DEFENSE NUCLEAR FACILITIES SAFETY BOARD

625 Indiana Avenue, NW, Suite 700, Washington, D.C. 20004-2901
(202) 694-7000

May 23, 2000

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:

The Defense Nuclear Facilities Safety Board's (Board) Recommendation 98-2, *Safety Management at the Pantex Plant*, highlights the need to simplify and expedite the Seamless Safety for the 21st Century (SS-21) process at the Pantex Plant. Completing the SS-21 process for all weapon systems at Pantex will substantially increase the safety and reliability of nuclear explosive operations at the site. In some cases, the Department of Energy (DOE) has opted to divide the process into two steps instead of performing "full" SS-21. The first of the two steps is primarily analytical and is intended to establish a safety basis for existing operations. The second step is intended to result in more thorough reengineering and improvement of operations.

The two enclosed reports prepared by the Board's staff identify several specific issues related to hazard analysis, implementation of controls, and feedback and improvement. These issues are much less prevalent in programs that have gone through the full SS-21 process. Although Step 1 of the two-step SS-21 process includes identifying enhancements to increase the margin of safety, areas in which the largest increases in the safety margin might be gained (e.g., tooling, testers, trainers, and facilities) are generally deferred to Step 2. In this light, the Board believes that performing SS-21 as one "full" process expedites the development and implementation of substantial safety improvements and is in keeping with the original intent of Recommendation 98-2. Therefore, the Board believes DOE should reassess its plans for weapon systems that involve implementing SS-21 in a two-step process and incorporate changes accordingly in the Implementation Plan for Recommendation 98-2.

Sincerely,

John T. Conway
Chairman

c: Mr. Mark B. Whitaker, Jr.
Mr. Dave Beck
Mr. Rick Glass

Enclosures

DEFENSE NUCLEAR FACILITIES SAFETY BOARD

Staff Issue Report

April 13, 2000

MEMORANDUM FOR: J. K. Fortenberry, Technical Director

COPIES: Board Members

FROM: D. L. Burnfield

SUBJECT: Review of Tooling, Design, Manufacturing, and Procurement Program, Pantex Plant

This report summarizes the results of a review performed by members of the staff of the Defense Nuclear Facilities Safety Board (Board) in support of the Board's Recommendation 98-2, *Safety Management at the Pantex Plant*. Staff members D. Burnfield, J. DeLoach, and M. Moury met with representatives of the Department of Energy (DOE) and Mason and Hanger Corporation (MHC) during February 22–24, 2000, to review activities associated with tooling design, manufacturing, procurement, and control. Further review of site documentation was completed on March 21, 2000.

Background. Special tooling is used at the Pantex Plant to lift, move, and measure weapons systems and components during their assembly, disassembly, or evaluation. Since 1995, Pantex has undertaken various efforts to increase the level of formality associated with tooling design, maintenance, configuration control, and usage. These efforts have included the development of the integrated safety process commonly referred to as Seamless Safety for the 21st Century (SS-21). The objective of this process is to integrate safety systematically into management and work practices at all levels, including tooling design. Evaluations by the Board's staff revealed that dismantlement programs developed using SS-21 result in improved tooling that is safer and more reliable and has better configuration control than that developed using previous processes. Unfortunately, not all programs are carried out using SS-21.

In 1996, following several tooling-related occurrences, DOE performed an extensive 4-month review of special tooling. All actions resulting from this review are complete, with the exception of several that require additional funding. However, a number of recent reportable occurrences involving tooling have raised concerns about the control of special tooling at Pantex and prompted this review by the Board's staff.

Discussion. The staff identified a number of issues, which are presented below in the framework of the core functions of Integrated Safety Management (ISM). These issues were found to be less prevalent in programs that used the full SS-21 process.

Analysis of Hazards:

- Hazard analyses are not performed to determine the failure modes of complex tooling. The site specifically chose to delete a requirement for failure modes analysis of tooling because of the development of the Hazard Analysis Reports (HAR). However, the HAR specifically excludes analysis of those accidents unlikely to result in an insult to the nuclear explosive. Thus tooling failures that could result in severe injury to a worker or damage to the facility are not analyzed. This analysis, if performed, could be used to reduce the industrial accident rate and to improve the reliability of tooling.

Implementation of Controls:

- The staff noted that because of its broad experience base, the Tooling Design Department has generally designed high-quality tooling. However, the design process relies too heavily on an expert-based approach and could be improved if lessons learned in the past were incorporated more formally into the ISM System. For example, the *Tooling Fabrication and Inspection Manual* (MNL-10666) could be upgraded to include more detailed guidance on weapon tooling design in the areas of material selection, torquing of dissimilar metal joints, and welder qualification.

- Acceptance criteria for visual inspection of tooling performed by production technicians or tooling warehouse personnel are vague and do not provide specific information on potential failure modes that could result from normal wear and tear. For example, critical dimensions are not measured, and no disassembly and inspection is required.

- Several authorization bases for weapon activity take credit for safety functions performed by tooling. However, the processes for periodically testing these safety functions are not well defined or controlled.

- The training of production technicians (PTs) in the use of tooling and in the reasons behind specific design features has shown some improvement in both quality and standardization, but this improvement is uneven. In particular, those PTs not on a start-up crew for a weapon program receive significantly less instruction in tooling design features and engineering decisions involved in the process flow/tooling development.

- While observing PT training, the staff noted that PTs were sometimes performing minor maintenance on tooling. The limits of such minor maintenance are not defined. Further, Tooling and Machine Design personnel stated emphatically that minor maintenance by PTs is not permitted.

Feedback and Improvement:

- There is no process in place to collect, analyze, and examine trends in historical information obtained from tooling failures due to usage that could be used to develop a formal preventative maintenance program for tooling. Currently, only rudimentary visual inspections and limited functional tests are performed on tooling prior to its use. In large part, tooling is operated in a "use-to-failure" mode. For example, a certain W88 vacuum lifting device, which has been in use for approximately 12 years, has a 1-year inspection cycle, but experience has shown that it will cease to maintain vacuum after three to four uses (approximately 3–4 weeks).

- PTs and managers reported that tooling has become damaged and electrical testers have malfunctioned as a result of movement or storage, resulting in production downtime while awaiting replacement tooling. There is no process in place to collect, analyze, and examine trends in historical information obtained from tooling failures due to movement of tooling from the warehouse to the bay or cell and/or storage in the warehouse. This information could be used to develop additional protective measures for storage and movement of sensitive tooling and electrical testers, improving the equipment's availability and reducing production downtime.

- The tooling design engineers at the site do not have a formal system to promote feedback of information from the Manufacturing Division on methodologies to improve tooling.

- There is no system that provides procurers, tooling fabricators, or tooling vendors with information on minor manufacturing deficiencies in tooling that is accepted without rework. The lack of such a system hinders the formulation of actions that could improve the manufacturing process.

- Improvements could be made to allow the flowdown of critical requirements to tooling suppliers. Currently only those items listed on the applicable drawing are passed to suppliers. This means requirements that are invoked on site are not always levied on the supplier. For example, one procurement reviewed by the Board's staff did not pass down welder qualification and certification requirements.

DEFENSE NUCLEAR FACILITIES SAFETY BOARD

Staff Issue Report

May 1, 2000

MEMORANDUM FOR: J. K. Fortenberry, Technical Director

COPIES: Board Members

FROM: J. Deplitch
M. Forsbacka

SUBJECT: Analysis of Hazards and Derivation of Controls for Disassembly and Inspection of W76 and W88

This report documents a review of the W76 and W88 disassembly and inspection (D&I) processes at the Pantex Plant, performed by members of the staff of the Defense Nuclear Facilities Safety Board (Board) W. Andrews, C. Coones, T. Dwyer, J. Fingerlos, and C. Martin and outside expert R. West. The Board's staff reviewed the analysis of hazards and derivation of controls at Pantex during March 7–9, 2000. Since this review, the staff has closely monitored contractor readiness activities that will eventually lead to the Department of Energy (DOE) Readiness Assessment (RA) and Nuclear Explosives Safety Study (NESS).

Background. The W76 D&I process was developed using the full Seamless Safety for the 21st Century (SS-21) approach, which follows protocols specified in the *Development and Production Manual*, DOE Albuquerque Operations Office (DOE/AL) Appendix 56XB. The W88 Existing Operations Reauthorization Project (EORP) is an SS-21 "Step 1" program. This program is limited to development of a Hazard Analysis Report (HAR) and Activity-Based Controls Document (ABCD), inclusion of newly developed controls in the Nuclear Explosive Operations Procedures (NEOPs), and upgrades to tooling only when deemed vital for safety. The hazards associated with the W76 and W88 D&I processes are to be summarized in HARs, and the subsequent controls are to be specified in ABCDs. The authorization bases also include the newly created Technical Safety Requirements (TSRs) and facility Basis for Interim Operation (BIO) documents.

W76 Status—The HAR for the W76, which was originally rejected by DOE, has been conditionally approved. Approval is contingent on improving the fire hazard analysis by incorporating a complete analysis of combustible materials in the bays and cells, controlling the use of flammable solvents, and assessing the effectiveness of the dielectric sling used in the three hoisting operations in the D&I process. (Notably, the SS-21 process has eliminated approximately 25 lifts from the D&I process.) Following the staff's review, however, the contractor RA was halted after a safety concern was raised by Los Alamos National Laboratory

(LANL) regarding the Mid Case Removal tool. It now appears that there will be a delay of 3 months in the program.

W88 Status—DOE also rejected the first submission of the W88 HAR and ABCD in November 1999. The W88 HAR and ABCD were resubmitted to DOE on April 13, 2000, after further development and resolution of the remaining issues with the W76 HAR. In accordance with decisions by DOE, the W88 EORP has applied Step 1 of a two-step SS-21 process. The approach of the W88 Project Team to the W88 EORP appeared to be based on the assumption that procedures and tooling were already adequate, and the program lacked only a HAR and ABCD. Therefore, the procedures and tooling were essentially unchanged.

Discussion. This review led the Board's staff to make several critical observations regarding the adequacy of work definition, the identification of hazards, the efficacy of the hazard analysis process with regard to hazard reduction, and the identification of controls.

Scope of Work Defined in W76 HAR—The analyses done by Mason and Hanger Corporation (MHC), its subcontractors that prepared the W76 D&I HAR and ABCD documents, and the design agencies focused on the hazards associated with single-unit operations in the bays and cells. The intent, however, is to perform D&I operations in parallel with two or more units at a time. The position of the project team on this matter is that an Unreviewed Safety Question Determination would be initiated to approve multiple-unit operations. A major impact of this approach is that it fails to address increased fire loading and interactions between units. The staff is also concerned that some of the subtleties of human factors issues and unit interaction among multiple units in an accident condition would not be subjected to the same level of scrutiny as the single-unit operations will undergo during the NESS and RA processes. After the staff's review, LANL issued an Information Engineering Release, dated March 16, 2000, stating that collocated activities have not been analyzed and that only single-unit operations are to be performed in the facility.

Scope of HARs—The scope of the W76 HAR (and the W88 HAR as well) omits operations such as receiving inspections, ramp transportation in the shipping container, mass properties testing, separation testing, and radiography of full-up units. Each of these operations is to be covered by BIO documents that are still in draft form. Therefore, it is difficult to ascertain whether hazards are effectively identified and controls specified for the W76 and W88 D&I programs. This situation is reminiscent of the W69 program, for which similar concerns were transmitted to DOE on August 8, 1997.

Fire Hazard Analyses for W76 and W88 D&I—As noted above, DOE has appropriately identified inadequacies in the W76 and W88 fire hazard analyses. As fire in the bays or cells is one of the dominant accident scenarios, the staff rigorously questioned the Pantex fire hazard analysis team with regard to the analysis methodology and identification and control of combustible materials. The staff's preliminary analysis indicates that the fire hazard analyses may be inadequate for a number of scenarios. With regard to reduction of combustible materials

in the bays and cells, the staff is concerned that the hazard analysts are not effectively communicating their concerns to management. For example, the tooling carts have thick foam pads with cutouts for approved tools; this foam is a major component of the combustible loading and could easily be replaced with a noncombustible material.

Scope of W88 EORP—When the W88 EORP began in 1999, W88 processes were authorized and being executed at the Pantex Plant. It appears that the project team for the W88 EORP limited its efforts to developing an authorization basis, i.e., a HAR and ABCD. The W88 D&I procedures and tooling were apparently accepted as they had been authorized previously without further review for acceptance under current (more stringent) RA and NESS criteria.

The hazard analysis appeared to have been focused too narrowly on fire and lightning hazards. The methodology for hazard analysis consisted mainly of reviewing existing procedures as compared with the W76 D&I program. The staff's review identified tooling that appeared to be unstable and to require refurbishment or further assessment. The staff noted several hazards that it may be hoped will be eliminated during the full SS-21 reengineering of the W88.

Given the lack of action to address physical conditions in an EORP, the staff questions the value of these efforts for other systems such as the W78. The W88 EORP plan (and Step 1 of the SS-21 process) includes identifying enhancements to the NEOPs and other procedures, tooling, testers, training, trainers, and facilities to increase the margin of safety. However, the interpretation and application of the EORP plan and Step 1 process appear to exclude consideration of these enhancements.

Efficiency and Efficacy of SS-21—The SS-21 process as it has been applied to the W76 program has been plagued by resource problems during the past year. As a result, the HAR was being produced in an incremental manner that was not always in step with the program itself. For example, the fire hazard analysts stated in their report that the W76 processes had not yet been defined, so they used representative data from what they viewed as analogous programs. The deficiencies noted by the staff indicate that this approach is inadequate. The degree of collaboration between the design agencies and the Pantex Plant also appears to impact the efficient execution of the program. The most cogent example is that of the Special Instruction Engineering Release issued by LANL on April 4, 2000, with regard to the Mid Case Disassembly Fixture. This correspondence directs the redesign of the tooling to prevent the rapid recoil of the fixture when the mid case is released and to add a pressure readout feature. If the SS-21 process were applied as specified in DOE/AL Appendix 56XB, it would be difficult to envision tooling redesigns being ordered during a contractor RA.