DEFENSE NUCLEAR FACILITIES
SAFETY BOARD
Washington, DC 20004-2901

September 22, 2010

The Honorable Ines R. Triay
Assistant Secretary for Environmental
Management
U.S. Department of Energy
1000 Independence Avenue, SW
Washington, DC 20585-0113

Dear Dr. Triay:

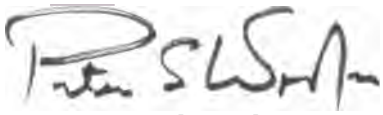
The staff of the Defense Nuclear Facilities Safety Board (Board) recently reviewed the electrical system and electrical safety program at the Waste Isolation Pilot Plant (WIPP). The review included discussions with Department of Energy (DOE) staff and contractor personnel at WIPP during June 8-10, 2010. The enclosed staff report provides examples of areas in which the electrical safety program is not meeting guidance in DOE's *Electrical Safety Handbook* (DOE-HDBK-1092-2004).

The handbook includes Appendix A, "DOE Model Electrical Safety Program," which provides guidance for developing and maintaining an effective electrical safety program. The Board's staff uses the guidance provided in the handbook as the template for an acceptable electrical safety program. WIPP personnel should evaluate their electrical safety program by comparing it with this guidance and electrical safety programs at other DOE nuclear sites, and address any identified gaps. The Board is particularly concerned that WIPP lacks a structured program for identifying electrical equipment that is not approved by a nationally recognized testing laboratory. Defective or improperly installed electrical equipment poses an electrical safety risk to workers, and can initiate facility fires and disable important safety equipment.

The staff report also describes deficiencies in the 480-volt Motor Control Center (MCC) in the Fire Water Pump Building. This MCC has many unsealed conduit openings at the top that carry 480-volt electrical cables. These openings are located under the sprinkler heads of the fire protection system and the leaking roof. Water spray resulting from an activation of the sprinkler system or dripping from the leaking roof would likely penetrate the MCC and generate a short circuit that could damage the MCC, create hazardous conditions, and leave fire protection system loads without power. The Board notes that WIPP personnel agreed to correct these deficiencies and perform an extent-of-conditions review.

The Board notes that DOE and contractor management have begun to take corrective action to address these issues. Based on the staff's observations and pursuant to 42 U.S.C § 2286b(d), the Board requests a report within 90 days of receipt of this letter outlining actions taken or planned by DOE to address the inadequacies in the electrical safety program, the deficiencies related to the MCC, and other issues discussed in the enclosed report.

Sincerely,



Peter S. Winokur, Ph.D.
Chairman

Enclosure

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

DEFENSE NUCLEAR FACILITIES SAFETY BOARD

Staff Issue Report

August 10, 2010

MEMORANDUM FOR: T. J. Dwyer, Technical Director

COPIES: Board Members

FROM: A. K. Gwal

SUBJECT: Electrical System and Electrical Safety Program, Waste Isolation Pilot Plant

This report documents a review by the staff of the Defense Nuclear Facilities Safety Board (Board) of the electrical system and electrical safety program at the Waste Isolation Pilot Plant (WIPP). During June 8-10, 2010, staff members A. Gwal, T. Davis, and D. Winters assessed the design and condition of the electrical system, with the participation of representatives from the Department of Energy (DOE) and its contractor. The staff's assessment of the electrical safety program is based on the documentation presented to the staff during the review and additional documentation received as of July 13, 2010, related to the electrical safety manual, training manual, configuration and responsibilities of the electrical safety committee, and electrical occurrences during the past 3 years.

Background. In a letter dated June 21, 2001, the Board urged DOE to proactively ensure that adequate electrical safety programs were in place at defense nuclear facilities in accordance with *DOE's Electrical Safety Handbook* (DOE-HDBK-1092-98). The handbook's Appendix A, "DOE Model Electrical Safety Program," provides guidance for developing and maintaining an effective program, and is used by the Board's staff as the template for an acceptable electrical safety program. The Board also encouraged DOE to continue making planned updates to the handbook, addressing such topics as electrical safety during excavation. Further, in a letter dated August 7, 2003, the Board asked DOE to revise the handbook and explain how it planned to provide contractors with effective, detailed guidance on electrical safety programs. DOE ultimately revised the handbook to address these issues in December 2004.

Because of a considerable increase in the rate of electrical occurrences from 2002 to 2004, which included a fatality, the Deputy Secretary of Energy initiated an Electrical Safety Campaign in April 2004, and May 2004 was designated as Electrical Safety Month. Most of the sites developed electrical safety improvement plans in accordance with direction from the Assistant Secretary for Environmental Management that was issued in July 2004. The goal was to have fully compliant programs implemented and maintained at all sites.

The Board's staff has observed notable improvements in the electrical safety programs of many of the sites across the nuclear complex. However, during 2009-2010, WIPP experienced a surge of safety occurrences related to lockout/tagout violations, near misses in the 13.8 kV cable system, and power outages. Taken as a whole, the surge in occurrences indicates there are remaining weaknesses in the electrical safety program. In 2009, the Board's staff reviewed electrical systems at WIPP and observed deficiencies in the area of electrical calculations. The staff's review during June 8-10, 2010, was focused mainly on determining the adequacy of the electrical safety program and the resolution of previously identified issues. The staff identified the following issues during this review.

Unprotected 480-Volt Motor Control Center (MCC). The MCC in the Fire Water Pump Building has many 4-inch diameter conduit openings without seals at the top that carry 480-volt electrical cables. These openings are located under the sprinkler heads of the fire protection system and the leaking roof. Water spray resulting from an activation of the sprinkler system or from the leaking roof would likely penetrate the MCC and generate a short circuit that could damage the MCC, create hazardous conditions, and leave fire protection system loads without power. Institute of Electrical and Electronics Engineers (IEEE) Standard-833, *Recommended Practice for the Protection of Electric Equipment in Nuclear Power Generating Stations from Water Hazards,* addresses these issues and provides guidance for the protection of electrical equipment. The Board's staff suggested that WIPP personnel protect or seal the top of the MCC and repair the roof on a priority basis. Additionally, an extent-of-condition review of all the MCCs at the site would be advisable to identify any similar conditions. WIPP personnel agreed to correct these deficiencies and perform an extent-of-condition review.

Electrical Safety Program. The electrical safety program at **WIPP** is extremely weak, as evidenced by the lack of content in the program manual and the training for electrical workers. The Board's staff believes that WIPP needs to evaluate its program against the model program delineated in Appendix A of the *DOE's Electrical Safety Handbook* and make necessary changes. The Board's staff also asked **WIPP** representatives to contact other DOE nuclear sites, such as the Savannah River Site (SRS), and compare electrical safety programs. Subsequently, the results of this comparison, as reported by the WIPP staff, are as follows:

- The electrical safety program at WIPP is fragmented, spread over many implementing procedures, as opposed to having a single program owner/lead.

- The **WIPP** program does not fully implement *DOE's Electrical Safety Handbook* and is currently focused on meeting minimum requirements.

- There is no specific, targeted oversight of the **WIPP** electrical safety program; oversight is dispersed among management and programmatic assessments.

- There is no specific tracking/trending of electrical safety issues after they are recorded.

- In contrast with SRS, no single person is assigned full-time to electrical safety program functioning/oversight.

- The training program for electrical workers is not as extensive as that at SRS.

- The overall program is not committed to continuous improvement compared to the program at SRS.

Non-Nationally Recognized Testing Laboratory (NRTL) Components. WIPP lacks a program for evaluating and identifying components that are not approved by an NRTL. Without such a program, **WIPP** lacks plans to prevent the use of non-NRTL components at the site. The staff believes that non-NRTL electrical components need to be identified on a priority basis and removed from stock to eliminate any possibility of using them inadvertently.

Incomplete 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 should be performed in accordance with IEEE Standard-141, *IEEE Recommended Practice for Electric Power Distribution for Industrial Plants,* and IEEE Standard-242, *IEEE Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems.* WIPP has not yet completed these calculations. Specifically, the interrupting current rating of the electrical equipment has not been compared with the short circuit current available at the equipment. Therefore, the Board's staff could not verify the adequacy of the electrical equipment to withstand the short circuit current. **WIPP** plans to use SKM Systems Analysis, Inc. software to revise the electrical calculations by September 2011. The staff urged site personnel to complete the calculations on a priority basis so that inadequate and unsafe electrical equipment can be identified as soon as possible.

Non-Safety Electrical System Supplying Power to Safety-Significant Loads. Safety-significant loads (exhaust fans for the Contact Handled Bay and the Hot Cell Complex) are being supplied by a non-safety-significant electrical distribution system. DOE Guide 420.1-1, *Nonreactor Nuclear Safety Design Criteria and Explosives Safety Criteria Guide,* requires that systems, structures, and components supporting safety-significant equipment be classified as safety-significant. The Documented Safety Analysis (DSA) for WIPP does not address this issue. In the event of loss of site electrical power, the above non-safety-significant electrical distribution system can be connected to on-site standby diesel generators (DGs) manually with a significant time delay to supply power to the safety-significant loads. However, there is no procedure providing details for implementing this configuration. Additionally, DGs are neither classified nor procured as safety-significant equipment. The staff believes that the DSA needs to be revised to (1) include a discussion of this issue, (2) identify the need for safety-signigicant DGs, (3) ensure that a procedure is in place for implementing the above configuration in a timely manner during a loss of power, and (4) train operators to implement this configuration. The staff also believes that surveillance and maintenance for the above DGs and related equipment should be equivalent to those for a safety-significant DG. **WIPP** representatives agreed to evaluate this issue and make necessary changes to the DSA and other documentation.

Underground Substation Replacement. Underground substation #SS4 is more than 20 years old and is being replaced, but there are no plans to replace the associated 13.8 kV electrical cable, which is also more than 20 years old. Proposed testing (insulation resistance measurements using a megger) to verify the condition of this cable is inadequate. A high-potential DC test was not suggested because it might damage the cable. Typically, this test is performed on newly installed cables. The Board's staff suggested a partial discharge method for identifying any age-related cable/splice degradation of the 13.8 kV cable. This method involves an analysis of materials, electric fields, arcing characteristics, pulse wave propagation and attenuation, sensor spatial sensitivity, frequency response and calibration, and noise, as well as data interpretation. Several vendors are qualified to perform/interpret this test. This method was applied successfully at Y-12 to identify defective 13.8 kV cables/splices. **WIPP** representatives agreed to evaluate the age-related degradation of the cable for this substation using the partial discharge method or some other appropriate method. The staff suggested the replacement of any defective cable.

Delayed Recovery from Power Outages. During the staff's visit a loss of offsite power to the plant's substation Bus B occurred because a bird contacted and shorted the two phases of a transformer in the Excel Energy switchyard. No adverse consequences resulted from the recovery actions taken by Washington TRU Solutions personnel. However, the critique identified a lack of procedures related to abnormal operations due to loss of power, load shedding, and transfer of salt hoist control power. Additionally, site personnel were unfamiliar with the ability to transfer the salt hoist control power without realignment at the plant substation. Nor did they consider transferring the uninterruptible power supply to Bus A, which would have provided sufficient illumination for operators who were responding to equipment alarms in a work environment with minimal lighting. The Board's staff believes that the procedure for abnormal operations during and after a loss of power needs to be completed as soon as possible and that operators must be trained for a loss-of-power event. This procedure must include a checklist of all the required actions for every piece of equipment and component, such as resetting the breakers and drop-out relays.

Fire Water System. Fire protection was not the focus of this review, but the staff made the following observations that suggest the need for a follow-on fire protection review:

- As a result of leaking buried fire water lines, the jockey pump is running almost continuously. Plans are under way to locate and replace leaking section(s) of fire water lines. The extent of the problem is unknown at present.

- The site lacks a certified individual to work on fire suppression systems.

- False fire alarms occur because of a defect in the design of the fire water supply system (two false alarms occurred in one day while the staff was on site).