

September 22, 1999

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

Dear General Gioconda:

The Defense Nuclear Facilities Safety Board (Board) recently reviewed the Weapon Safety Specifications (WSSs) for the W76 and B83 disassembly and inspection programs and the W56 dismantlement program. The current WSS concept was developed by the Department of Energy (DOE) in response to the Board's Recommendation 93-6, *Maintaining Access to Nuclear Weapons Expertise in the Defense Nuclear Facilities Complex*. Revision 1 of the Implementation Plan for Recommendation 93-6, dated January 30, 1996, clearly states the requirements for capturing safety-relevant information in the WSS. Importantly, the implementation plan identifies the WSS as the single source document for all safety-related information. The DOE Albuquerque Operations Office Appendix 56XB, *Development and Production (D&P) Manual*, captures the requirements specified in the implementation plan.

However, the WSSs reviewed by the Board's staff appear to fall short of meeting the requirements set by the D&P Manual. In particular, these WSSs appear to have limited value for use in performing hazard analyses for nuclear weapons operations. The WSSs capture design agency data, but data from lessons learned at the production plants and substantive archival data are lacking. Additionally, even though the WSS is intended to form the technical foundation for the safety basis for a particular nuclear weapons operation, there is no effective provision to ensure that the authorization basis is updated following a revision of the WSS.

It would be prudent for DOE to review all WSSs with particular regard to their adequacy and the currency of safety-related data from surveillance and other means. The enclosed report documents the staff's observations and is provided for your consideration. The Board's staff will continue to follow the application of the WSSs. If you have any comments or questions on this matter, please do not hesitate to call me.

Sincerely,

John T. Conway
Chairman

c: Mr. Mark B. Whitaker, Jr.

Enclosure

DEFENSE NUCLEAR FACILITIES SAFETY BOARD

Staff Issue Report

July 15, 1999

MEMORANDUM FOR: G. W. Cunningham, Technical Director
J. K. Fortenberry, Deputy Technical Director

COPIES: Board Members

FROM: M. Forsbacka
J. Deplitch

SUBJECT: Review of Weapon Safety Specifications for the W76, B83, and W56 Nuclear Weapons Programs

This report documents an effort by J. Deplitch, M. Forsbacka, and C. Martin of the staff of the Defense Nuclear Facilities Safety Board (Board) to review the efficacy of the Department of Energy's (DOE) Weapon Safety Specification (WSS) documents for the W76 and B83 disassembly and inspection programs and the W56 dismantlement program. The Board's staff was seeking evidence in the WSSs for the use of findings, experience, and research from the Core and Enhanced Surveillance Programs to continuously improve surveillance operations and knowledge of stockpile safety issues, particularly with regard to aging effects. Additionally, the staff evaluated the effectiveness of the WSSs as inputs for hazard analysis reports for Pantex Plant nuclear weapon activities.

Background. The WSS plays an important role in safe nuclear weapons operations at the Pantex Plant as defined by the DOE Albuquerque Field Office in Appendix 56XB, *Development and Production Manual*: to ensure that lessons learned from surveillance program data and relevant as-built information are properly incorporated in the Seamless Safety for the 21st Century (SS-21) process at the Pantex Plant, and to provide essential information for the safety basis documentation. In essence, the function of the WSS is to identify hazards inherent in the weapon itself, and to provide a summary of the analyses concerning mechanical, electrical, thermal, and chemical insults to a nuclear weapon. This information is drawn from design drawings, baseline process flows, use control reports, criticality reports, intrinsic radiation reports, and past surveillance data that are pertinent to safety. The as-built information provided in the WSS should pertain to the characteristic design features, safety attributes, and hazards for a nuclear weapon or family of similar nuclear weapons. In addition, skills and knowledge drawn from individuals involved with initial production, surveillance operations, system modification operations, and disassembly operations are also key features of an adequate WSS. The document is intended as a tool to facilitate interactions with the Pantex contractor during the development of the authorization basis. The WSSs are also to be reviewed and updated (if needed) annually. The design agencies are the principal authors of the WSS.

W76 WSS Review Findings. While the WSS provides extensive information about design characteristics related to nuclear safety to ensure enhanced nuclear detonation safety (ENDS) for the W76 in the ultimate user configuration, it does not organize this information in a manner that facilitates hazard analysis of Pantex activities involving partially assembled and disassembled systems. Potential weapon response information for thermal, kinetic energy, electrical, and chemical insults cannot readily be derived from the WSS. Thus, Pantex hazard analysts must rely on the design agencies for information on material response for many hazard-inducing environments. Providing such information for the four basic categories of insults at various stages of assembly/disassembly could enhance the efficiency of hazards analyses at the Pantex Plant.

The WSS provides a great deal of information on the properties of the high explosives used in the W76, as well as the performance characteristics of many of its subsystems. The WSS also raises issues that are the result of uncertainties due to modeling capabilities and fundamental data. Examples included in the WSS are issues relating to aging of high explosives, thermal insults, and one-point safety. A path forward for resolving uncertainties is provided for some cases, but not universally. The significance of these uncertainties should be presented in the WSS.

Overall, the WSS provides extensive technical information on the characteristics of materials and components used in the W76. There is archival data relevant to the W76 system, such as pit hydriding issues and associated safety concerns. It appears, however, that the most recent surveillance information is not included in this revision of the WSS, dated November 9, 1998. For example, a Surveillance Finding Investigation (SFI) opened in February 1998 is not mentioned; in fact, the most recent SFIs included in the report were opened in 1995.

B83 WSS Review Findings. The B83 is one of the most modern nuclear weapons in the stockpile. It is considered inherently safe by DOE as compared with older nuclear weapons. The weapon has an insensitive high explosive (IHE) main charge and fire-resistant pit features. However, the detonators consist of a more sensitive conventional high explosive. Yet the WSS asserts that it is acceptable to use IHE handling procedures and controls.

According to the WSS, there are no known safety issues associated with the B83. The Stockpile Surveillance Program has identified no safety findings. However, the WSS states that the emphasis on development testing and design details, materials testing and certification, and production quality control (reliability) is insufficient to ensure high quality and reliability of the nuclear assembly components during the projected stockpile lifetime of several decades. This lack of data to determine performance might imply the same lack of basis to determine safety. No information is provided in the following three sections of the report, which are marked “TBD (to be determined).”

- Appendix B, “Review of Pantex Assembly Operations”
- Appendix C, “Review of Pantex Disassembly Operations”

- Appendix D, “Pantex B83 Archiving Methodology”

At a minimum these sections would be expected to include tooling, processes, and lessons learned, which are not currently discussed in the WSS.

The WSS cites a number of safety-related recommendations for which there is no disposition. The following are examples of these recommendations:

- There is a need to better characterize lightning arrest connector performance in thermal and crush environments.
- There is a need to better characterize the mechanical strength of the MXB-71 phenolic firing set case material to determine its performance at elevated temperatures.
- Use of a relief valve or rupture disc design to avoid disassembly of the nuclear system and bomb electrical system in fires should be investigated.
- As new B83 drawings are issued or revised, Pentagon S (/S/) callouts for nuclear safety-critical items should be included.

The incomplete sections of the WSS and the inclusion of open-ended recommendations show inadequate follow through on DOE’s Implementation Plan for Recommendation 93-6, *Maintaining Access to Nuclear Weapons Expertise in the Defense Nuclear Facilities Complex*. Revision 1 of the implementation plan, dated January 30, 1996, clearly states that the WSS will be the single source document for all safety-related information and identifies the requirements for capturing safety-relevant information in the WSS.

W56 Dismantlement Issues. In light of recent difficulties with stuck threads on the W56 warhead radiation case, the staff reviewed the W56 WSS for historical data that could provide insight on this problem. This review was augmented by observations of the staff and the Board’s outside expert of interactions between the W56 Project Team and Y-12 staff with expertise in bimetallic joints. The surveillance history summary in the WSS provides a list of Unsatisfactory Reports and SFIs and states that none of these were safety-related. This summary fails to disclose a worker safety issue related to a fire hazard that is documented in the Y-12 hazard analysis and could be relevant to safety at the Pantex Plant.

Given that the W56 was in the stockpile for more than 25 years, one would expect a historical overview of the type and characteristics of the tooling used during the life of the program. Archival information of this nature would have been helpful in safety reviews of the modern tooling developed under the SS-21 process for W56 dismantlement. In addition, any SFI reports of operational difficulties related to the bimetallic joint would have provided additional insight, even if they had not been classified as safety-related when they were written. Finally, a more thorough effort to document the experiences of Pantex Production Technicians would have been helpful in identifying potential pitfalls.

Overall Staff Assessment. Philosophically, it appears that the WSS concept is sound. Implementation of this concept, however, appears to be inconsistent and incomplete. More emphasis on providing WSS information that is meaningful for nuclear operations at the Pantex Plant would be useful. The WSSs do not consistently identify the key hazards at each stage of an assembly or disassembly process. They do not provide relevant technical information with references to more detailed information as necessary. Annual updates often do not reflect continuous improvement, incorporate the latest understanding of phenomena related to weapon hazards, or include up-to-date findings that have safety relevance.

The WSS plays an important role as a technical foundation for the authorization basis of nuclear weapons operations. However, it does not appear that a formal change control process has been adopted for document control which is consistent and coordinated with change control for the Safety Analysis Report, Basis for Interim Operations, Hazard Analysis Report, Technical Safety Requirements, and Activity Based Controls Document. The authorization basis should reflect the most complete and up-to-date understanding of a particular process, and any lack of coordination with the WSS could result in the inadequate consideration of safety issues.