

5.8 Defense Nuclear Facilities Safety Board



S. M. Hahn

The Defense Nuclear Facilities Safety Board is an independent federal agency established by Congress in 1988. The board's mandate under the *Atomic Energy Act* is to provide safety oversight of the nuclear weapons complex operated by DOE. The nuclear weapons program remains a complex and hazardous operation. DOE must maintain readiness of the nuclear arsenal, dismantle surplus weapons, dispose of excess radioactive materials, clean up surplus facilities, and construct new facilities for many purposes. It is the board's responsibility to help ensure that all of these activities are carried out by DOE in a manner that provides adequate protection for the public, workers, and the environment.

5.8.1 Defense Nuclear Facilities Safety Board Related Accomplishments, DOE Richland Operations Office

S. M. Hahn

In 2004, the DOE Richland Operations Office accomplished the following tasks related to Defense Nuclear Facilities Safety Board recommendations:

- Completed stabilization and packaging of all plutonium metal, oxide, polycube, and alloy items (approximately 11 tonnes [12.1 tons]) at the Plutonium Finishing Plant into standardized 3013 cans, suitable for long-term storage.
- Completed removal of all spent fuel (2,106 tonnes [2,321.5 tons]) from the K Basins into safe, dry, compliant storage at Hanford's Canister Storage Building about 14.5 kilometers (9 miles) from the Columbia River. The spent fuel is now awaiting eventual shipment to a national repository.

- Initiated the second phase of K Basins cleanup by removing about 50 cubic meters (65 cubic yards) of radioactive sludge. Sludge from the K Basin's North Load Out Pit is being pumped into large-diameter canisters and will be mixed with grout in a treatment facility for disposal offsite as contact-handled transuranic waste. The remainder of the K Basin sludge, containing higher concentrations of cesium and uranium, is being transferred to containers in preparation for onsite treatment. The treatment method for K-West sludge has been selected.
- Began retrieval of transuranic waste from trenches in Hanford's 200-West Area burial grounds. The Tri-Party Agreement milestone for removal of 6,000 drums was met 4 months early. The DOE Richland Operations Office continues to provide the Defense Nuclear Facilities Safety Board with the status on plans to safely retrieve and disposition drums containing plutonium.
- Completed several commitments related to software quality assurance including the qualification of software quality assurance personnel, completion of software quality assurance related assessments, and an update of the *Richland Functions, Responsibilities, and Authorities Manual* (RL/RIM-2002-01).

5.8.2 Defense Nuclear Facilities Safety Board Related Accomplishments, DOE Office of River Protection

C. M. Fetto

The DOE Office of River Protection worked closely with the Defense Nuclear Facilities Safety Board during 2004 to



address safety questions related to the design and construction of the Hanford Waste Treatment and Immobilization Plant (Waste Treatment Plant) and operations of the tank farms. Significant progress was made designing and constructing the Waste Treatment Plant in 2004 with 74.1% completion of the engineering design and 28% completion of construction. Primary areas of interest to the Defense Nuclear Facilities Safety Board are discussed below.

5.8.2.1 Structural Design and Seismic Analysis of the Waste Treatment Plant

DOE has completed the final review of the *Site Specific Seismic Site Response Model for the Waste Treatment Plant, Hanford, Washington* (PNNL-15089). The report, issued March 1, 2005, provides revised seismic data for the design of the Waste Treatment Plant following analysis by expert seismologists from industry and the Pacific Northwest National Laboratory. As a result of the analysis, the seismic design specifications for the Waste Treatment Plant Pretreatment Building and High-Level Waste Building will be modified to withstand larger ground motions. The design changes do not affect other large facility structures within the Waste Treatment Plant complex. The previous seismic design basis, derived from a seismic hazard analysis in 1993-1994 by Geomatrix (WHC-SD-W236A-TI-002) was questioned by the Defense Nuclear Facilities Safety Board in 2002, and most questions regarding the adequacy of the design basis were resolved. The 2005 report (PNNL-15089) is expected to resolve the final questions.

The principal impact of the revised specifications is additional expense for design re-analysis and probable project delays from equipment procurement and redesign of piping hangers. The design re-analysis is expected to take approximately 6 months, while the effects of the redesign on the construction schedule are still being determined. Preliminary analyses indicate that most of the existing construction has sufficient design margin to preclude physical modifications to the existing construction. DOE is performing an analysis of overall project costs and schedule impact.

5.8.2.2 Concerns about Hydrogen Generated at the Waste Treatment Plant

Throughout 2004, DOE and its contractor have worked closely with the Defense Nuclear Facilities Safety Board to resolve their concerns about the presence of potentially flammable concentrations of hydrogen in the Waste Treatment Plant. The Waste Treatment Plant waste will generate hydrogen in quantities and at rates that may require controls in some of the pretreatment facility vessels and high-level radioactive waste vessels. The normal control strategy to prevent accumulation in the vessel headspace is to maintain a continuous air purge to dilute the hydrogen released from the waste and vent it through the vessel ventilation system. In addition to ventilation, a key component of the control strategy is to keep the waste mixed so that hydrogen will not accumulate in the solids and release in large amounts all at once.

Mixing will be accomplished with pulse jet mixers and air spargers. A number of tests have been completed which demonstrate the pulse jet mixers and air spargers are effective in releasing hydrogen that may be retained in solids in Waste Treatment Plant vessels. In cases where pulse jet mixers are inoperable for periods of time, spargers alone have been confirmed to be adequate for agitating settled solids in Waste Treatment Plant tanks facilitating hydrogen release and preventing potential gas buildup.

Work has also been done to systematically identify and evaluate locations throughout the Waste Treatment Plant beyond the primary process vessels (in pipes and ancillary vessels) where hydrogen could accumulate. A design guide for evaluating the potential of hydrogen buildup and applying preferred preventive and mitigative engineering controls has been proposed. Identification of areas where additional controls are needed has been completed, and recommended design solutions are currently being finalized. The final report was scheduled to be completed in April 2005.

DOE and the Defense Nuclear Facilities Safety Board have been working to refine and finalize the hydrogen generation calculation, which is the technical basis for the rate and amount of hydrogen to be generated in the Waste Treatment Plant. One of the last tasks to be performed

in support of the hydrogen generation calculation is to confirm that an anti-foam reagent will contribute minimal amounts of hydrogen during operations. Bechtel National, Inc. Engineering and Research and Technology selected an appropriate simulant to perform the hydrogen generation rate studies on the anti-foam reagent and worked with Savannah River National Laboratory to accelerate work to provide early data to support the hydrogen generation calculation activity. Savannah River National Laboratory will provide test results for discussion by April 2005 and issue a letter report to the Waste Treatment Plant Project by May 2005.

5.8.2.3 Assessment of Waste Treatment Plant Design and Analysis Computer Software

The DOE Office of River Protection assessed the design and analysis computer software being used at the Waste Treatment Plant. The assessment was an action included in the DOE response to the Defense Nuclear Facilities Safety Board Recommendation 2002-1, *Quality Assurance for Safety Software at Department of Energy Defense Nuclear Facilities*. The assessment team concluded that the overall software control program was effective.

5.8.2.4 Assessment of Instrument and Control System Computer Software for Tank Farms

The DOE Office of River Protection assessed tank farm instrument and control system computer software in response to the Defense Nuclear Facilities Safety Board Recommendation 2002-1. The DOE Office of River Protection evaluated five Hanford tank farm instrument and control systems and found them to be acceptable. The Defense Nuclear Facilities Safety Board is evaluating the DOE Office of River Protection's assessment and will continue to follow this topic.

5.8.2.5 Integrated Safety Management System in the Tank Farms

The Defense Nuclear Facilities Safety Board requested a report identifying weaknesses in the Integrated Safety Management System for the tank farms, with particular

focus on work planning, conduct of operations, feedback and improvement programs at the activity level, and corrective action plans and schedules. DOE provided a response to the Defense Nuclear Facilities Safety Board describing its path forward. The Defense Nuclear Facilities Safety Board staff will continue to follow this topic.

5.8.2.6 Double-Shell Waste Tank Integrity

A Chemical Optimization Expert Panel recommended stress corrosion cracking testing be conducted on double-shell waste tanks to better define double-shell tank chemistry control limits. In response to this recommendation, the DOE Office of River Protection and tank farms contractor are developing a test design matrix to perform laboratory studies of the effects of stress-related corrosion on crack formation in the walls of waste storage tanks. The first test phase is to validate previous slow strain rate test results. A subset of the test design matrix will include conducting similar tests with waste simulant on tank 241-AN-107 to be finalized by the end of 2005. Additional testing of simulants for other tank waste types is planned for 2006 and beyond.

The tank farms contractor proposed increasing operating waste levels in double-shell tanks. Structural analysis of the tanks indicated that waste levels could be increased to new operating levels by decreasing the specific gravity of the tank waste. The AP Tank Farm was selected for waste-level testing after review of construction and structural records. An expert panel was formed and a workshop was held in 2004 to review the analysis. The expert panel agreed with a recommendation to increase waste levels in AP Tank Farm tanks. Proposed authorization basis amendments, which could modify the nuclear safety basis, are being discussed by the DOE Office of River Protection and the tank farms contractor.

5.8.3 Status of DOE Order 435.1, Radioactive Waste Management

S. D. Stubblebine

DOE Order 5820.2A, *Radioactive Waste Management*, was issued in 1988. During September 1994, the Defense



Nuclear Facilities Safety Board issued *Recommendation 94-2, Conformance with Safety Standards at DOE Low-Level Nuclear Waste and Disposal Sites*, addressing problems with DOE's radioactive waste management. In July 1999, DOE issued a revised directive on managing radioactive waste, DOE Order 435.1, *Radioactive Waste Management*, with its associated manual and guidance documents, reflecting advances in radioactive waste management practices. DOE Order 435.1 included a compliance date of July 12, 2000.

The U.S. District Court for the District of Idaho ruled on July 3, 2003, that a key provision of DOE Order 435.1 was invalid. The ruling applied to that portion of the order that allows radioactive waste that is incidental to reprocessing to be managed as low-level radioactive waste. Such determination is viewed by DOE as important to speeding the treatment and reducing associated disposal costs of radioactive liquid wastes generated by DOE's prior reprocessing of spent nuclear fuel. Under the Order, waste incidental to reprocessing that remains in Hanford waste storage tanks could be disposed of in place as low-level

waste rather than being disposed of in a repository as high-level waste. The Natural Resources Defense Council, along with others, challenged the provision as inconsistent with the *Nuclear Waste Policy Act*. The court agreed that part of DOE Order 435.1 was inconsistent with the *Nuclear Waste Policy Act* and held that portion invalid.

DOE appealed this decision to the 9th Circuit Court of Appeals. The Court of Appeals issued a unanimous decision on November 5, 2004, determining that the case was not ripe for decision and reversed and remanded it to the District Court with instruction to dismiss. In other words, the 9th Circuit Court of Appeals concluded that since the case did not involve actual application of DOE Order 435.1, there were no facts upon which to determine how DOE would apply the rule, and that, therefore, the plaintiffs had filed their action prematurely. Plaintiffs filed requests with the three-judge panel that decided the case and the full bench of the entire 9th Circuit Court of Appeals to grant a re-hearing but these petitions were denied. The case is currently with the District Court, awaiting the Court's entry of dismissal.