DEFENSE NUCLEAR FACILITIES SAFETY BOARD

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August 18, 2000

General John A. Gordon
Administrator of the National
Nuclear Security Administration
Department of Energy
1000 Independence Avenue, SW
Washington, DC 20585-0701

Dear General Gordon:

The staff of the Defense Nuclear Facilities Safety Board (Board) recently conducted a review of the fire protection program at the Y-12 Plant in Oak Ridge, Tennessee. The enclosed issue report documents the staff's findings and observations. As the staff's report makes clear, the fire protection program at Y-12 is not compliant with the Department of Energy's (DOE) safety criteria embedded in the contract. Both the site contractor and DOE field management are aware of the problems, which were catalogued in a recent comprehensive self-assessment.

In the Board's view, DOE and the operating contractor need to develop a comprehensive sitewide action plan to strengthen the fire protection program and remedy long-standing deficiencies. The Board believes that the problems identified in the staff's report require substantive actions to address fundamental infrastructure and programmatic deficiencies and prevent a recurrence. Prolonged reliance on compensatory measures will not be sufficient. While there are genuine shortfalls of funding and staffing at the site, it appears that existing resources are not being effectively utilized and that, with savings realized through efficiencies, the types of changes needed are feasible in today's budget environment.

The Board notes that fire protection is a vital system within the scope of Recommendation 2000-2, *Configuration Management, Vital Safety Systems*. Implementation of this recommendation is intended to ensure that vital safety systems such as fire protection programs are properly maintained at all defense nuclear facilities. The Board believes the line management actions called for in response to the deficiencies in fire protection at Y-12 exemplify the actions discussed more generally in Recommendation 2000-2.

The Board asks to be kept abreast of the contractor's and DOE's corrective actions regarding the issues in the March 2000 assessment report as well as in the enclosed staff report.

Sincerely,

John T. Conway
Chairman

c: The Honorable Madelyn R. Creedon
Mr. Steven V. Cary
Ms. Gertrude Leah Deaver
Mr. Mark B. Whitaker, Jr.

Enclosure

DEFENSE NUCLEAR FACILITIES SAFETY BOARD

Staff Issue Report

July 19, 2000

MEMORANDUM FOR: K. Fortenberry, Technical Director

COPIES: Board Members

FROM: W. M. Shields

SUBJECT: Review of Fire Protection Program, Y-12 Plant

This report documents a review performed by the staff of the Defense Nuclear Facilities Safety Board (Board). Staff members W. Shields, F. Bamdad, and C. Coones and outside expert R. West, assisted by the Board's Oak Ridge Site Representative D. Moyle, met with personnel from the Department of Energy (DOE) and Lockheed Martin Energy Systems (LMES) to assess the fire protection program at the Y-12 Plant. The review team also toured selected Y-12 facilities. The staff's review revealed five issues for the Board's consideration.

Background. A comprehensive assessment of the fire protection program at the Y-12 Plant was conducted by a qualified contractor from late 1999 through early 2000, with a report being issued in March 2000. The report describes significant weaknesses in the fire protection program as revealed by the assessment, including the following:

- Findings and recommendations in Fire Hazard Analyses (FHAs) and Fire Protection Engineering Assessments (FEAs) have not been addressed. (Sections 4.12 and 4.13)
- FHAs and FEAs are not updated at the required frequencies (Sections 4.9 and 4.10).
- Compensatory measures are in use for long periods of time (Section 4.12).
- Many fire protection test, maintenance, and inspection (TMI) requirements have not been formalized into procedures (Section 4.3).
- TMI work is not accomplished at the required frequencies (Section 4.3).
- Y-12 lacks a program to inspect, test and maintain fire barriers (Section 4.1).

Note that the fourth and sixth findings above represent failures in the configuration management program, the focus of Board Recommendation 2000-2.

In response to this assessment, the site's Fire Protection Operational Safety Board (OSB) met on April 13, 2000. The OSB established a process for categorizing weaknesses and developing plans for corrective action. At the time of the staff's site visit—more than 2 months after the OSB meeting—a draft set of corrective actions had been prepared, but not acted upon

by the OSB. In addition, the proposed actions in many cases would not be sufficient to remedy the deficiency addressed.

Standards and Requirements. The LMES contract's List B requirements (Department of Energy Acquisition Regulations [DEAR] 970.5204.-78) include both Standards/Requirements Identification Documents (S/RIDs) and Work Smart Standards (WSS). The former apply to operations and the latter to design and construction.

The fire protection sections of the S/RIDs are structured around DOE Order 420.1, i.e., current DOE programmatic criteria, but detailed review showed that they are incomplete and poorly structured. Weaknesses include use of "implementation assumptions" to modify explicit order requirements and failure to commit to compliance with the National Fire Protection Association (NFPA) codes as required by the Order.

A WSS set was approved in April 1997 to specify the flowdown of requirements for engineering design and construction. The WSS set was somehow intended to stand in parallel with the S/RIDs for operations. It does not include DOE Orders or DOE Standard 1066, though the engineering standard (not a contract requirement) does reference these documents.

The staff believes the site fire protection program would benefit greatly from consolidation of the S/RIDs and WSS into a single, cohesive set of requirements and standards based on Section 4.2 of Order 420.1, that Order's fire protection implementation guide, and other DOE fire protection criteria listed in Section 2 of DNFSB/TECH 27, *Fire Protection at Defense Nuclear Facilities*.

Identification of Hazards. Buildings 9720-18 and 81-22 are side-by-side structures used to store depleted uranium. The latter facility is of more concern to the staff because of its age and the configuration of the building. Building 81-22 is a wooden structure built in the early 1950s, now housing several hundred tons of depleted uranium, mostly in wooden boxes stacked on untreated wooden pallets. The roof of the building consists of asphalt applied over plywood; the building itself is made entirely of wood. The wiring is consistent with 1950s construction and appears to be as old as the building itself. Building 81-22 is normally unoccupied, lacks fire or smoke detectors and has no lightning protection features. It is protected to some degree by a dry pipe sprinkler system, actuation of which will send an alarm to the fire department. The fire department has estimated that it would need about 15 minutes to get into position to fight a fire in the building. The nearest hydrants are about 150 feet from the facility.

There is no FHA for Building 81-22, only a 4-page engineering assessment dated 1993. The conclusion of the assessment was that (with some qualifications) the sprinkler system was adequate for the hazard posed at that time. The assessment provides no assurance that the installed fire suppression system would operate properly in case of a fire, that structural collapse from a roof-initiated fire would not cause the sprinkler system to fail and the wooden boxes to ignite, and that the sprinkler system would not be overwhelmed by the combustibles now stored in the facility before the fire department could respond.

The staff believes the current effort to reduce the fire hazards in this building is inadequate. The facility manager stated that an activity was under way to reduce the fire risk by putting the wooden boxes into stainless steel overpack containers. This activity, however, is being performed at a rate of about 10 boxes per year; hence it may take another 20 to 30 years to complete. The potential for a lightning strike or a fire started by an electrical short-circuit given the age of the facility, combined with the all-wood construction of the building, warrants a more aggressive plan by DOE to store this material in a safer structure or to pack it in fireproof containers. In view of the building's age and condition, improvements in fire protection would not be a sensible solution.

Implementation of Fire Protection Program. The staff reviewed several aspects of the implementation of the fire protection program at Y-12.

Testing, Maintenance, and Inspection—The self-assessment of the fire department indicated that for approximately 50 percent of the NFPA-required tasks at Y-12, there was no current procedural guidance. This lack of guidance is compounded by a lack of current test and maintenance activities for fire protection systems across the site. The requirements for TMI in the S/RID are based on a 1994 DOE-Headquarters equivalency that decreases the TMI frequencies contained in NFPA 25. This equivalency requires that component failure rates be tracked and trended to validate that the more liberal frequencies provide adequate reliability. Such tracking and trending has not been adequately performed since 1994. Typically, the fire department performs all the TMI requirements set forth in the Operational Safety Requirements (OSRs) and uses remaining resources to perform TMI in the rest of the site facilities. Information provided by the fire department indicated that approximately 80 percent of the required tasks were being completed; this figure does not include those tasks for which there is no procedural guidance. The more labor-intensive tasks, such as testing of deluge systems, are not being completed, while relatively easy items, such as visual inspections, are being performed.

The fire department has requested additional personnel, some of whom have recently been obtained. However, LMES stated that the current level of staffing does not support the TMI requirements identified in the site S/RIDs. Additional efforts to streamline TMI performance, such as deleting OSRs for fire alarm systems and developing generic approaches to testing of sprinkler systems, have decreased the fire department's tasking somewhat, but a significant number of the TMI requirements are still not being met. Poor maintenance of fire protection systems decreases confidence that these systems will function as designed when called upon to do so.

B-1 Wing Fire Suppression System—The lack of sprinkler protection in B-1 Wing of Building 9212 was documented as early as 1986. The 1997 FHA for this building estimated a potential fire loss of $50 million (excluding cleanup costs) and 2 years to rebuild the facility. The existing liquid inventory of B-1 Wing contains the maximum amount of both combustible organics and uranium, more than will be present during the postulated facility operations. The current Safety Analysis Report for B-1 Wing estimates that the consequences of a major fire in the area exceed 5 rem off site and 74 rem on-site. There are no available methods in place for

actively mitigating a large fire, aside from response of the fire department. This area is arguably the most hazardous in the 9212 complex in terms of off-site dose potential, yet restart schedules still indicate the area will be operational before an automatic suppression system is installed. LMES has outlined a sprinkler installation project that is projected to cost $20 million, but the earliest start date for the installation is 2003.

LMES has developed a series of compensatory measures for combustible control designed to decrease the frequency of fire in the area, but not of all these compensatory measures are in place. The Board's staff observed raw wood in use in the area during a walk-on inspection; this observation raises questions about the effectiveness of compensatory measures.

Fire Alarm Project—The Life Safety Upgrade Project was a line item project originated to correct a number of long-term fire protection deficiencies at the Y-12 Plant, as well as to provide a new fire alarm system for the site. The project has been plagued, however, by technical problems and poor management. Its scope was narrowed, eliminating much of the retrofitting work on sprinklers and fire barriers. The project ran out of money in May 2000, with one nuclear facility still entirely on the old Gamewell alarm system. A minor number of other components of the new alarm system have yet to be designed or installed. The site is currently attempting to complete the alarm system with operating funds, but has no idea of what can be accomplished with remaining fire department and maintenance forces or what schedule can be met.

Staff Observations. During the past decade, there have been many attempts at Y-12 to upgrade fire protection systems, write FHAs, and resolve long-standing noncompliant conditions. These efforts have generally yielded some results. For example, the staff observed that several tons of combustible material had been removed from Building 9206. Yet many initiatives have stalled before being completed because of inefficient project execution, changes in funding priority, and loss of management commitment. This situation creates doubt that fire protection systems at the site have the reliability needed to respond to emergency events. At this juncture, before any real progress can be made on improving all aspects of the Y-12 fire protection program, the staff believes the site needs a strong management commitment on the part of both DOE and LMES, coupled with a comprehensive sitewide action plan.

Additional funding is clearly needed to increase available staff and remedy program deficiencies, yet much could be done by utilizing existing resources more effectively. As an example, fire hydrant testing is extremely cumbersome and expensive because Limiting Conditions of Operation (LCO) violations are declared for suppression systems experiencing a pressure drop. The affected facilities must enter the action steps; establish fire patrols and observers at each sprinkler riser; and, when the test is complete, carry out surveillance on each fire system potentially affected to restore the systems to operability. This narrow interpretation of the LCO is partially responsible for the lack of fire system maintenance elsewhere in the Y-12 Plant. A small investment in rewriting the LCO to provide some flexibility for testing would free up resources for other activities.