

**[DNFSB LETTERHEAD]**

June 3, 1997

The Honorable Victor H. Reis  
Assistant Secretary for Defense Programs  
Department of Energy  
1000 Independence Avenue, SW  
Washington, DC 20585-0104

Dear Dr. Reis:

Enclosed for your consideration and action, where appropriate, are the observations developed by the staff members of the Defense Nuclear Facilities Safety Board (Board) concerning the electrical and fire protection systems of the Building 9212 Complex at the Oak Ridge Y-12 Plant. These observations are based on reviews of available documents, as well as discussions with Department of Energy (DOE) staff and contractor personnel at Oak Ridge on March 25-27, 1997.

In the [enclosed report](#), the Board's staff concludes that the 50-year-old motor control center (MCC) 230-1A and its associated conduit systems show significant age-related degradation, are severely corroded, and have exceeded their useful life. This degradation and corrosion increase the likelihood of fire initiation from the MCC. In addition, the staff observed badly corroded water supply piping and associated valves for the fire protection system in some areas (e.g., E-wing basement near MCC 230-1A). Finally, the Board's staff observed that parts of the Building 9212 Complex have an unnecessarily high combustible loading. These conditions, coupled with the potential unavailability of the fire protection system because of the failure of badly corroded components, could create a very hazardous condition.

The Board believes that it would be advisable to correct deficiencies in the MCC 230-1A and other components of the fire protection and electrical systems prior to Enriched Uranium Operations (EUO) restart. The Board understands that the conditions observed in the vicinity of MCC 230-1A are not unique. Therefore, the Board would like to be briefed on your efforts to assess the magnitude of these issues, including any resultant corrective actions prior to resumption of EUO restart.

Sincerely,

***John T. Conway***  
Chairman

c. Mr. Mark B. Whitaker, Jr.  
Mr. Jim Hall

Enclosure

# DEFENSE NUCLEAR FACILITIES SAFETY BOARD

April 7, 1997

**MEMORANDUM**  
**FOR:** G. W. Cunningham, Technical Director  
**COPIES:** Board Members  
**FROM:** A. K. Gwal  
**SUBJECT:** Review of the Y-12 Plant, Building 9212 Complex, Electrical and Fire Protection Systems

## 1. Purpose

This report documents a review of the electrical and fire protection systems required to support Enriched Uranium Operations (EUO) restart in the 9212 Complex at the Oak Ridge Y-12 Plant. This review was performed by Defense Nuclear Facilities Safety Board (Board) staff members W. White, W. Andrews, and A. K. Gwal on March 25-27, 1997, using the approach of DNFSB/TECH-5, *Fundamentals for Understanding Standards-Based Safety Management of DOE Defense Nuclear Facilities*, and Recommendation 95-2.

## 2. Issues

The review identified the following major issues:

- Essential short-circuit, voltage profile, and coordination studies have not been performed. Thus, it is not possible to verify the capability of the electrical equipment to perform the intended functions when required.
- Motor Control Center (MCC) 230-1A and its associated conduit systems are more than 50 years old and utilize fuses instead of the conventional molded-case circuit breakers. These components show significant age-related degradation, are severely~ corroded, and have exceeded their useful life. The potential unavailability of the fire protection system, coupled with the possibility of fire initiation and propagation from MCC 230-1A, creates a potentially very hazardous condition. An uncontrolled fire could damage and affect the functional adequacy of the safety systems. It would be advisable for Lockheed Martin Energy Systems (LMES) to thoroughly evaluate this condition. The Board staff believes this condition could be corrected by replacing MCC 230-1A and other deficient components of the fire protection and electrical systems prior to restart.
- Transformers manufactured by Southern Transformer Company (STC) have high failure rates. The Board staff believes that these transformers represent a safety risk, and therefore it would be prudent to replace the three transformers used in EUO as soon as possible.
- It would also be prudent to resolve inadequacies in the emergency lighting and

lightning protection systems prior to restart.

- During the walkdown associated with the electrical review, the Board staff observed that parts of the 9212 Complex have an unnecessarily high combustible loading. Some of the areas with the highest loading have no automatic fire protection system. This deficiency creates an untenable situation whose correction is essential as soon as possible, but definitely prior to restart. A significant effort to remove combustibles not directly related to EUO would be advisable.

### 3. Background

In September 1994, LMES shut down all nuclear operations at the Oak Ridge Y-12 Plant because of safety concerns related to conduct of operations and nuclear criticality. Since that time, operational activities in four of the five mission areas where corrective action was required have been restarted. The final mission area, EUO, is currently scheduled to be restarted in early calendar year 1998. The purpose of the Board staff's review was to assess the current status of electrical systems associated with EUO restart efforts, and to ensure that the necessary site-wide infrastructure is in place to support these specific electrical systems, as well as EUO restart efforts in general.

### 4. Discussion

The Board staff review identified the following potentially significant issues related to EUO.

**Electrical Systems.** The Board staff evaluated the design of the electrical distribution system in Building 9212. The evaluation was performed based on the assumption that electrical power is not required for any safety systems, as stated by LMES and documented in the Final Safety Analysis Report (FSAR). The major deficiencies observed are in the areas of age-related degradation and corrosion of motor control centers, electrical conduits, and distribution transformers. Most of the components of the electrical systems in Building 9212 are decades old and have not been adequately maintained. In some cases, they are more than 50 years old. These components have exceeded their useful life, and age/corrosion-related degradation is very obvious.

*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 would be 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*. LMES has completed these calculations for 13.8 kV systems only. Short-circuit analysis and protective device coordination studies for 480 V and lower-power systems have not been performed. Therefore, the Board staff could not verify the capability of the electrical equipment to perform the intended functions when required. It is important for LMES to complete these analyses as part of its electrical upgrades.

*Motor Control Centers (MCCs)*—MCCs in Building 9212, installed for the control of motors, lighting, and power circuits, are 1950s vintage and utilize fuses rather than the conventional molded-case circuit breakers. Some of these MCCs are very old (50+ years) and have exceeded their useful life. In particular, the Board staff observed MCC 230-1A, where age-related degradation and corrosion are obvious (see the attached three photographs). This MCC feeds several supply fans and other miscellaneous equipment. The required short-circuit study, relay/breaker/fuse coordination study, and verification of equipment and component rating for this MCC and all the components at 480 V and below do not exist. Because of the deteriorated condition of this MCC, initiation of fire during a short-circuit condition is possible.

The unavailability of the fire protection system because of the failure of badly corroded piping and valves, coupled with the possibility of fire initiation and propagation from MCC 230-1A, could create a very hazardous condition whose thorough evaluation by LMES is essential. In addition, an uncontrolled fire could damage safety system components and affect the functional adequacy of safety systems. Evaluation of this condition by LMES would also be advisable. The Board staff believes this condition could be corrected by replacing MCC 230-1A and other deficient components of the fire protection and electrical systems prior to restart.

*Transformers*—Transformers manufactured by STC have high failure rates. On March 13, 1993, 5 STC transformers failed, bringing the total STC transformer failures to 9 of the 52 transformers installed at the Oak Ridge Y-12 Plant during 1987 and 1988. It appears that possible moisture contamination, poor quality of transformer construction, and lack of space heaters were the primary contributing causes of the failures. During a Board staff review of the Oak Ridge Y-12 Plant on November 3-5, 1993, the Department of Energy (DOE) presented its plans for replacing all 52 transformers. This plan was never completed, and 3 of the failure-prone STC transformers are still being used in EUO. The Board staff believes that these transformers represent a safety risk and therefore it would be prudent to replace them prior to EUO restart.

*Emergency Lighting*—In the event of an earthquake, emergency lighting is needed for personnel egress from the facility. The Board staff observed that emergency lighting equipment in Building 9212 does not appear to be seismically supported or qualified, and may not provide adequate illumination levels in some areas. This is another concern requiring LMES evaluation and resolution.

*Lightning Protection*—Lightning protection for Building 9212 consists of a system of air terminals, surge arresters, and cables that are installed only on the stacks. The Board staff has determined that Building 9212, except for the stacks, does not have protection against lightning damage. U. S. Nuclear Regulatory Commission Regulatory Guide 3.38 requires that provisions be made for protection of the plant against lightning damage for facilities similar to Building 9212. Thus it would be advisable for LMES to consider designing and installing additional lightning protection for Building 9212.

**Fire Protection System.** While assessing the condition of electrical switchgear equipment in the 9212 Complex, the Board staff noted that large amounts of unnecessary combustibles were being stored on and around the switchgear. The

combustibles took the form of wooden pallets; large cardboard dowels; and numerous newspapers, magazines, outdated equipment tags, and other common trash. This was not a transient situation, but rather one that had existed for a prolonged period of time. The Board staff was told that a fire watch had been established in E-wing basements over a year ago because of the combustible loading situation. Some other areas with high combustible loading, such as the headhouse basement, do not have automatic fire protection systems.

The above discussion does not represent a new issue. During DOE's Highly Enriched Uranium Vulnerability Assessment, numerous vulnerabilities were identified in EUO facilities with respect to the potential for fire, with the resulting release of highly enriched uranium. In fact, Building 9212 was identified as having significant vulnerabilities for workers, the public, and the environment. More specifically, it was stated that the fire protection program was "... not effective in preventing the accumulation of large volumes of combustibles that contribute to fire loadings and to fires capable of overwhelming fire suppression systems." The Board staff concurs with that assessment and notes that the combustible loading issue in the 9212 Complex has not yet been resolved adequately.

The Board staff also observed badly corroded water supply piping and associated valves (see attached photographs) for the fire protection system in some areas (e.g., E-wing basement near MCC 230- 1A). The adequacy of the fire protection system to perform its intended function could not be verified. It would be advisable to perform a walkdown of fire protection system components to determine any deficient conditions, as well as to replace deficient components prior to restart or provide justification for each of the existing deficient conditions.

**Supervisory Control and Data Acquisition.** LMES is currently installing a supervisory control and data acquisition (SCADA) system that will allow remote monitoring and control of high-voltage electrical distribution system equipment. This system will monitor voltage, current, power, alarm points, and status of breakers and switches. Installation should be complete before the end of 1997. Although the system does not meet the requirements of safety-class IEEE standards, it does appear to have appropriate reliability for control and monitoring of non-safety-class electrical power. Control functions performed by the SCADA system will still be able to be performed manually, if necessary. Provided LMES takes advantage of the capabilities of the system, SCADA should provide significant enhancements in the areas of electrical safety and predictive maintenance of high-voltage electrical equipment.

## 5. Future Staff Actions

The Board staff will continue to follow the resolution of the issues identified in this report, and will review the Pre-Fire Plan package and Fire Hazard Analysis for Building 9212. A review of instrumentation and control systems supporting EUO is planned for August 1997.