[DNFSB LETTERHEAD]

May 5, 1995

The Honorable Victor H. Reis
Assistant Secretary for Defense Programs
Department of Energy
Washington, D.C. 20585

Dear Dr. Reis:

On November 25, 1994, the Defense Nuclear Facilities Safety Board (Board) requested a report identifying the formal process(es) the Los Alamos National Laboratory (LANL) is following to identify and mitigate hazards in the design, construction, and preparation for operation of new and upgraded defense nuclear facilities. In your initial reply of March 6, 1995, you stated that the Chemistry and Metallurgy Research (CMR) building upgrades project will serve as an example for defense nuclear projects at LANL.

The Board's staff has recently visited the CMR building, as well as the TA-55 Plutonium Facility, to review electrical, instrumentation and control systems, and configuration management. The staff has provided the Board with the two enclosed reports. Based on these reports, it is likely that a proper identification of hazards for the apparent mission of CMR would lead to the necessity of providing emergency/standby power. LANL stated that while emergency/standby power will be considered for the upgrades, it is possible that neither emergency nor standby power will be implemented. In addition, it appears that configuration management activities need to be considerably strengthened prior to significant additional physical work on the CMR upgrades.

The Board believes these observations merit Department of Energy line management attention. Hence, the enclosed staff trip reports ***[to follow is the report of the January 23-26, 1995 visit]*** are forwarded for your information and use. Mr. Steven Krahn of the Board's staff will be available to provide any additional information you may require.

Sincerely,

John T. Conway
Chairman

c: Mr. Mark Whitaker
Enclosures

DEFENSE NUCLEAR FACILITIES SAFETY BOARD

February 22, 1995

MEMORANDUM FOR:	G. W. Cunningham, Technical Director
COPIES:	Board Members
FROM:	Ajit K. Gwal
SUBJECT:	Los Alamos National Laboratory - Chemistry and Metallurgy Research and Technical Area 55 - Trip Report (January 23-26, 1995)

1. **Purpose:** This report documents a review of the electrical, instrumentation, and control systems at the Los Alamos National Laboratory (LANL) Chemistry and Metallurgy Research (CMR) building and the Technical Area 55 (TA-55) facility by Defense Nuclear Facilities Safety Board (DNFSB) technical staff, Ajit K. Gwal and R. Todd Davis on January 23-26, 1995.

2. **Summary:**

   a. CMR Building:

      1. Maintenance: A comprehensive program for corrective, preventive, and predictive maintenance does not exist for electrical equipment at the CMR building. Facility electrical maintenance is performed approximately every three years by a site-wide LANL organization, regardless of equipment requirements in accordance with industry standards and vendor recommendations.

      2. Emergency/Standby Power: The facility ventilation system (that maintains directional air flow to prevent spread of contamination), fire alarm system, and most radiological monitors are not supplied with emergency or standby power. Reliable power is an essential element of the power distribution system for defense nuclear facilities to ensure safe facility shutdown, limit the spread of contamination, and detect fire and radiological hazards.

      3. Battery Ventilation: Lead-acid battery ventilation in both the CMR building and the TA-55 facility is inadequate. Ventilation is necessary to prevent hazardous buildup of hydrogen gas. There is currently no plan to upgrade the battery ventilation systems. Good industry practices with respect to battery room ventilation are the requirements of American National Standards Institute (ANSI) C2, *National Electric Safety Code.*

   b. TA-55 Facility:

      1. Oil-Insulated Transformer: Four oil-insulated transformers, that are part of the power distribution system, are located inside the TA-55 facility. The transformer oil, that provides transformer cooling, is flammable and is a

fire hazard if the transformer leaks or fails catastrophically.

2. Electrical Calculations: Electrical calculations required by industry standards for voltage profile, short circuit studies, and protective device coordination were not available. These calculations are necessary in the evaluation of the electrical distribution system's safety and reliability.

3. Emergency Power: The facility currently has only one standby Diesel Generator (DG). There is an ongoing staff review to determine if the facility requires emergency backup power and, therefore, requires an additional diesel generator.

3. **Background:** The CMR building was constructed in the early 1950s and provides experimental facilities for plutonium and uranium chemistry and metallurgy research. The TA-55 plutonium processing and handling facility, that was constructed in the mid 1970s, provides capabilities for recycling, preparation, fabrication and research of plutonium and analytical chemistry.

4. **Discussion:**

   a. The review identified the following potentially significant issues at the CMR building:

      1. Maintenance: Electrical maintenance at the CMR building is performed by a site-wide organization approximately every three years. However, many electrical components (e.g., batteries, relays and breakers) require more frequent maintenance. CMR personnel are preparing a Master Equipment List (MEL) in accordance with Department of Energy (DOE) Order 4330.4B, *Maintenance Management Program*, that will identify safety and non-safety related equipment. As discussed in the CMR building Maintenance Implementation Plan, the MEL will eventually be used for maintenance planning and scheduling.

      2. Emergency/Standby Power: The facility ventilation system (that maintains directional air flow to prevent spread of contamination), fire alarm system, and most radiological monitors are not supplied with emergency or standby power and become inoperable during a loss of power. DOE Order 6430.1A requires emergency or standby power for " . . . equipment components whose operating continuity is determined to be vital . . . for protection of health, life, property, and safeguards and security systems. . . [including] fire alarm, security alarm, and supervisory sensing devices designated essential by the cognizant DOE authority. " Based on the safety-related function of the systems identified above, the staff believes a reliable backup power source is appropriate for the CMR building. Additional analysis is required to determine whether the backup power supply should be emergency or standby. CMR personnel stated that

installation of backup generators will be considered during the second phase of upgrades scheduled to begin in 1996.

3. Battery Ventilation: ANSI C2 *National Electric Safety Code* requires adequate ventilation and loss of ventilation alarms for rooms with lead-acid batteries to ensure hydrogen does not buildup and result in an explosion. The battery systems at both the CMR building and the TA-55 facility do not meet the requirements of ANSI C2 (i.e., inadequate ventilation and no loss of ventilation alarms).

4. Electrical Upgrade: Because the CMR building was constructed in the early 1950s and is reaching the end of its design life, significant upgrades are required to allow the building to continue its mission. An interim safety analysis report was written in 1992 that identifies the facility weaknesses and formed the basis for a 10-year upgrade project. The project is divided into three phases with the first through third phases scheduled to be complete in 1996, 2002, and 2003, respectively. Most of the electrical upgrades, that are budgeted for approximately 20 million dollars, are scheduled for accomplishment during the first phase of upgrades. The electrical upgrades include replacement of three substations, correcting deficiencies, installing an Uninterruptible Power Supply (UPS) for the stack monitors and upgrading the emergency lighting, low voltage power distribution, grounding and lightning systems.

5. Facility Electrical Support: Except for personnel associated with the current electrical upgrades, the CMR building does not have an electrical systems engineer as part of the dedicated staff. Considering the size and type of facility, the staff believes facility staffing should include an electrical systems engineer.

6. Single Point Failure: The LANL electrical distribution system can receive power from two separate power generation plants. However, the high voltage transmission lines that provide power to the site cross each other at one point. A failure of the transmission lines at this point could isolate the site from power for an extended period.

b. The review identified the following potentially significant issues at the TA-55 facility:

1. Oil-Insulated Transformer: Four oil-insulated transformers located inside the plutonium handling facility are part of the power distribution system. The transformer oil provides cooling for the transformer. Because the oil is flammable, it is a fire hazard if the transformer leaks or fails catastrophically. DOE Order 6430.1A states that "only hazardous gases or liquids that are necessary for a process shall be used in plutonium processing and handling facilities. " In addition, the *National Electrical*

Safety Code and National Fire Protection Association (NFPA) 70, *National Electric Code,* require indoor oil-insulated transformers be located in a transformer vault. The code requirements for the transformer vault include fire walls and doors, ventilation, and oil containment and drainage. The TA-55 transformers do not meet the requirements for oil containment. Additional justification and/or mitigation of the oil hazard may be appropriate to ensure safe operation of the TA-55 facility. DNFSB staff believes that the replacement of oil-insulated transformer with a dry type transformer is a prudent approach to resolve this concern.

2. Electrical Calculations: Electrical calculations for voltage profile, short circuit studies and protective device coordination, as required by the ANSI/Institute of Electrical and Electronics Engineers (EEE) standard 141, *IEEE Recommended Practice for Electrical Power Distribution for Industrial Plants,* and ANSI/IEEE standard 242, *IEEE Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems*, were not available. Therefore, the staff could not verify the capability of electrical equipment to withstand available short circuit currents without creating unsafe conditions for site workers.

3. Emergency Power: The TA-55 facility currently has only one Diesel Generator. In addition, this generator does not start automatically after failure of the normal source of power. TA-55 personnel stated that a review of DG design has been performed and that final determination of DG classification and functional requirements will be addressed in the Final Safety Analysis Report (scheduled to be submitted to DOE in July 1995). There is an ongoing staff review to determine if the facility requires emergency backup power and, therefore, requires an additional diesel generator and design upgrades.

4. Utility Control System Upgrade: The TA-55 utility control system, which monitors and partially controls the power distribution, ventilation, and radiological monitoring systems, is over 15 years old and fails frequently. The facility is upgrading the system with programmable logic controllers that will provide reliable utility monitoring and control capabilities. This project is scheduled to be completed in 1996.

5. **Future Staff Actions:** The DNFSB staff plans to continue to follow the upgrade project for the CMR building including resolution of maintenance, backup power, and battery ventilation issues identified in this report. In addition, the staff plans to follow-up on the TA-55 facility resolution of staff observations relative to the backup DG, oil-insulated transformers, the electrical distribution system calculations and the utility control system upgrade.