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**DEFENSE NUCLEAR FACILITIES
SAFETY BOARD**

Washington, DC 20004-2901



May 20, 2011

The Honorable Steven Chu
Secretary of Energy
U. S. Department of Energy
1000 Independence Avenue, SW
Washington, DC 20585-1000

Dear Secretary Chu:

The Defense Nuclear Facilities Safety Board (Board) has reviewed your February 10, 2011, response to Recommendation 2010-2, *Pulse Jet Mixing at the Waste Treatment and Immobilization Plant*. Under the criteria set forth in the Board's Policy Statement 1, *Criteria for Judging the Adequacy of DOE Responses and Implementation Plans for DNFSB Recommendations* (October 19, 1990), the Board finds that the response "...says it is an acceptance, but by its language or terms in fact rejects part of the recommendation." In its response, the Department of Energy (DOE) provides clarifications that fundamentally redefine the Board's Recommendation and fall short of meeting its intent. At this time, the Board remains unclear about the actions DOE will follow to address the Recommendation and, consequently, reaffirms its Recommendation.

The strategy detailed in the Board's Recommendation relies on preventing nuclear safety hazards arising from inadequate mixing by determining the performance limits of the mixing, sampling, and transfer systems using a suitable large-scale test program and establishing a waste acceptance criteria (WAC) based on these performance limits. As part of this strategy, the Board believes that obtaining representative samples from the waste feed delivery vessel(s) and Waste Treatment and Immobilization Plant (WTP) vessels will provide the necessary assurance that the WTP is operated within suitable safety limits. The Board fully appreciates that further testing could impact the project, but these impacts must be weighed against the substantial risk of proceeding without an adequate understanding of the performance limitations of the current design. On balance, the Board's strategy outlined in Recommendation 2010-2 allows for continued design and construction in conjunction with large scale testing. Clearly, the large-scale testing program will continue after the placement of vessels to enable the project to develop a conservative WAC and determine whether other capabilities are needed to complete DOE's cleanup mission at Hanford's tank farms. The Board believes that potential issues arising from performance limitations of the mixing, sampling, or transfer systems need to be addressed before the initiation of WTP operations and hopefully as soon as practicable.

Therefore, the Board reaffirms the Recommendation in its entirety and summarizes several of the primary elements of the Recommendation below:

- Testing must be done at the proper scale to demonstrate the limits of performance of the vessel mixing and transfer systems. These tests must be conducted using appropriate waste simulants with properties that conservatively envelope the properties of the high-level wastes stored in Hanford's tank farms.
- Testing must demonstrate that pulse-jet mixed vessels can be adequately operated using prototypic equipment (e.g., control systems) during multi-batch operations.
- Testing must demonstrate that representative samples can be taken from waste feed delivery tanks to meet the WAC, and from WTP process vessels to meet safety-related operating requirements.
- The heel removal and cleanout systems must be designed and tested as early as practicable, the performance limits for these systems established, and the limits of their operation factored into the development of the WAC and the operating envelope of WTP.

The Board considers that DOE has rejected sub-Recommendation 3 associated with the use of large-scale test results to verify and validate computational fluid dynamic (CFD) models of full-scale WTP mixing systems. DOE's clarification states that verification and validation of the model will be finished prior to the commencement of large-scale testing activities. Because of the complexities involved in simulating multi-phase, transient, non-Newtonian mixing and transport systems, the Board believes that obtaining data from near full-scale tests is necessary to establish, within a reasonable range of uncertainty, that the WTP's CFD model is an accurate representation of the full-scale mixing systems.

The Board also considers that DOE has rejected sub-Recommendation 4 associated with the capability of WTP and tank farms to obtain representative samples. DOE's clarification suggests that the sampling systems need only have the ability to obtain sample material, but does not specify that this material must be representative of the waste feed in (1) delivery tanks to meet the WAC and (2) WTP process vessels to meet safety-related operating requirements. The Board believes that obtaining representative samples of WTP process slurries, including feed from the Hanford tank farm, is a prerequisite for meeting safety-related aspects of the WAC and management of criticality hazards consistent with existing nuclear safety requirements specified in DOE Order 420.1B, *Facility Safety*.

Pursuant to 42 U.S.C. § 2286d, the Board finds that the February 10, 2011, response rejects sub-Recommendations 3 and 4, and hereby reaffirms the Recommendation in its entirety. Paragraph (d) of this statutory provision requires that you now make:

...a final decision on whether to implement all or part of the Board's recommendation[s]. Subject to subsection (h), the Secretary shall publish the final decision and the reasoning for such decision in the Federal Register and shall transmit to the Committees on Armed Services and on Appropriations of the Senate and to the Speaker of the House of Representatives a written report containing that decision and reasoning.

Sincerely,

A handwritten signature in black ink, appearing to read "Peter S. Winokur". The signature is stylized and cursive.

Peter S. Winokur, Ph.D.
Chairman

c: The Honorable Inés R. Triay
Mrs. Mari-Jo Campagnone