DEFENSE NUCLEAR FACILITIES SAFETY BOARD

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June 12, 2003

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

Dear Secretary Abraham:

On March 8, 2000, the Defense Nuclear Facilities Safety Board (Board) issued Recommendation 2000-2, *Configuration Management, Vital Safety Systems*. This recommendation called for the Department of Energy (DOE) to take steps to ensure that safety systems for defense nuclear facilities will remain reliable and effective. In particular, the Board stressed the actions required to ensure the reliability of confinement ventilation systems. The Board approved DOE's Implementation Plan for Recommendation 2000-2 on December 14, 2000. This plan consists of 29 specific actions designed to meet the intent of the recommendation. Two of the key actions required by the plan are the performance of initial reviews of vital safety systems (Phase I assessments), followed by more detailed reviews of selected vital safety systems (Phase II assessments).

The Board's staff observed several Phase II assessments and reviewed the reports on all completed assessments, as well as the implementation of the requirements for providing qualified federal and contractor employees cognizant of the vital safety systems. A report summarizing these reviews is enclosed for your use in assessing the progress at several DOE sites.

The Board is particularly interested in DOE's efforts to institutionalize these assessments. In a letter dated April 7, 2003, the National Nuclear Security Administration (NNSA) provided a discussion of the processes the NNSA sites are using to institutionalize the Phase II assessments and stated that NNSA expected each site office manager to appraise the implementation of these processes. The Office of Environmental Management provided the Board with a similar discussion in a letter dated May 2, 2003. In this letter it was noted that institutionalizing these assessments would not be completed at the Rocky Flats Environmental Technology Site (RFETS). This is acceptable for RFETS; however, a systematic study should be completed before curtailing similar assessments at other closure sites.

The Board has directed its staff to continue to work with DOE on resolving the remaining issues associated with the implementation of Recommendation 2000-2 identified in the Board's letter of September 18, 2002. Specific items that remain to be completed include:

- *Fully staffing the federal and contractor subject matter expert/systems engineer positions.* While DOE has developed an adequate path forward to provide qualified federal and contractor personnel, no site that was reviewed has fully achieved that

objective. More senior management attention and resources are needed to staff and qualify technical personnel for these systems engineering organizations.

- *Formally scheduling the completion of DOE's engineering-related functional area qualification standards.* While DOE staff members have discussed alternatives for ensuring the qualification of federal subject matter experts, DOE has yet to select and commit to an adequate path forward. The Board expects this commitment to be completed this year.

- *Issuing a revision to the Nuclear Air Cleaning Handbook.* The Board's staff has been working with DOE's staff and understands that a completed revision is expected to be issued later this year.

The Board considers that implementation of Recommendation 2000-2 should result in improved configuration management and reliability of vital safety systems at defense nuclear facilities. Further, the Board believes that both DOE and NNSA must vigorously pursue the completion of this important activity. Therefore, pursuant to 42 U.S.C. § 2286b(d), the Board requests to be briefed within 6 months of receipt of this letter on the status of the following: (1) site activities to institutionalize the Phase II assessments, (2) the staffing of federal and contractor subject matter expert/systems engineer positions, (3) changes to DOE's engineering-related functional area qualification standards, (4) issuance of the revised Nuclear Air Cleaning Handbook, and (5) actions being taken to address the common weaknesses and lessons learned identified in the enclosed report.

Sincerely,

John T. Conway
Chairman

c: The Honorable Linton Brooks
The Honorable Robert Gordon Card
The Honorable Everet H. Beckner
The Honorable Beverly Ann Cook
The Honorable Jessie Hill Roberson
Mr. Mark B. Whitaker, Jr.

Enclosure

DEFENSE NUCLEAR FACILITIES SAFETY BOARD

Staff Issue Report

April 24, 2003

MEMORANDUM FOR: J. K. Fortenberry, Technical Director

COPIES: Board Members

FROM: D. L. Burnfield

SUBJECT: Summary of Site Visits to Review Progress in Implementing Recommendation 2000-2, *Configuration Management, Vital Safety Systems*

This report documents observations resulting from visits made to four sites in the Department of Energy's (DOE) weapons complex by members of the staff of the Defense Nuclear Facilities Safety Board (Board). The purpose of these visits was to evaluate progress made in implementing the Board's Recommendation 2000-2, *Configuration Management, Vital Safety Systems.* Reviews were conducted at the Y-12 National Security Complex (Y-12), the Pantex Plant, the Hanford Site (Fluor Hanford, CH2M Hill, and Pacific Northwest National Laboratory), and Lawrence Livermore National Laboratory (LLNL). The visits, led by D. Burnfield with J. DeLoach and outside expert D. Volgenau, were conducted during a 6-month period from July 2002 to January 2003, with follow-up discussions and documentation reviews being performed through March 2003.

Background. The Implementation Plan for Recommendation 2000-2 includes commitments to improve the competence of DOE and contractor engineering personnel, as well as to perform summary (Phase I) and detailed (Phase II) assessments of the material condition and operability of vital safety systems, including the programs that support them (e.g., maintenance and engineering). The reviews at the five DOE site offices (two at Hanford) emphasized these commitments. Specific areas evaluated included the following: (1) DOE's subject matter expert (SME)/systems engineer programs; (2) Site contractor systems engineering programs; and (3) Phase II assessments, which included a walkdown by the staff of one or more vital safety systems at each site.

Summary. Although it appeared that, for the four sites visited, the managers of the DOE site offices and of the site contractors were actively supporting the intent of Recommendation 2000-2 and were working to implement its principles, there was a wide disparity in the effectiveness of their actions:

- DOE's SME/systems engineer programs were weak at all four sites, and the intended benefits from these programs in terms of contractor oversight have yet to be fully realized. Although each DOE site office had established an SME organization, only

the Y-12 and LLNL site offices had developed and (recently) promulgated such a program. In addition, the DOE SMEs have not yet had a meaningful presence in the field.

- The effectiveness of site contractors' systems engineer programs varied significantly. Only the contractors for Y-12 and the Hanford tank farms had maturing, well-founded, and robust systems engineer programs. The contractors' systems engineer programs at the remaining sites suffered from a number of shortcomings and were much less effective.

- With the exception of the Pantex Plant, each site visited had conducted at least three Phase II assessments. All of the contractors believed they were making progress toward institutionalizing the principles of Board Recommendation 2000-2. Although this appeared to be true, some were doing better than others. The contractors for Y-12 and the Hanford tank farms had been the most aggressive in accepting and working to correct the areas for improvement noted during the assessments. None of the sites had a fully institutionalized process for conducting Phase II-like assessments. In general, the contractors' systems engineers had not been adequately trained in how to assess the material condition of their system(s).

Detailed Observations. The following observations support the above summary comments.

DOE's SME/Systems Engineer Programs—As noted, this area remains weak at all of the site offices visited, and the intended benefits in terms of contractor oversight remain to be fully realized. All of the DOE site offices had established SME/system engineer organizations; however, a program had been developed, recently promulgated, and implemented only at the Y-12 and LLNL site offices. The Pantex Site Office (PXSO), DOE-Richland Operations Office (DOE-RL), and the Office of River Protection had yet to fully establish effective SME/systems engineer programs. Common weaknesses noted in the existing programs included the following:

- Programs were reactive rather than proactive, and assigned individuals were not spending sufficient time in the field.

- Insufficient numbers of personnel had been assigned as SME/systems engineer, and in some cases, these duties were considered a collateral responsibility.

- Training and qualification requirements had not been formalized or lacked rigor, and site/facility-specific qualification requirements had not been established.

- Personnel vacancies existed in critical technical specialties such as electrical, mechanical, and ventilation.

- Programs lacked a succession plan.

Contractors' Systems Engineering Programs—As noted, the Board's staff observed a wide disparity in the effectiveness of the site contractors' systems engineering programs. Both BWXT at Y-12 and CH2M Hill at the Hanford tank farms had implemented well-founded and robust systems engineering programs. These programs are maturing. The contractors appeared to be cognizant of the areas requiring further emphasis and enhancement and were working aggressively to improve their programs and to increase the staffing to allow adequate coverage of all vital safety systems. The programs at the remaining sites suffered from a number of shortcomings and were much less effective; several required increased staffing. Each could benefit from the lessons learned at Y-12 and the Hanford tank farms. The staff observed that the contractors for the other Hanford Site projects and the environmental management facilities at LLNL had particularly weak systems engineer programs. The following are examples of common weaknesses noted in these contractors' systems engineer programs:

- Some training and qualification programs for systems engineers lacked formality, rigor, and consistency.
- Component and system parameter trending was not being accomplished routinely.
- Systems engineers were not periodically assessing the operability, reliability, and material condition of their system(s), and had not been adequately trained in how to do so effectively.
- The roles and responsibilities of systems engineers had not been fully articulated and/or were not completely understood by individuals assigned these positions.

The two contractors with strong systems engineer programs demonstrated some common strengths, such as the following:

- Clearly defined roles and responsibilities.
- Comprehensive training and qualification programs for systems engineers and their backups.
- Inclusion of all vital safety systems (not just safety-class and safety-significant systems).
- Frequent material assessments of systems.

The best of the material assessments included specific requirements to note conditions, ensure that deficiencies were corrected, and trend important parameters to identify degradation.

Phase II Assessments—Each of the visited sites has scheduled or completed its Phase II assessments. All of the site contractors believed they were making progress toward institutionalizing the principles of Recommendation 2000-2; however, some were found to be doing better than others in this regard. The contractors for Y-12 and the Hanford tank farms had

been the most aggressive in accepting and working to correct the areas for improvement noted in the Phase II assessments. None of the sites had fully institutionalized a process for conducting Phase II-like assessments. The contractors for some of the sites, such as Hanford, were examining how such a process might be incorporated into existing assessment processes. Other sites, such as LLNL, had not yet given this area much consideration.

The Board's staff reviewed system drawings and then conducted a walkdown of one or more vital safety systems together with representatives of DOE and the contractors during each of the site visits. In general, both the federal and contractor systems engineers demonstrated good knowledge of their systems, and each system's material condition appeared to indicate that it was being maintained adequately. A common weakness noted was a lack of understanding on the part of systems engineers of how to properly assess the material condition of their system(s).

A review of the Phase II assessments completed at Y-12 and subsequent discussions with site personnel revealed some lessons learned that ought to be considered for applicability across the DOE weapons complex:

- It would be advisable to develop a system design description for each vital safety system and perhaps for some of the defense-in-depth systems as well. This description would include a system definition, system boundaries, and other systems required to ensure the operability of the vital safety system.

- It would be advisable to list all the documents and drawings that make up the authorization basis in a technical basis index document to allow ready access to each of these documents and drawings.

- Whenever possible, it would be best to use direct, real-time indications for measuring the operability of ventilation systems (e.g., volumetric flow rates) instead of less direct indications, such as pressure drops across high-efficiency particulate air filters.

- It is imperative that the technical basis for the positioning of fire dampers, their operation, and maintenance be understood.