DEFENSE NUCLEAR FACILITIES SAFETY BOARD

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December 1, 1998

The Honorable Ernest J. Moniz
Acting Deputy Secretary of Energy
Department of Energy
1000 Independence Avenue, SW
Washington, DC 20585-0104

Dear Dr. Moniz:

Enclosed for your consideration and action, where appropriate, are the observations developed by the members of the staff of the Defense Nuclear Facilities Safety Board (Board) concerning the electrical, control, fire protection, and ventilation systems for the Cold Vacuum Drying Facility (CVDF) at the Hanford Spent Nuclear Fuel Project (SNFP). These observations are based on reviews of available documents and discussions with Department of Energy (DOE) staff and contractor personnel for the SNFP during September 28–October 1, 1998.

The staff's review identified design concerns related to electrical, control, and instrumentation systems, as well as the lightning protection system, and raised concerns related to the safety classification of the process ventilation fans and power supply. The Board asks to be kept abreast of DOE's actions to address the concerns discussed in the enclosed report.

Feel free to contact me if you have any questions on these matters.

Sincerely,

John T. Conway
Chairman

c: Mr. Mark B. Whitaker, Jr.
Mr. John D. Wagoner
Mr. James M. Owendoff

Enclosure

DEFENSE NUCLEAR FACILITIES SAFETY BOARD

Staff Issue Report

October 21, 1998

MEMORANDUM FOR: G. W. Cunningham, Technical Director

COPIES: Board Members

FROM: A. K. Gwal

SUBJECT: Review of Electrical, Control, Fire Protection, and Ventilation Systems for the Cold Vacuum Drying Facility at the Hanford Spent Nuclear Fuel Project

This report documents a review by members of the staff of the Defense Nuclear Facilities Safety Board (Board) A. K. Gwal, R. T. Davis, and D. J. Wille of the electrical, control, fire protection, and ventilation systems for the Cold Vacuum Drying Facility (CVDF) at the Hanford Spent Nuclear Fuel Project (SNFP). This review was conducted September 28–October 1, 1998. The review revealed design deficiencies in electrical, control, and instrumentation systems, as well as the lightning protection system (LPS), and raised concerns related to the safety classification of the process ventilation fans and power supply.

Electrical Systems. The Board's staff evaluated the design of the electrical distribution system for the CVDF. The electrical distribution system is not classified as either safety class or safety significant, in that loss of power will not affect design features important to ensuring public safety. However, availability and reliability are important aspects that affect operability and the maintenance of a workplace safe for operating staff. Therefore, they merit attention.

For the CVDF electrical distribution system, DOE Order 6430.1A, *General Design Criteria*, specifies the use of 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*. In accordance with these CVDF design requirements, electrical system components are to be coordinated for short-circuit capability, interrupting duty and capability, insulation levels, protective relaying, reliability, interchangeability, transformer and line voltage drop, stability under normal conditions, and restart on power dips and outages. Because most of these calculations and studies have not been performed, the Board's staff could not verify that the electrical distribution system will provide safe and reliable power. It is important for the project to complete these analyses prior to procurement and installation activities.

Lightning Protection System (LPS). The Board's staff observed that the ventilation exhaust stack is designed to have an LPS, but the existing building design does not include such a system. The decision not to have an LPS was based on a risk assessment performed in accordance with National Fire Protection Association (NFPA) standard NFPA-780, *Lightning Protection Code.* However, this assessment did not adequately consider the material that will be processed at the CVDF. The staff believes that a lightning protection system in accordance with NFPA-780 would be appropriate for this facility.

Fire Protection System (FPS). The preliminary Fire Hazard Analysis (FHA) adequately addressed the elements of DOE Order 5480.7A on fire protection. Compliance with NFPA-101, *Life Safety Code,* could not be verified, however, because the FHA is being thoroughly revised (scheduled to be completed by December 1998). Therefore, the Board's staff could not complete its review of the FPS. However, during a tour of the CVDF site, which was under construction, the staff observed the installation of the wet pipe fire sprinklers in the control room. The control room has many computers and items of electronic equipment that could become disabled during spurious operation of a sprinkler system. It would be prudent to have a dry-pipe sprinkler system or a dry-type FPS.

Instrumentation and Control Systems. The safety-class instrumentation and control (I&C) system is used to monitor important system parameters and take appropriate actions to put the system in a safe condition during upset conditions. The system design specification references the appropriate IEEE standards for safety-class equipment, including IEEE-344, -379, -384,-603, and -627. The system appears to have appropriate separation and redundancy. Based on the current design specification, the staff has the following comments:

- To ensure sufficient heat transfer capability, adequate water must be present in the cask annulus. The safety-class I&C system provides a water-level alarm that requires operators to take appropriate action. The existing alarm system may not be able to withstand a seismic event. The project and the system vendor are working to resolve this issue. Additionally, operator response to this alarm is not well defined, and may require that the cask be isolated and filled from a local water source.

- The set point for the cask annulus high-temperature trip is currently expected to be only 0.9°C above the normal operating temperature. This set point could result in numerous process upsets because of instrument error or small temperature fluctuations.

The nonsafety control system uses a programmable logic controller (PLC)-based system with operator interfaces through several computers. The operator interface software package that will be used for the CVDF has the capability of providing several alarms for each system parameter, as well as numerous system diagnostic alarms. The staff noted that the current mockup may provide too many alarms and could confuse operators during a major upset. The project continues to tailor the system for CVDF and expects that the number of alarms will be significantly reduced and prioritized.

Safety-Related Ventilation System. Each process bay and the process water conditioning tank room have an exhaust ventilation system that is classified as a safety-significant system. The Board's staff observed that the exhaust ventilation systems function to mitigate accidents, contain contamination in the event of a credible breach in the primary confinement barrier, and monitor airborne effluents during normal and upset conditions. The Board's staff also observed that the exhaust fan motors and the power supplies are classified as nonsafety general-service systems, which is not consistent with the safety-significant designation. The reasoning provided by the project is that the loss of negative differential pressure is indicated during normal operation by a safety-significant alarm, and the process is stopped. The safety-significant function of the exhaust system is credited in the safety analysis, and exclusion of the exhaust fan motors from safety-significant designation is being justified on the basis that failure of the exhaust fans or power supply would constitute a second failure. This rationale does not adequately explain the loss of the safety-significant mitigative, contamination control, or monitoring functions. The Board's staff notes that this highly selective application of safety-system function appears to defeat the safety classification process, which is intended to provide a balanced level of protection to workers and the public. It is essential that the safety analysis for the CVDF provide justification for the existing design, or that the safety-significant classification include the exhaust fans and their power supply.

Future Staff Action. The above issues were discussed with DOE Site Office personnel, and actions to address these issues are in progress. The Board's staff will continue to follow the resolution of these issues, and will review the FHA and its compliance with the *Life Safety Code*.