98-0002782

DEFENSE NUCLEAR FACILITIES SAFETY BOARD

625 Indiana Avenue, NW, Suite 700, Washington, D.C. 20004
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August 24, 1998

The Honorable Victor H. Reis
Assistant Secretary for Defense Programs
Department of Energy
1000 Independence Avenue, SW
Washington, D.C. 20585-0104

Dear Dr. Reis:

The Defense Nuclear Facilities Safety Board (Board) has been following the efforts of the Department of Energy (DOE) and Lockheed Martin Energy Systems to restart operations for the processing of enriched uranium in Buildings 9212 and 9215 at the Y-12 Plant. Most recently, the Board's staff conducted a review of the new anhydrous hydrogen fluoride (HF) delivery system being constructed to support certain enriched uranium operations. During this review, the Board's staff identified two issues associated with the design and construction of the HF system: (1) lack of effective implementation of the hazard analysis and control development process, and (2) a breakdown in weld quality assurance. A copy of the report documenting the staff's review is enclosed for your consideration.

The Board would like to take this opportunity to commend the efforts of DOE Y-12 Site Office (DOE-YSO) Facility Representative, Michael Glasman, in taking the initiative to perform the inspection that initially identified the welding problems with the HF system. The Board considers his efforts to be an example of the benefits of the DOE-YSO upgrading of personnel competence and capabilities during the past several years.

Sincerely,

John T. Conway
Chairman

c: Mr. Gene Ives
Mr. Mark B. Whitaker, Jr.
Mr. James Hall

Enclosure

DEFENSE NUCLEAR FACILITIES SAFETY BOARD

Staff Issue Report

June 26, 1998

MEMORANDUM FOR: G. W. Cunningham, Technical Director

COPIES: Board Members

FROM: W. Yeniscavich

SUBJECT: Anhydrous Hydrogen Fluoride System at Oak Ridge Y-12 Plant

This report documents a review of hazard analysis and weld quality conducted at the Y-12 Plant on June 9–10, 1998, by members of the staff of the Defense Nuclear Facilities Safety Board (Board) D. Burnfield, P. Gubanc, M. Helfrich, and W. Yeniscavich.

Background. Anhydrous hydrogen fluoride (HF) is used at the Oak Ridge Y-12 plant in the process of uranium metal production. Several historical leaks in the existing HF system prompted the design of the new system. This new system, now being constructed, will provide improved leak resistance, including double containment. It will deliver HF from the receiving dock to the reactor building (9212 B-1 Wing), a distance of approximately 450 feet, and should be operational in about a year. Upon learning of reported weld defects in the new HF system, the Board's staff contacted the Department of Energy (DOE) site office and began discussions aimed at assisting in the resolution of these problems. These discussions were fruitful and allowed DOE to provide the necessary leadership to Lockheed Martin Energy Systems (LMES). As a follow-on to the discussion of the weld defects, and because of prior knowledge of problems with hazard analysis at Y-12, the Board's staff conducted a review of the new system.

Hazard Analysis. The Board's staff reviewed the methodology being used to perform process hazard analysis on the design, fabrication and construction, and operation phases of the HF system. As applied to the HF system, this methodology appeared to be disjointed and may not have been effectively integrated into the design and construction phases of the system. When questioned about the apparent ambiguity of the analysis methodology, LMES personnel responded that the ambiguity was due to the changing scope of Enriched Uranium Operations (EUO). It was originally decided to leave the old HF system in place to support production, and install the replacement system under the Unreviewed Safety Question Determination (USQD) process. Midway through the design and construction phases, it was decided that the old system would not be used, and its replacement would be handled as a new system to support EUO restart. Unfortunately, the hazard analysis process for new systems is different from the analyses done to support a USQD in that the former is intended as a design tool, whereas the USQD process is normally used to determine whether additional analysis is required. As an interim

step, a preliminary hazard analysis was developed to incorporate design work done to date. It is not clear whether this preliminary hazard analysis actually assisted in designing out problems as it was intended to do.

Contractor personnel intend to submit a safety analysis document on the HF system to the Department of Energy in August. The Board's staff reviewed the draft hazard analysis chapter of this document and found many of the problems previously observed in the Basis for Interim Operations for Buildings 9212 and 9215. Specifically, while the hazards appear to be adequately identified and analyzed, controls are not systematically developed with an appropriate level of detail. Some of the controls are well defined, with references to specific flow rate and pressure requirements, while other controls are simply references to high-level programs (e.g., emergency preparedness, radiation protection), with no indication as to what specific element of the program is being credited as the control.

The Board's staff also reviewed the activity hazard analysis performed for the construction of the HF supply system. As was observed during the last review of work planning by the Board's staff in December 1996, activity hazard analyses performed at the Y-12 Plant do not consist of a systematic hazard assessment. The activity hazard analysis performed on the construction of the HF system lacked detail on specific hazards that were likely to occur and the controls in place to protect the workforce from these hazards. Therefore, the Board's staff believes the Y-12 Plant still does not effectively implement its methodology for identifying applicable construction hazards and assigning appropriate controls to protect the workforce.

Weld Quality Assurance. An inspection of four completed transfer line welds by a DOE Facility Representative revealed one weld with lack of penetration and excessive oxidation on the inside diameter of the pipe. The other three welds showed excessive underbead reinforcement inside the pipe. These four welds, with rejectable defects, had been inspected and accepted by LMES. Inspection of additional welds expanded the scope of the problem. One welder in particular made a large number of defective welds, but these went undetected because of the inadequate inspection procedure that was used. The required radiographic inspection, which would have revealed these defects, was not performed because of the potential to activate criticality alarms with the radiographic source. The substitute inspection was incapable of finding these defects.

Reinspection of welds on elbow sections of the jacket piping, made at a vendor's shop before the pipe sections were shipped to Y-12, revealed defects on the inner diameter of some of the welds. These defects included lack of penetration, cracks, and porosity. In this case, it appears that the weld inspection requirements may not have been properly specified to the vendor.

Another vendor welding problem was discovered on the vaporizer containment chamber. Cracked seal welds were found on the jacket piping penetrating the chamber wall at some

locations. These welds were not specified on the drawing and were made by the vendor on his own initiative. The jacket piping at these locations is a nickel-copper alloy. The vendor made the seal welds with incorrect filler metal (a stainless steel) and without qualified procedures or welders. Other welds specified on the drawing were performed incorrectly or not at all.

The staff believes the root cause of the welding problems at Y-12 is a breakdown in the weld quality assurance program. Welder selection and training were not performed to the level needed for materials and welding conditions that were more difficult than normal. Radiography of welds was prohibited because of the concern with falsely activating criticality alarms, and the alternate inspection was incapable of finding the defects on the inside of the pipe. If the welds had been radiographed as they were made, defective welds would have been repaired, and the welder making the defective welds would have been retrained or reassigned. It also appears that the contractual requirements for welds made by vendors and the oversight of work performed by vendors need to be reviewed and strengthened.

Future Staff Actions. The Board's staff will continue to follow corrective actions for the welding and weld quality assurance problems associated with the HF system. The staff will also follow the development of the activity-level hazard analysis methodology for the Y-12 Plant. A future staff review will focus on protection of the workforce at Y-12.