DEFENSE NUCLEAR FACILITIES SAFETY BOARD

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March 15, 2001

Brigadier General Thomas F. Gioconda
Acting Deputy Administrator
for Defense Programs
Department of Energy
1000 Independence Avenue, SW
Washington, DC 20585-0104

Dear General Gioconda:

One of the significant issues facing the Department of Energy (DOE) and the National Nuclear Security Administration (NNSA) at the Y-12 National Security Complex (Y-12) is the need to improve the maintenance work control program. The Defense Nuclear Facilities Safety Board (Board) has noted in the past that large backlogs of overdue or deferred maintenance at Y-12 can undermine the effectiveness and reliability of safety systems, structures, and components. The impact of maintenance on the degrading infrastructure of the nuclear weapons production complex and on the ability of the NNSA to complete its mission was also highlighted in a recent report to Congress by the Panel to Assess the Reliability, Safety, and Security of the United States Nuclear Stockpile.

The enclosed report prepared by the Board's staff summarizes observations from a review of the Y-12 maintenance program and is provided for your information and use as appropriate. The Board is particularly concerned to note that the Y-12 Standards/Requirements Identification Document has vitiated the requirement in Section 10.b of DOE Order 4330.4B, *Maintenance Management Programs*, on periodic inspections of safety-related equipment. This requirement is essential to DOE's successful implementation of Recommendation 2000-2, and aggressive action toward its reinstatement at Y-12 is therefore warranted. The Board would like to discuss the resolution of this issue with you at your earliest convenience.

Sincerely,

John T. Conway
Chairman

c: Mr. Mark B. Whitaker, Jr.

Enclosure

DEFENSE NUCLEAR FACILITIES SAFETY BOARD

Staff Issue Report

March 5, 2001

MEMORANDUM FOR: J. K. Fortenberry, Technical Director

COPIES: Board Members

FROM: M. Moury

SUBJECT: Maintenance Program Review at Y-12 National Security Complex

This report documents a review of maintenance activities at the Y-12 National Security Complex (Y-12). This review was performed by members of the staff of the Defense Nuclear Facilities Safety Board (Board) M. Moury, T. Dwyer, P. Gubanc, and D. Moyle and outside expert R. Lewis during January 16–19, 2001.

Background. On September 16, 1997, the Board issued a letter that enclosed a staff issue paper noting deficiencies with the Y-12 maintenance program in the areas of configuration management, preventive maintenance, and maintenance planning and scheduling. The letter also noted that the Integrated Safety Management (ISM) core functions of hazard analysis, development and implementation of controls, and feedback and continuous improvement as related to maintenance were in an early stage of development.

Many of these deficiencies still existed when the Department of Energy (DOE) conducted a Phase II ISM Verification Review in August 2000. In fact, two maintenance-related opportunities for improvement were identified during this verification: (1) there was little or no training in the work control process and its various elements for personnel involved in the process, and (2) the mechanism available for providing postmaintenance feedback was not being used to develop improvements or lessons learned. Additionally, the contractor's independent internal assessment identified as a site-wide deficiency the fact that many equipment inspections and preventive maintenance tasks were past due.

Given these continuing deficiencies, the Board's staff scheduled a follow-up maintenance review in January 2001. This review focused on maintenance programs in the following areas: Building 9212 (Enriched Uranium Operations [EUO]), Building 9215 (machine operations), Building 9204-2E (dismantlement), and certain cross-cutting areas (high-efficiency particulate air [HEPA] filters, stacks, roofs over fissile material storage arrays, and the Criticality Accident Alarm System).

Department of Energy/National Nuclear Security Administration (DOE/NNSA) Y-12 Area Office (YAO). Although the YAO engineer responsible for maintenance oversight appeared to be informed on the issues and deficiencies associated with the maintenance program,

YAO has not taken aggressive action to cause the contractor to address long-standing maintenance issues. The new management and operating contractor, BWXT Y-12, has committed to upgrading the program. However, the current performance-based incentive metrics and award fee milestones specific to maintenance contain few incentives for effective corrective action. Many of the contract performance expectations do not define explicit, measurable end states. Rather, they read, for example, as follows: "Track and trend for the first 6 months; then a goal will be established for the remaining fiscal year [FY] performance." Such metrics are unlikely to drive contractor performance toward best practices, or even to meet DOE's minimum performance requirements. YAO has committed to revising its FY 2001 maintenance incentives for BWXT Y-12.

Contractual Maintenance Program Requirements. The contractor has comprehensively mapped the requirements of DOE Order 4330.4B, *Maintenance Management Program*, down through the contract and Standards/Requirements Identification Document (S/RID) to the site procedures. However, the staff noted that in tailoring the S/RID language, Y-12 vitiated the requirement in Section 10.b. of the Order for periodic inspections of structures, systems, components, and equipment. This requirement is focused on ensuring the safe and reliable operation of a facility and its systems; determining whether deterioration is taking place; and identifying and addressing technical obsolescence that threatens performance, safety, or facility preservation. By contrast, the Y-12 S/RID requirement erroneously focuses on "facility condition and housekeeping," and the implementing procedures worsen the situation by dealing mainly with housekeeping. The S/RID as written and implemented therefore meets neither the letter nor the spirit or the Order 4330.4B requirements, which are intended to ensure safe and reliable operation of a facility and all safety structures, systems, components, and equipment in that facility. At the time of the staff's review, YAO was cognizant of this noncompliance but had not taken any action to rectify the situation. This requirement is key to actions being taken under the Board's Recommendation 2000-2, *Configuration Management, Vital Safety Systems.*

Maintenance Program Instructions. Y-12 currently has two distinct processes for developing maintenance work packages: one for the site as a whole and one developed specifically for EUO as a pilot program. The former process involves several site-wide instructions (e.g., Y15-012, *Hazard Identification Planning*, which is the starting point for drafting a Maintenance Job Request) and instructions specific to maintenance personnel (e.g., Y18-35-008, *[Maintenance] Planner's Guide*). These documents appear to contain all of the necessary requirements for an adequate maintenance program, but the process flow is disjointed and self-contradictory, especially across documents. The EUO-specific *Work Control Process Manual* (Y18-004INS) provides a much clearer process flow for the pilot program, although some requirements from Y18-35-008, *[Maintenance] Planner's Guide*, are not explicitly captured. However, in walking through several completed work packages, it became apparent to the staff that neither process is followed in a step-by-step manner by the personnel involved in maintenance planning in either program (a recurrent ISM review finding).

In an effort to address recognized shortcomings in the maintenance program, the contractor has issued a series of standing orders designed to use senior management reviews of maintenance work packages to drive process improvements. The checklist used for these reviews is very thorough, but is not formally sanctioned in any document other than the standing orders. Yet it appears that facility and maintenance management personnel use this checklist in

a manner that supercedes the process flows directed by both the site-wide and EUO-specific maintenance instructions. Also, while it appears that positive results have been obtained from the increased management attention, this effort has been focused on corrective, not preventive maintenance; thus improvements have not been uniform across the spectrum of maintenance activities.

Y-12 is beginning to realize benefits associated with the EUO Work Control Process Pilot Program, initiated in March 2000. However, that program has suffered from the absence of a champion, inadequate resources, and a lack of metrics for evaluating the program's implementation and effectiveness. The Integrated Task Planning Worksheet portion of the new program is in place, linking each task of a maintenance action to its hazards and controls. The resulting Work Instructions are concise and appear to place appropriate reliance on skill-of-the-craft. However, while the formal development and completeness of EUO work packages have improved significantly, integration of the subtasks of hazard identification and control selection remains inconsistent.

BWXT Y-12 plans to start combining the EUO Work Control Process Pilot Program with the site-wide maintenance program in approximately 3 months. It is not clear, however, that either program has been objectively evaluated to determine what attributes from each should be incorporated into the resulting combined program.

The staff evaluated concerns related to the size and complexity of maintenance work packages. The site-wide work planning process, although in some cases difficult to follow and deliberately ambiguous (reportedly to provoke thought), appears to be complete and does not prescribe unnecessary details. Despite recent improvements, however, many supervisors, planners, and workers still lack sufficient proficiency to understand the major pieces that constitute a work package and the relevance of those pieces to their tasks. As a result, some packages are burdened by inappropriate, superfluous, or perfunctory documentation. The work instructions are typically one or two pages long; the bulk of the information comprises mainly documentation necessary for proper planning. Contractor management is examining methods for highlighting the information relevant to the workers' tasks.

Maintenance Program Implementation. Overall, the staff noted improvement in the EUO maintenance process relative to observations made during the maintenance review conducted in 1997. However, little has been done to reduce the maintenance backlog (1200–1300 items), which has remained virtually unchanged since the 1997 review. The maintenance programs for facilities other than EUO appear to operate primarily in a reactive (corrective maintenance only) mode. As a result of years of infrastructure neglect in these aging facilities, most maintenance (70 percent in one facility) is focused on repairing critical equipment directly required to support ongoing production. There is no plan for reducing the large maintenance backlog or for shifting from the current reactive mode to a program with a better balance of preventive and corrective maintenance. Further, there is no policy or plan for dealing with the significant number of cases involving continued use of equipment for which the preventive maintenance or inspection requirements are overdue. Finally, the contractor plans to shift to reliance on the Equipment Inspection Scheduler (EIS) computer program for work control of preventive maintenance. However, EIS suffers from defects in configuration management, compounded by a lack of communication: senior line management believes the

EIS database is close to being completely loaded and fully operational, while field-level (facility and maintenance) management considers the system to be 50 percent accurate at best.

ISM in the Maintenance Process. The staff's review of the maintenance process from the standpoint of the five core functions of ISM led to the following observations.

Define Scope of Work—As noted earlier, in response to deficiencies in maintenance planning identified during the ISM Verification Reviews, the contractor issued a series of standing orders designed to use management reviews to upgrade preparation of work packages and execution of work. In general, as a result of this upgrade program, corrective maintenance work packages now adequately address the scope of work for the assigned tasks. However, preventive maintenance work packages are not addressed in the standing orders, and the staff identified several cases in which the scope of work is not adequately defined.

Analyze Hazards and Develop and Implement Controls—The work control process requires a hazard identification screen and, if appropriate for the risk, a job hazard analysis. Appropriate expert participation is the key means by which hazards and associated controls are properly identified. In many cases this process is being carried out pro forma. Of nine work packages reviewed, only one had all appropriate expertise integrated into the hazard identification process. Most teams were composed of only the planner, maintenance supervisor, and one or two workers. In two packages, inputs from radiological controls personnel were written in by the planner, and in one of these two packages, radiological controls personnel apparently commented on industrial safety hazards. In each of these cases, the value of having the necessary experts involved to help integrate all inputs was not realized. Observed hazard identification activities also revealed that technical rigor was inconsistent. For example, system drawings were not obtained to verify potential source terms for the planned opening of a contaminated ventilation system.

Perform Work Within Controls—Only limited work was being performed during the staff's review. Observation of one relatively simple preventive maintenance task at Building 9215 revealed that technician attention to the detailed work package instructions was not rigorous. Further, the instructions in the work package were not sufficient to enable adequate completion of the maintenance task.

Provide Feedback and Continuous Improvement—The mechanism for consistently capturing feedback from maintenance personnel is inadequate. In one case, material deficiencies were identified during preventive maintenance on a safety-significant fan, but the deficiencies were not captured in the work control program for subsequent repair. In other cases, the lessons learned from performing a maintenance task were captured in the work package, but it appeared that such feedback would be taken into account in the future only if the exact same maintenance task were repeated. There did not appear to be a vehicle by which feedback from one task could be identified for use in similar tasks. Work planners were making a good effort to capture lessons learned from the lessons-learned Internet Web site, but the staff noted that the lessons identified in this fashion were often of such a general nature as to be of little value.

Status, Adequacy, and Completeness of Maintenance-Related Corrective Actions Stemming from August 2000 ISM Verification Review. The new contractor has put in place a

Corrective Action Plan for responding to the opportunities for improvement resulting from the August 2000 ISM Verification Review. Several areas remain of concern and were overlooked when developing this Corrective Action Plan. Among these is the failure to use performance metrics or other means in a consistent manner to determine the effectiveness of corrective actions. This shortcoming can be seen in several maintenance areas, including the lack of any meaningful evaluation of the EUO Work Control Process Pilot Program. The reactive nature of the approach to preventive maintenance at most Y-12 facilities is another area that invites closer management attention. With so many opportunities for improvement, recognized and unrecognized, it is uncertain whether there will be sufficient time to implement the improvements before the next Verification Review of ISM effectiveness in spring 2001.

Site-Wide Maintenance of High-Efficiency Particulate Air (HEPA) Filters and Roofs over Fissile Material Storage Areas. In response to the Board's technical report on HEPA filters, DNFSB/TECH-23, *HEPA Filters Used in the Department of Energy's Hazardous Facilities*, the Y-12 Plant issued a vulnerability assessment of HEPA systems in its nuclear facilities in June 2000. Based on DOE guidance and relevant technical data, Y-12 used a lifetime criterion of 10 years (from date of manufacture) for dry systems and 5 years for potentially wetted applications. Of the 51 systems reviewed, 6 were identified as vulnerable. Since that assessment, Y-12 Engineering (as the Y-12 Design Authority) has yet to formalize a criterion for maximum HEPA filter life. The staff noted that one HEPA system at Building 9215 has now aged to the point of being considered vulnerable, but because of the lack of a Y-12 HEPA service life policy, there is currently no site-wide mechanism for identifying and addressing new vulnerabilities. Failure to address this issue could threaten the successful implementation of the Board's Recommendation 2000-2.

Since the mid-1990s, roof maintenance at Y-12 has continued to suffer neglect; the result has been increasingly leaky roofs and standing water, even in fissile material storage areas. In response to a severe flooding event, the Y-12 contractor implemented a roof maintenance program in 1998, but then stopped funding the program in 1999. On September 29, 2000, EUO personnel discovered water in an inactive dry highly enriched uranium (HEU) system in Building 9212. (While the source of the water was never identified, rainwater intrusion was suspected.) With the arrival of a new operating contractor in November 2000, the staff reviewed Y-12's efforts to address roof maintenance, especially over fissile material areas:

- In early 2000, Y-12 Engineering performed a roof assessment of the HEU facilities (last done in 1996). While comprehensive, this information was not shared with the new management team until it was provided by the Board's staff during its review.

- Y-12 management has not issued a policy or standard on roof leaks in fissile material areas, nor is there any site-level program or direction on inspection or maintenance. As recently as mid-February 2001, the staff observed standing water in fissile material storage arrays (Building 9206).

- Y-12's on-site capability is limited to spot repairs with limited effectiveness. In FY 2000, $250,000 was spent to repair 14 locations on the Building 9212 roof (which represented not all of the known leaks in that building's roof). These repairs succeeded only in moving the leaks several feet from their previous locations.