

TESTIMONY OF  
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DEFENSE NUCLEAR FACILITIES SAFETY BOARD

CONGRESSIONAL REVIEW  
OF THE DEPARTMENT OF ENERGY'S HANFORD  
WASTE TREATMENT AND  
IMMOBILIZATION PLANT PROJECT (WTP)

SUBCOMMITTEE ON ENERGY AND WATER DEVELOPMENT  
COMMITTEE ON APPROPRIATIONS  
UNITED STATES HOUSE OF REPRESENTATIVES

April 6, 2006

**MR. CHAIRMAN AND MEMBERS OF THE SUBCOMMITTEE:**

Thank you for the opportunity to present testimony on the Defense Nuclear Facilities Safety Board's review of the Department of Energy's Waste Treatment Plant (WTP) at Hanford, Washington. My testimony today will focus on the Board's efforts to ensure that the nuclear safety aspects of the design of this important nuclear waste processing facility are adequate.

**Legislative History and Statutory Mission of the Board**

In the late 1980s, it became increasingly clear to Congress that conditions at sites used for production of nuclear materials and weapons were such that additional measures were needed to ensure adequate safety management by DOE. Residuals of production in formerly used facilities represented a potential threat to the safety of the public, workers, and the environment, and facilities required for the national security mission needed to be brought into operational modes consistent with current safety and environmental protection objectives. From 1987 to 1989, both houses of Congress examined a variety of legislative proposals intended to upgrade the safety management of DOE defense nuclear facilities. The Senate Committee on Governmental Affairs, under the chairmanship of Senator John Glenn, initially proposed to establish an independent nuclear safety board with recommendation powers (S.1085, *Nuclear Protections and Safety Act of 1987*). The Senate Committee on Armed Services, under the chairmanship of Senator Sam Nunn, proposed in the Nuclear Protections and Safety Act of 1987 an independent defense nuclear safety board with advisory powers, but reserving to the Secretary of Energy the ultimate responsibility to accept or decline advice.

During 1988, the House and Senate worked out a compromise solution resulting in formation of the Defense Nuclear Facilities Safety Board in 1989. The Board was granted extensive safety oversight over defense nuclear facilities under the control or jurisdiction of DOE. The Atomic Energy Act of 1954, as amended, currently establishes two categories of facilities subject to Board jurisdiction: (1) those facilities under Secretary of Energy control or jurisdiction, operated for national security purposes that produce or utilize special nuclear materials, and (2) nuclear waste storage facilities under the control or jurisdiction of the Secretary of Energy. The Board's jurisdiction does not extend to facilities or activities associated with the Naval Nuclear Propulsion Program, transportation of nuclear explosives or materials, the U.S. Enrichment Corporation, facilities developed pursuant to the Nuclear Waste Policy Act of 1982 and licensed by the Nuclear Regulatory Commission, or any facility not conducting atomic energy defense activities.

Under its enabling statute, 42 U.S.C. § 2286 *et seq.*, the Board is responsible for independent oversight of all programs and activities impacting public health and safety within DOE's defense nuclear facility (i.e., nuclear weapons) complex, which has served to design, manufacture, test, and maintain and decommission nuclear weapons. The Board is authorized to review and analyze facility and systems designs, operations, practices, and events, and make recommendations to the Secretary of Energy that the Board believes are necessary to ensure adequate protection of public health and safety, including worker safety. The Secretary may accept or reject the recommendations in whole or in part. The Board must consider the technical

and economic feasibility of implementing the recommended measures, and the Secretary must report to the President and Congress if implementation of a recommendation is impracticable because of budgetary considerations. If the Board determines that an imminent or severe threat to public health or safety exists, the Board is required to transmit its recommendations to the President, as well as to the Secretaries of Energy and Defense. After receipt by the President, the Board is required to make such recommendations public and transmit them to the Committees on Armed Services and Appropriations of the Senate and to the Speaker of the House.

The Board's enabling statute also requires the Board to review and evaluate the content and implementation of health and safety standards, including DOE's orders, rules, and other safety requirements, relating to the full life cycle of defense nuclear facilities, including design, construction, operation, and decommissioning. The Board must then recommend to the Secretary of Energy any specific measures, such as changes in the content and implementation of those standards, that the Board believes should be adopted to ensure that public health and safety are adequately protected. The Board is also required to review the design of new defense nuclear facilities before construction begins, as well as modifications to older facilities, and to recommend changes necessary to protect health and safety.

The Board may also conduct investigations, issue subpoenas, hold public hearings, gather information, conduct studies, establish reporting requirements for DOE, and take other actions in furtherance of its review of health and safety issues at defense nuclear facilities. These ancillary powers of the Board relate to the accomplishment of the Board's primary function, which is to assist DOE in identifying and correcting health and safety problems at defense nuclear facilities. DOE is required to cooperate fully with the Board in all of these matters.

### **Design Review of WTP**

In 1995, DOE commenced a program to privatize the processing of high-level radioactive waste at Hanford. At its Richland Operations Office, DOE established a dedicated Regulatory Unit to establish design requirements for the plant (then referred to as the Tank Waste Remediation System, or TWRS) and to serve as a principal interface with the U.S. Nuclear Regulatory Commission (NRC), according to the terms of a Memorandum of Understanding signed in January 1997. This Memorandum of Understanding provided for the NRC to "assist DOE in performing reviews in a manner consistent with the NRC's regulatory approach and ... to be prepared to develop an effective and efficient regulatory program for the licensing of DOE contractor-owned and contractor-operated facilities that will process waste at Hanford..." With the express statutory approval of Congress through specific appropriations, NRC provided assistance to DOE from January 1997 to May 2000, at which time DOE decided to abandon the privatization approach for TWRS in favor of a management and operating (M&O) style contract. This change ended NRC's involvement in the project. On December 11, 2000, DOE awarded the WTP construction contract to Bechtel National, Inc. (BNI). During the following year, BNI was heavily focused on completing the baseline validation, hiring and training, conducting a due diligence review of the previous design, and completing a safety basis certification required by the contract.

The Board began to devote substantial technical resources to the review of the plant's design near the end of 2001. In the early spring of 2002, the Board's technical staff commenced a detailed review of seismic design documentation. In a June 5, 2002, meeting between the Board's staff, DOE, and BNI, the issue of ground motion during an earthquake was discussed, with particular focus on the application of California attenuation relationships to the Hanford site. (These attenuation relationships establish how ground motion propagates through bedrock to the surface.) In a letter to DOE on July 30, 2002, the Board clearly stated that these unresolved seismic issues meant that the seismic loads used to design the WTP facility foundations may have been underestimated. In addition, the Board cautioned DOE that the aggressive schedule being pursued, which demanded that construction commence before the design was completed, posed a serious risk that design changes could result in expensive modifications. To avert this potentiality in regard to seismic design, the Board advised DOE to adopt conservative design margins.

Why are the seismic issues affecting the WTP design important to public and worker health and safety? Unmitigated radiological consequences to the general public, 6 miles away, from an earthquake induced event at the WTP could exceed 250 rem, an order of magnitude larger than the evaluation guideline. Also, should an earthquake of sufficient magnitude to threaten or possibly damage the high level waste storage tanks occur at the Hanford site, then the ability of the WTP to operate safely with manageable earthquake damage becomes even more important.

In its response to the Board on September 18, 2002, DOE took the position that the seismic loads used to design the WTP facility foundations were adequate. In two further letters to DOE dated December 16, 2002, and January 21, 2003, the Board continued to insist that the seismic loads being used in the design did not appear to be appropriately conservative.

The Board continued its efforts in 2003 and 2004 to ensure that the seismic design of WTP would be adequate. In November 2003, the Board's staff reviewed DOE's efforts to validate the attenuation model used by WTP; the problems this review uncovered were discussed with DOE in February 2004. On July 29, 2004, the Board wrote to DOE once again, challenging the conservatism of the ground motion criteria for Hanford. Three months later, the Board's staff met with DOE to discuss progress in addressing ground motion concerns and demonstrated to DOE the problems with their attenuation model.

Because DOE originally believed the specified ground motion was adequate, work to resolve the seismic issues raised by the Board was not started immediately, and did not produce results until March 2005. On March 16, 2005, DOE forwarded to the Board a report entitled "Site-Specific Seismic Response Model for the Waste Treatment Plant (WTP) Hanford Washington." This report provided results from actions taken in response to the Board's July 29, 2004, letter. The most significant result was that DOE identified a significant increase in the ground motion applicable to WTP. This report was followed by an April 1, 2005, letter from DOE that contained interim seismic criteria for WTP to allow design efforts to continue. Subsequently, DOE provided the revised ground motion criteria to accommodate the increased seismic loads now applicable to the project.

What is the current status of the seismic design in the Board's view? The Board finds that the most recent estimate of ground motion developed by DOE provides a reasonably conservative basis for validating the existing design and construction of the plant. But this finding is contingent on DOE using a conservative approach in the design of safety-related structures and equipment. Because conservative design margins in the structure were maintained, little or no change to the structure will be required as a result on the increased seismic loads. The Board has been informed that existing structures need not be torn down. However, the design margins for equipment were less conservative, and so some changes may be required to accommodate the increased seismic loads. There is, unfortunately, continued uncertainty caused by lack of site characterization data and final resolution of the site attenuation relationship. DOE has informed the Board that it plans to resolve this uncertainty.

### **Other Design Problems at WTP**

The Board has reviewed other aspects of WTP's design and construction: structural engineering, electrical distribution, instrumentation and control, ventilation systems, process safety, fire protection, hydrogen control, pipe erosion, and concrete quality. In October 2005, the Board provided to the Secretary of Energy a summary of the primary remaining safety issues. These issues are summarized below.

- The Board identified structural engineering problems in the mesh density used in the structural models, application of thermal loads, and unique aspects of the High Level Waste building design. The Board also asked DOE to identify how loads are distributed throughout the structural members for each facility so the local and global behavior of the structural components could be understood. In response, BNI is revising the structural design bases, as well as the structural models, for the High Level Waste and Pretreatment facilities.

Only a few issues remain unresolved in this area, and the Board expects that its future review of the design bases and model revisions should not result in the need to make any significant changes.

- The Board questioned the hydrogen generation rate estimates being used to design hydrogen mitigation systems. The Board suggested that the markedly different processing and accident conditions at WTP were not accurately reflected in that generation rate. After conducting studies, BNI revised its design basis generation rate equation to reflect the WTP process more accurately. BNI also revised the design basis for the waste feed to be consistent with an updated forecast of waste feed characteristics. BNI is in the process of revising its final estimate of the quantity of hydrogen that will be generated during WTP operations and will incorporate this information into the design and safety bases.
- BNI has correctly identified hydrogen hazards associated with pipes and ancillary vessels and has developed some engineering solutions that will successfully prevent hydrogen-

related accident scenarios. The exception appears to be BNI's desire to accept the risk associated with certain hydrogen deflagrations and detonations. If this is BNI's strategy, it must be demonstrated that the likelihood of these accidents is extremely remote and that the public and collocated and facility workers will be protected. DOE also needs to consider both the safety and mission risk of these types of accidents before approving a design with any inherent weaknesses. The Board believes this will be a difficult undertaking.

- The Board challenged the adequacy of test data being used to design the pulse jet mixing equipment for mixing non-Newtonian high-level waste. Although BNI has not completed the final mixing design, the research completed by BNI's research organization and Pacific Northwest National Laboratory indicates that BNI has developed a sufficient understanding of the requirements for mixing non-Newtonian fluids. The Board is aware of a number of design approaches, such as not requiring redundancy in certain cases, that will require careful DOE review before final designs can be approved. However, the Board believes BNI can develop a design that meets existing safety requirements upon completion of remaining research activities and ongoing engineering work.
- The Board objected to DOE's decision not to apply fire resistant coatings to structural steel because the decision was not consistent with applicable fire codes. DOE finally changed course, and a somewhat limited fire proofing project is now in progress. The project is, strictly speaking, consistent with the applicable fire code, but the selective approach taken requires a detailed load analysis to determine which steel members need to be coated. DOE's contractor has prepared structural design criteria for implementing this strategy across the project and is now in the process of completing the calculations. Installation of the coatings has been started. Recent problems with the installed coatings have occurred due to water infiltration. DOE is working with the contractor to identify appropriate means of repairing damaged areas and resolving a question on the adequacy of the installed coatings.

## **Conclusion**

The Board is fully aware of DOE's desire to build WTP on time and within budget, and for that reason the Board has provided its technical advice at a time when it could best be utilized to achieve a safe design. To the best of my knowledge, the technical accuracy of the advice provided by the Board on WTP has not been disputed. In any large, complex, costly project, the failure to address technical issues quickly, from the beginning, can have serious consequences later. It is these consequences that the Board has endeavored to prevent.

Thank you for the opportunity to report to you on the Board's work to ensure that the protection of the public and worker health and safety is an integral part of the WTP design and construction process. I will be happy to answer any questions you may have.