system that would not require electrical power to perform its safety function. Subsequently, the design was changed, so that the SCIS is now an active system that requires a safety-significant power source for fans and control systems. The corresponding design for the electrical distribution system was also revised, and now includes a safety-significant diesel generator as a backup power source during loss of normal offsite power to comply with the requirements of a safety-significant system. However, it is not clear that the current rating of the diesel generator can handle the starting transients of the connected motors. The contractor has committed to performing a calculation to confirm that the starting of the connected electric motors will not overload the diesel generator.

Emergency Lighting. In the event of an earthquake, emergency lighting would be needed for egress of personnel from the facility. The Board's staff observed that emergency lighting equipment in the facility is not designed to be seismically supported or qualified. The contractor has committed to evaluating this issue.

Electrical Calculations. Comprehensive short-circuit, voltage profile, and coordination studies are essential to safeguard personnel and maintain a safe and reliable power system. Such studies are typically performed in accordance with Institute of Electrical and Electronics Engineers (IEEE) STD-141, *IEEE Recommended Practice for Electric Power Distribution for*

Industrial Plants, and STD-242, *IEEE Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems*. The contractor has completed most of the required calculations. However, during its November 2003 review, the Board's staff found that calculated short-circuit values had not been compared and evaluated against the equipment rating. Therefore, the staff could not verify the capability of the electrical equipment to perform its intended functions. The contractor has now evaluated the calculations and found 27 discrepancies. The Board's staff will review these discrepancies and their resolutions to confirm the adequacy of the electrical systems.

Penetration Seals. The Board's staff requested details of the design of cable penetration seals, which are part of the safety-significant confinement system. The contractor recently provided a list of the seals, the fire rating of the seals and penetration assemblies, and qualification requirements. However, these documents do not contain an evaluation of the ampacity-derating effect (reduction in the rated current of the cable) of the penetration seals in accordance with the IEEE STD-848, *IEEE Standard Procedure for the Determination of the Ampacity Derating of Fire-Protected Cables.* Project personnel have stated they will address this issue during the procurement process.

Electrical Distribution System. Three independent Y-12 utility sources will provide 13.8 kV underground service into HEUMF. Switching equipment is provided for multiple-source arrangements, and all facility loads can be carried by any one of the incoming sources. The indoor secondary double-ended unit substation has two transformers rated at 2000 kVA. These transformers step down the voltage from 13.8 kV to 480 V and either one can supply all 480 V loads and panels. Because the current design load of the plant is approximately 2330 kVA (16.5 percent higher than the 2000 kVA rating of the transformers), the staff suggested increasing the transformer rating to accommodate the design load with a margin for future design changes. The contractor promptly evaluated the loads and revised the rating of the transformers to 2500 kVA, as shown on the current drawings submitted to the Board on January 28, 2004.