

DEFENSE NUCLEAR FACILITIES SAFETY BOARD

January 30, 1995

MEMORANDUM

FOR:

G. W. Cunningham, Technical Director

COPIES:

Board Members

FROM:

R. T. Davis

SUBJECT:

Backup Power Supply Systems, Idaho National Engineering Laboratory - Idaho Chemical Processing Plant, Report of Site Visit, November 30 - December 1, 1994

1. **Purpose:** This memorandum provides a report of a visit by Defense Nuclear Facilities Safety Board (DNFSB) staff members, Todd Davis and Dan Ogg, to the Idaho Chemical Processing Plant (ICPP) from November 30 to December 1, 1994. The review focused on backup power supplies (i.e., Backup Generators and Uninterruptible Power Supplies (UPSs)).
2. **Summary:** The review identified the following major issues and observations:
 - a. Lockheed Idaho Technologies Company (LITCO) recently changed the designation of most of their backup power supplies from emergency to optional standby as defined in the National Electric Code (NEC). These generators are identified as vital equipment in Idaho National Engineering Laboratory (INEL) technical standard 4.1B1, Vital Equipment Operability, and supply loads identified in INEL technical standard 4.1E1, ICPP Equipment Requiring Alternate Electrical Power. Optional standby design requirements in the NEC are less stringent than emergency requirements and do not appear appropriate for ICPP loads requiring backup power.
 - b. All five backup generators reviewed by the staff have a connected load that exceeds the generator rated capacity. LITCO states that operators will ensure generator overloading does not occur; however, the operating procedures do not identify any precautions or requirements concerning backup generator loading. This deficiency will be corrected by installing additional backup generators as part of the utilities upgrade currently scheduled to begin in 1995 (scheduled to be complete in 2001).
 - c. Several criticality alarm warblers are supplied from the standby generators vice the emergency backup power supply. Warblers are integral to criticality alarms which ensure personnel are warned of a criticality.
 - d. Preventive maintenance and testing of ICPP generators are not consistent with industry standards and DOE-STD-3003, Backup Power Sources for DOE Facilities (e.g., periodic fuel sampling and 24 hour load test).
 - e. Several flooded cell batteries that support backup power systems at ICPP were

replaced with "maintenance free" batteries in 1990. In the last four years, two battery cells have failed. ICPP is in the process of qualifying an impedance measurement device to help predict battery failure.

3. **Background:** Backup power systems at ICPP provide power to criticality alarm systems, ventilation systems, instrumentation and control systems and other process related systems during loss of offsite power. Backup generators typically use diesel engines as the source of energy while UPSs use batteries. A UPS provides power for a short period (usually less than two hours) while backup generators supply power for an extended period.

4. **Discussion/Observations:**

- a. Backup Generator Classification: LITCO recently changed the designation of most of their backup power supplies from emergency to optional standby as defined in the NEC. The only remaining emergency backup power supplies support criticality alarm systems. However, the NEC definition of optional standby, "...intended to protect private business or property where life safety does not depend on the performance of the system...", is not consistent with the safety significance of some ICPP loads (e.g., ventilation systems to maintain differential pressure for contamination control and instrumentation associated with the New Waste Calcining Facility (NWCF)). The NEC contains additional design requirements for emergency generators (e.g., backup supply available in 10 seconds, automatic start and transfer, fuel requirements, and wiring separation).

DOE Order 6430.1A requires emergency power systems (i.e., power systems which supply safety class loads) be qualified for design basis accidents and seismic category-I requirements. In addition, emergency power systems are required to be fully redundant power generation, switching, and distribution systems that meet the IEEE class 1E criteria. DOE Order 6430.1A refers to the NEC for optional standby system requirements. While an IEEE class 1E backup power supply system may not be required or appropriate for the ICPP applications, the NEC requirements for emergency power, which are less stringent (e.g., no seismic and redundancy requirements), are appropriate. The staff believes that the NEC emergency power and DOE-STD-3003 requirements for backup power systems are the minimum requirements appropriate for application to ICPP safety related backup power systems.

- b. Generator Loading: The connected load for all five ICPP backup generators reviewed by the staff exceeded the generator's rated capacity. The generators may shut down or may be damaged if the actual loading exceeds the rated loading. Both National Fire Protection Association (NFPA) 110, Emergency and Standby Power Systems, and DOE-STD-3003 require that the full load be within the continuous rating of the generator. LITCO states that the running load is being controlled by the operators to ensure that generator overloading does not

occur. However, the operating procedures do not include a precaution or requirement for generator loading.

This deficiency will be corrected as a part of the utilities upgrade project which will begin in 1995. This project includes the installation of additional backup diesel generators. The new backup generators will be installed in parallel with the existing generators. The new parallel system will have sufficient capacity to supply the necessary loads with one of the generators out of service. The utility control station, which is part of the utilities upgrade, will have remote indication and control of all ICPP backup generators and generator loading. The utilities upgrade project is scheduled to be complete in 2001.

Until the completion of the upgrade project, the staff believes that procedural controls or automatic load shedding are necessary to ensure the backup generators are not overloaded.

- c. Criticality Alarm Warblers: LITCO technical standard 4.1E1 identifies equipment which must be connected to emergency or standby power. This standard notes that, while the criticality alarms are required to be connected to emergency power, the warblers associated with some of these alarms do not have emergency power backup. DOE Order 6430.1A requires structures, systems and components that provide nuclear criticality safety to be capable of performing their criticality safety functions during and following design basis accidents and events. Because loss of offsite power is a credible event, DOE Order 6430.1A requires that the warblers be supplied with emergency backup power.
- d. Preventive Maintenance and Testing: Both the U.S. Nuclear Regulatory Commission Regulatory Guide 1.9, Selection, Design, and Qualification of Diesel-Generator Units Used as Standby (Onsite) Electric Power Systems at Nuclear Power Plants, and DOE-STD-3003 require a 24-hour full load test every 18 months. The backup generators at ICPP are loaded monthly for less than two hours. Periodic demonstration of extended generator operation is necessary to identify problems not observed in the shorter tests.

The Office of Nuclear Safety issued Safety Notice 94-01, Contamination of Emergency Diesel Generator Fuel Supplies, in July 1994. This notice identifies several diesel fuel deficiencies at DOE facilities which may have prevented backup diesel generators from functioning as required. While diesel fuel at ICPP is sampled and tested at the central storage facility, no program is in place to sample local fuel systems. Local fuel systems for backup power generators are particularly susceptible to contamination because of the limited amount of fuel turnover. The safety notice and DOE-STD-3003 include applicable periodic sampling and testing requirements for diesel fuel systems which will identify potential fuel problems.

- e. Batteries: The Augmented Evaluation Team, which was formed by DOE in 1991 to review the reliability of DOE backup generators, concluded that battery

problems in the backup generator starting system are the dominant contributor to generator failure. In the past four years, ICPP has had two battery cells fail. To better predict battery cell failure, an impedance measurement device is being qualified for use at ICPP. Impedance measurement trending will allow early determination and replacement of defective battery cells.

5. **Future Staff Actions:** The staff intends to resolve concerns with the classification and design requirements of the backup generators. Staff electrical reviews at the INEL are scheduled to occur approximately twice per year.