

June 21, 2001

The Honorable Spencer Abraham  
Secretary of Energy  
1000 Independence Avenue, SW  
Washington, DC 20585-1000

Dear Secretary Abraham:

In 1998, the Department of Energy (DOE) issued a handbook on *Electrical Safety* (DOE-HDBK-1092-98). The Defense Nuclear Facilities Safety Board (Board) reviewed this document before it was issued, provided constructive comments, and encouraged its use complex-wide. The Board's staff has used the guidance in this handbook as a reference for performing electrical safety reviews at several DOE nuclear sites. The handbook's Appendix A *DOE Model Electrical Safety Program* provides guidance for developing and maintaining an effective electrical safety program, and was used by the Board's staff as the template for an acceptable electrical safety program.

The staff reviews at several DOE nuclear sites noted that DOE and its contractors are not giving appropriate consideration to the guidance in DOE's *Electrical Safety* handbook. The Board urges DOE to take a proactive stance to ensure that adequate electrical safety programs are in place at every defense nuclear facility. The electrical safety programs at all DOE sites could be enhanced by evaluating each program against the guidance in DOE's *Electrical Safety* handbook and implementing appropriate upgrades. The Board also encourages DOE to continue with its planned updates to the handbook, addressing such topics as electrical safety during excavation, decontamination, and decommissioning activities.

Enclosed for your information is a report prepared by members of the Board's staff providing illustrative examples of areas where electrical safety programs are not meeting the guidance in the *Electrical Safety* handbook. The Board was particularly concerned that many sites do not have a structured program for identifying existing noncompliant and nonlisted electrical equipment. Defective or improperly installed electrical equipment not only poses an electrical safety risk to workers, but also can initiate facility fires and disable important safety equipment.

The Board wishes to be informed of DOE's progress in addressing the issues noted above.

Sincerely,

John T. Conway  
Chairman

c: The Honorable Carolyn L. Huntoon  
Brigadier General Thomas F. Gioconda  
Mr. Mark B. Whitaker, Jr.

Enclosure

# DEFENSE NUCLEAR FACILITIES SAFETY BOARD

## Staff Issue Report

April 16, 2001

**MEMORANDUM FOR:** J. K. Fortenberry, Technical Director

**COPIES:** Board Members

**FROM:** A. K. Gwal

**SUBJECT:** Department of Energy's Electrical Safety Program

This report documents a series of reviews of the electrical safety programs at the Pantex Plant, Lawrence Livermore National Laboratory (LLNL), the Y-12 National Security Complex (Y-12), and the Savannah River Site (SRS) performed by members of the staff of the Defense Nuclear Facilities Safety Board (Board) during the year 2000. The staff also monitored occurrence reports and activities related to electrical safety, including three occurrences involving electrical lines cut during excavation activities in January, February, and April 2001 (at Oak Ridge National Laboratory, Los Alamos National Laboratory, and SRS). Staff members A. Gwal, T. Davis, W. White, and C. Graham met with personnel from the Department of Energy (DOE) and the respective contractors to conduct these reviews.

**Background.** The DOE Handbook, *Electrical Safety* (DOE-HDBK-1092-98) presents the electrical safety standards for all DOE facilities. It provides uniform electrical safety guidance and information to help DOE facilities reduce or eliminate risks associated with the use of electrical energy. DOE also requires, through authorization bases and contractual documents that existing and new facilities comply with the provisions of Occupational Safety and Health Administration (OSHA) standards 29 Code of Federal Regulations (CFR) 1910 and 29 CFR 1926, the National Electrical Code (National Fire Protection Association [NFPA] 70), the National Electrical Safety Code (American National Standards Institute [ANSI] C2), and Electrical Safety Requirements for Employee Workplaces (NFPA 70E). These codes and standards also form the basis of the requirements for the handbook. The implementation of the guidance in the *Electrical Safety* handbook is not contractually required by DOE at the defense nuclear facilities. However, the Board's staff observed that the above facilities have utilized the handbook to some degree in developing their electrical safety procedures.

**Issues.** The Board's staff identified the following issues during its review of the electrical safety program at the Pantex Plant, LLNL, Y-12, and SRS.

*Electrical Safety During Excavation*—The staff has observed numerous examples of electrical cables/conduits being struck or cut during excavation activities at DOE sites. A search of

DOE occurrence reports revealed multiple such occurrences at sites in the defense nuclear complex, including SRS, the Hanford Site, the Pantex Plant, Oak Ridge National Laboratory, Los Alamos National Laboratory, the Rocky Flats Environmental Technology Site, and Idaho National Engineering and Environmental Laboratory.

The Board's staff believes such accidents could be minimized or avoided by the detection of underground utilities immediately before excavations are performed and by the conduct of thorough work planning. Locations of underground utilities need to be adequately identified using as-built drawings, subsurface radar, and a magnetometer. Currently, DOE Safety Notice 96-06, *Underground Utilities Detection and Excavation*, addresses electrical safety during excavation, but there are no contractual requirements for compliance. There is a need to revise the *Electrical Safety* handbook to add guidance for excavation safety and the detection of underground utilities. Indeed, DOE committed to adding a chapter on excavation safety more than 3 years ago when the handbook was issued.

At Pantex, in particular, existing detection equipment is not capable of adequately detecting the location of underground utilities. The Board's staff encouraged Pantex to evaluate alternate detection equipment (such as subsurface radar detection systems) and to adhere strictly to the recommendations of DOE Safety Notice 96-06. The staff also observed that excavation activities at Oak Ridge Y-12 require only the review of as-built drawings to determine possible interference with underground utilities prior to excavation, with optional use of detection devices before digging. The contractor at Y-12 has been encouraged by the Board's staff to require the use of appropriate detection devices as a means of reducing the incidence of accidents and power interruptions resulting from excavation activities. Existing detection equipment at SRS is capable of adequately detecting the location of underground utilities. However, because survey markers are easily moved, there is a need to establish a time limit between the survey and the initiation of work. In addition, electrical personnel should be trained to understand the limitations of detection equipment.

*Authority Having Jurisdiction (AHJ)*—According to the *Electrical Safety* handbook, the official designated as the electrical AHJ should have thorough knowledge of standard materials and work practices used in the installation, operation, construction, and maintenance of electrical equipment. The AHJ should, through experience or education, be knowledgeable about the requirements contained in the OSHA standards; the National Electrical Code; the National Electrical Safety Code; DOE requirements; and other appropriate local, state, and national standards. The AHJ is responsible for interpreting codes as well as regulations and standards, and for approving electrical equipment, site assembled electrical equipment, and materials.

At Pantex, the program for the contractor's electrical AHJ has not been fully implemented. Issues associated with this program include the lack of appropriate resources to fulfill AHJ responsibilities and a multiyear delay in addressing DOE's findings related to the program. The staff is concerned that the lack of an adequate AHJ function has impacted Pantex's ability to address existing

electrical equipment that is nonlisted or not in compliance with NFPA 70. A preliminary review of approximately 20 facilities by Pantex personnel revealed more than 506 instances of noncompliant or nonlisted equipment. Included are such items as emergency lights, transformers, switches, heater elements, and power supplies.

In addition to increasing the electrical safety risk to workers, the failure of nonlisted equipment or equipment that has not been properly installed per NFPA 70 could have a significant impact on facility safety. The use of noncompliant or nonlisted equipment increases the risk of fire and other equipment failures. A search of DOE occurrence reports revealed more than 100 occurrences at DOE facilities since 1991, related to defective or improperly installed electrical equipment. In particular, there have been several occurrences at DOE defense nuclear facilities in which a facility fire resulted from the use of defective or improperly installed electrical equipment:

- ! In 1991, defective electrical equipment led to a fire at the K Reactor at SRS.
- ! In 1997, an electrical equipment failure led to a fire in the emergency power switchgear at Building 707 at the Rocky Flats Environmental Technology Site.
- ! In 1999, use of an inappropriately rated solenoid led to a fire in Zone 12 at Pantex.

Following a review by the Board's staff in March 2000, the Pantex contractor conducted a self-assessment of its electrical AHJ program. This assessment, completed in July 2000, led to several findings. These findings were addressed through corrective actions identified to DOE in August 2000. One of these corrective actions, a rewrite of the AHJ standard to focus only on the identification and acceptance of unlisted electrical equipment, was completed in January 2001. The other major corrective action, a new site standard to establish an electrical AHJ program that would follow the guidance in DOE's handbook, was issued in April 2001. The staff will review the implementation of this new site standard during the next few years. In the interim, however, there has been little progress in addressing the backlog of non-listed equipment.

During its review of the electrical safety programs at LLNL, Y-12, and SRS, the Board's staff observed that although the contractors had established an AHJ program, no structured effort had been made to identify nonlisted and noncompliant electrical equipment that failed to meet the acceptance criteria set forth in the *Electrical Safety* handbook.

*Electrical Safety Committee*—The *Electrical Safety* handbook recommends that each site establish an Electrical Safety Committee (ESC), as well as an AHJ interpretation of the electrical requirements of OSHA, the National Electrical Code, and other standards applicable to the site or its facilities. The ESC also interfaces with DOE, all organizations and sites, and other DOE contractors. In addition, the ESC performs the following functions:

- ! Presents management with the requirements and training needed to implement the electrical safety program.
- ! Advises management of the need to fund and support these requirements.
- ! Maintains and assists in the implementation of the electrical safety program.
- ! Develops and maintains the electrical safety manual.
- ! Assists the departments by interpreting the electrical requirements of DOE Orders, criteria, and guides, as well as other codes, standards, and practices.
- ! Maintains a copy of each interpretation given.
- ! Publishes electrical safety bulletins.

The Board's staff has observed that the ESCs at Pantex, Y-12, LLNL, and SRS are involved primarily in the development of procedures and portions of the safety manual and are not performing all the duties and responsibilities set forth in Appendix A of the *Electrical Safety* handbook. Weaknesses in electrical safety can potentially impact any activity or facility function, as virtually everyone is exposed to electrical hazards. The staff believes the role of the ESC at DOE sites needs to be strengthened.