00-0001744

DEFENSE NUCLEAR FACILITIES SAFETY BOARD

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August 29, 2000

The Honorable Carolyn L. Huntoon
Assistant Secretary for
Environmental Management
Department of Energy
1000 Independence Avenue, SW
Washington, DC 20585-0111

Dear Dr. Huntoon:

The staff of the Defense Nuclear Facilities Safety Board (Board) continues to review work being performed at the Hanford Site to safely store hazardous waste. During an on-site review in June 2000, the Board's staff reviewed the site's high-level waste (HLW) tank integrity program. A report prepared by the staff summarizing issues identified during this review is enclosed for your information.

The Department of Energy and CH2M-Hill Hanford Group are developing an effective approach to making an informed recommendation in April 2005 on the need to construct new HLW tanks at Hanford. This approach integrates the essential components needed for the evaluation and can potentially serve as a model for the complex. However, as illustrated by the observations provided in the enclosed report, sustained close attention is needed to preserve the integrity of existing tanks through chemistry control and upkeep of essential systems. The Board's staff noted problems in the identification of and adherence to requirements important to preserving tank integrity, particularly with regard to the control of waste chemistry and operation of the tank annulus ventilation system. The lack of rigor associated with these efforts may stem from the fact that the HLW tanks at Hanford are not functionally classified as safety-class equipment.

The Board requests that the Department of Energy provide, within 90 days, a reply that identifies the actions that will be taken to address the issues identified in the enclosed staff report.

Sincerely,

John T. Conway
Chairman

c: Mr. Mark B. Whitaker, Jr.
Mr. Keith Klein

Enclosure

00-1744

DEFENSE NUCLEAR FACILITIES SAFETY BOARD

Staff Issue Report

August 4, 2000

MEMORANDUM FOR: J. K. Fortenberry, Technical Director

COPIES: Board Members

FROM: B. Jones

SUBJECT: High-Level Waste Tank Integrity Program, Hanford Site

This report documents observations made by members of the staff of the Defense Nuclear Facilities Safety Board (Board) during meetings held at the Hanford Site on June 27–28, 2000. These meetings were attended by staff members B. Jones, S. Stokes, and R. Tontodonato.

Background. The Hanford Site has 177 underground storage tanks containing approximately 54 million gallons of radioactive waste. Hanford has a need to assess and confirm the integrity of its aging high-level waste (HLW) storage tanks. Accurate assessment of the structural integrity of the tanks is necessary to make appropriate management decisions on such matters as liquid level reduction, waste retrieval prioritization, and the potential need for new tanks.

Both single- and double-shell carbon-steel HLW storage tanks have been built at Hanford. All of Hanford's 149 single-shell tanks, built from 1943 to 1964, have exceeded their design lives and are no longer used for waste receipt, but continue to store waste. Approximately 1 million gallons of HLW has leaked into the surrounding soil, and some waste has migrated to the groundwater. The integrity of the single-shell tanks is assumed to be inadequate, and an aggressive program for interim stabilization of the waste in these tanks is nearing completion.

The 28 double-shell tanks, constructed from 1967 to 1986, provide improved protection from leakage and better accessibility for inspections. The double-shell tanks, along with their network of piping systems, are expected to exceed their original design lives (50 years) before the waste can be removed. Current schedules for removing the waste from the double-shell tanks rely on the integrity of the tanks through the year 2028. If, in addition, the double-shell tanks are used during retrieval and stabilization of the waste in the single-shell tanks, double-shell storage space will be needed until approximately 2047. Presently, it is uncertain how Hanford will satisfy this need.

Integrity Program. Hanford is developing a systematic approach to making an April 2005 recommendation on the need to construct new HLW tanks at the site. This approach includes ultrasonic (UT) examinations of portions of all double-shell tanks, use of in situ corrosion monitoring probes, development of a predictive model for tank degradation, and evaluation of tank storage needs.

The April 2005 recommendation is expected to provide ample time for the construction of new tanks to support the retrieval of all HLW from the double-shell tanks by 2028. However, CH2M-Hill Hanford Group (CHG) personnel acknowledged that, under the current waste disposal plan, roughly 60–100 new double-shell tanks, each with a capacity of 1 million gallons, would be required to meet the existing Tri-Party Agreement milestone of retrieving all the HLW from the single-shell tanks by 2018. Therefore, the staff sees little chance that this milestone will be met.

Chemical Controls. The double-shell tanks have operating specifications that establish chemistry limits for corrosion control. Corrosion coupon tests performed in the early 1980s and waste treatment tests conducted in the early 1990s were used as the basis for these limits. Despite these chemistry controls, tanks have remained outside the specification limits for years. For example, tank AN-107 has a very low hydroxide concentration, well below the established limits. To correct this condition, approximately 60,000 gallons of highly concentrated caustic solution would need to be added to the tank. A UT examination of a portion of the tank did not reveal any problems, and other mechanisms have been cited as inhibiting corrosion, but a firm understanding of the present situation does not exist. CHG personnel intend to develop a plan next year for correcting the chemistry in AN-107, but it is not clear when the correction will occur.

A similar issue exists with tank AN-102, which is bordering on the established chemistry limits. Tank AY-101 is also documented as not being within corrosion specifications for hydroxide concentration. The practice of allowing tanks to remain outside the established chemistry limits is inappropriate, especially given the expectation that the tanks will be relied upon beyond their original design lives. If the chemistry limits are too conservative, alternative limits should be justified and enforced.

Annulus Ventilation. The design of certain double-shell tanks has limited the operability of their annulus ventilation systems. For example, a drain line from the center pump pit for AY-101 discharges to the primary tank at a level of 64 inches. If the annulus ventilation system is operating when the waste level is below 64 inches, airborne contamination from the primary tank can be drawn up through the open end of the drain line and spread through the ventilation system and potentially even the annulus. Apart from a short period when the annulus ventilation system in tank AY-101 was briefly run last year, the system has not been operated for approximately 7 years because of this concern. This lack of annulus ventilation likely caused the excessive surface corrosion discovered on the outside of the primary wall of tank AY-101 during a recent attempt to inspect the tank ultrasonically. CHG plans to characterize the observed

corrosion and add waste to the tank to allow operation of its annulus ventilation system. The presence of excessive corrosion is evidence of the need to maintain adequate annulus ventilation throughout the lives of the tanks.

Monitoring. CHG's current remote UT examination techniques can be used to inspect 20–25 percent of the primary tank wall. With current technology, the UT crawler is unable to examine the knuckle region of the tanks (i.e., the transition between the bottom and sides) because of transducer liftoff and problems with the crawler falling off the knuckle or getting stuck. Other difficulties have arisen as a result of the presence of excessive surface corrosion, which can lead to unsatisfactory UT results or a crawler fall. The presence of this corrosion product on the tank wall prevented reliable examination of tank AY-101. The Department of Energy (DOE) has plans to reexamine tank AY-101 after removing the excessive scale. It is important to determine the remaining intact thickness of AY-101's primary wall because of the unusual amount of rust observed on the outside of the wall.

Primary Tanks. Overall, UT examinations have been performed on portions of the primary walls of 6 of the 28 double-shell tanks, and CHG plans to examine the remaining 22 by the end of fiscal year 2005. The results of these initial UT examinations of the tank walls can be used in the future to assess the corrosion rate and develop more accurate life predictions. DOE plans to do this by reexamining the same areas of each tank 10 years after the initial examination. (Dimensional tolerances for the steel plates used to construct the HLW tanks were sufficiently broad to preclude their use as a baseline for estimating corrosion rates.)

The initial examinations revealed isolated wall thinning (20 percent of nominal wall thickness) in tank AN-105. No cracks were found within the heat-affected regions of the welds, nor was there evidence of stress corrosion cracking. The absence of cracks is attributed to the stress-relieving process to which each of the double-shell tanks was subjected during construction, as well as generally adequate waste chemistry controls. On the basis of historical data, CHG believes the corrosion of tank AN-105 occurred early in the tank's service life. CHG has installed a corrosion-monitoring probe in the tank to evaluate whether excessive corrosion is continuing to take place. In addition, another UT examination is planned for tank AN-105 in 5 years.

Secondary Tanks. CHG's inspection programs focus on ensuring the integrity of the primary tank wall. Limited inspection results have been documented regarding the integrity of the secondary shells. The Board's staff recognizes that the secondary tank does not require the same rigorous inspection program as does the primary tank; however, a defined program for ensuring the integrity of secondary shells is warranted.