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DEFENSE NUCLEAR FACILITIES SAFETY BOARD

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96-0003641



September 4, 1996

The Honorable Hazel R. O'Leary
Secretary of Energy
1000 Independence Avenue, SW
Washington, DC 20585-1000

Dear Secretary O'Leary:

The Defense Nuclear Facilities Safety Board (Board) received your letter of June 17, 1996, transmitting Revision 1 of the Department of Energy's (DOE) Implementation Plan (Plan) for Board Recommendation 93-5, which addresses characterization of the Hanford Site's high-level waste storage tanks and resolution of associated safety issues. The Board agrees with the proposed strategy of incorporating the remaining work for the ferrocyanide tank safety program (formerly addressed by the Recommendation 90-7 Plan) in the Recommendation 93-5 Plan. Accordingly, the Board considers Recommendation 90-7 to be closed.

The proposed Plan conforms to the standards set forth in the Board's Policy Statement No. 1, "Criteria for Judging the Adequacy of DOE Responses and Implementation Plans for DNFSB Recommendations" (55 Fed. Reg. 43398), and is therefore acceptable to the Board, with the qualifications expressed in this letter. The Board believes that improved integration of the characterization project and the tank safety programs, as identified in the Plan, will greatly enhance both the identification of characterization needs and the use of characterization data to resolve safety issues.

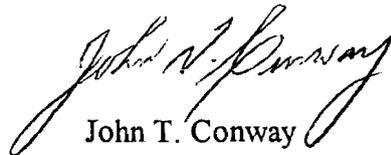
The Board is concerned, however, about several areas in which the revised Plan overstates the current understanding of tank safety, as well as the adequacy of existing controls. In particular, the Plan states that the existing controls are adequate to ensure the safety of the tanks while sampling is performed, and discounts ignition sources other than lightning for most accidents. It is important to continue with present plans for lightning protection, and to ensure that vehicle fires cannot occur above tanks. The need to upgrade the authorization basis for the tank farms has been documented in the *Tank Waste Remediation System Final Safety Analysis Report Project Plan* (WHC-SD-WM-PNL-113, February 5, 1996), and has been acknowledged by the Hanford management and operations contractor, the DOE Richland Operations Office, and DOE Headquarters. Until authorization basis upgrades are completed for the tank farms, it is premature to conclude that all accident initiators have been identified and that existing controls are adequate.

Based on a thorough review of the Hanford tank characterization and safety programs, the Board firmly believes that sampling will continue to be required beyond the 28 highest priority-tanks, and that the pace of such sampling is important. However, the revised Plan's discussion of staffing

for sampling operations considers only the first 28 tanks, and does not address resource requirements for sampling the remaining tanks. While the Board agrees that it is appropriate to focus initially on the tanks expected to provide the most useful information, the establishment of a sound safety basis for the Hanford tank farms requires characterizing all tanks in a timely manner. The DOE Office of Environmental Management and the Richland Operations Office will need to place continued emphasis on accomplishing the required sampling to ensure that this project does not lose the momentum gained through great effort and expense over the past several years.

Detailed technical comments on several aspects of the Plan are provided in the enclosure. The Board requests that you consider these comments in implementing the revised Plan and in preparing the Basis for Interim Operations and Final Safety Analysis Report for the Hanford tank farms.

Sincerely,

A handwritten signature in cursive script, appearing to read "John T. Conway".

John T. Conway
Chairman

c: The Honorable Alvin L. Alm
Mr. Mark B. Whitaker, Jr.

Enclosure

Enclosure

Comments on DOE Recommendation 93-5 Implementation Plan (Plan), Revision 1

1. **High-priority tanks:** Tank 241-U-103 (a single-shell flammable gas watch list tank) is listed as a tank that will be sampled using the retained gas sampler. This tank should also be listed as a "high-priority tank" to ensure that this sampling is accomplished in accordance with the milestone for completing high-priority tank sampling.
2. **Vapor sampling:** Vapor sampling of single-shell tanks for organic signatures is scheduled to continue until December 1999, and verification of vent paths to mitigate potential organic solvent fires in selected tanks will not be completed until April 2000. Since verification of vent paths does not face the same constraints as vapor sampling, it appears that the most expeditious path toward minimizing the risk of solvent fires would be to pursue vapor sampling and vent path verification on parallel paths.

In justifying this program, the Plan states that the radiological consequences of an organic solvent fire in an adequately vented tank would be acceptable per current risk acceptance guidelines. This statement is true but misleading, as it omits the fact that the calculated toxicological doses for fires in actively ventilated tanks exceed the guidelines. (The Plan subsequently acknowledges this problem for double-shell tanks, but not for actively ventilated single-shell tanks.)

3. **Runaway reactions:** The Plan states that chemical runaway will not occur in any tank because the waste has been stored much longer than its characteristic cooling time. This statement is based on a February 1996 Fauske and Associates, Inc. (FAI) report, which calculates characteristic cooling times for the tanks using the waste height and the thermal conductivity. The FAI report also estimates the maximum theoretical temperature the waste could reach if it dried out completely. In some tanks, the measured waste temperature is already above this theoretical maximum. This contradiction calls into question the validity of the FAI modeling and the estimated waste properties used in the calculations.
4. **Organic-nitrate reactions:** The Plan states that propagating organic-nitrate reactions cannot occur with waste energetics below 1200 J/g, and that no tanks sampled to date exceed this limit. The Plan states that the energy content required for a propagating organic-nitrate reaction in waste simulants is 30 percent higher than this limit.

This analysis has several weaknesses. A key observation is that ferrocyanide waste simulants have been shown to undergo propagating reactions at an energetics level of 900 J/g. Furthermore, close examination of the test methodology shows that (1) two of the three organic simulants and the ferrocyanide simulant contained waters of hydration, whereas the 1200 J/g number is calculated for absolutely dry fuel-oxidizer mixtures; and

(2) the actual energy content of the organic simulants was significantly exaggerated (by about 30 percent, based on data for ferrocyanides) as a result of using the theoretical thermodynamic heat of reaction, not the actual energy released, for this comparison.

The Plan also states that “robust and/or sustained” ignition sources are needed to ignite condensed-phase organic-nitrate reactions. The reports referenced in the Plan shows that a ball bearing heated to an energy content of 10 J could ignite the simulants being tested. This does not appear to be a robust or sustained ignition source. Furthermore, based on the references, it does not appear that incrementally smaller ignition sources (e.g., 5 J ball bearings) were tested.