



**The Secretary of Energy**  
Washington, D.C. 20585

June 20, 2011

The Honorable Peter S. Winokur  
Chairman  
Defense Nuclear Facilities Safety Board  
625 Indiana Avenue, NW, Suite 700  
Washington, DC 20004-2901

Dear Mr. Chairman:

This letter responds to your May 20, 2011, letter which reaffirmed the Defense Nuclear Facilities Safety Board (Board) Recommendation 2010-2, *Pulse Jet Mixing (PJM) at the Waste Treatment and Immobilization Plant (WTP)*.

Your reaffirmation letter interpreted the Department of Energy's (DOE) February 10, 2011, response to Recommendation 2010-2 as a rejection of sub-recommendations 3 and 4. The intent of our response was not to reject any of the sub-recommendations, but to clarify the actions being taken to validate the design, operation, and safety of the WTP PJM and transfer systems.

Our response explained that we agreed with both the intent of your Recommendation and that more testing and analyses should be conducted to provide additional confidence that the WTP PJM and transfer systems will achieve design and operating requirements. Since then, we have worked closely to ensure a mutual understanding of your Recommendation. The enclosure to this letter documents the significant progress we have collectively made in achieving the necessary clarification and a path forward for implementing your Recommendation. DOE is encouraged by the level of clarity achieved to date, and confident we have established the foundational premises needed to bring each of the remaining issues to closure, using the Implementation Plan (IP) as the vehicle for documenting a final technical approach that can be mutually endorsed.

This clarification serves to restate my decision to accept your Recommendation 2010-02. We believe our IP will meet the underlying safety improvement objectives of your Recommendation. Pursuant to 42 U.S.C. § 2286e, an IP for this Recommendation will be prepared and delivered to the Board no later than 90 days after publication of this response in the *Federal Register*.

We look forward to further working with the Board and your staff to reach final closure on the intent and scope of deliverables while maintaining our obligations to address Hanford's environmental liabilities. We are confident that the IP for Recommendation 2010-2 is being developed, such that the WTP Project completes its design and construction activities with full assurance of nuclear safety for the life of WTP operations.



Mr. Dale Knutson is the responsible manager for Recommendation 2010-02. If you have any further questions, please contact me or Dr. Inés R. Triay, Assistant Secretary for Environmental Management, at (202) 586-7709.

Sincerely,

A handwritten signature in black ink that reads "Steven Chu". The signature is written in a cursive style with a large, stylized 'S' and 'C'.

Steven Chu

Enclosure

## Enclosure to 2010-2 Reaffirmation Response

DOE has taken, and continues to take, steps to increase confidence that the pulse jet-mixed vessels will comply with operating requirements. Your reaffirmation letter highlights several primary elements of the Recommendation, and we believe our shared concerns regarding pulse jet mixing at the Waste Treatment Plant (WTP) will be adequately addressed by the Department of Energy's (DOE) current direction related to resolving pulse jet mixing and transfer system uncertainty. The project will rely on preventing nuclear criticality safety hazards by establishing and implementing waste acceptance criteria (WAC) for any waste transferred to WTP. A large scale test program will be used to determine the performance limits of the mixing, sampling, and transfer systems and its results will be used to confirm the WAC are implemented with due consideration for uncertainties and margins.

Significant progress has been made on achieving the clarifications needed to further develop, and ultimately complete the implementation plan for Defense Nuclear Facilities Safety Board's (Board) Recommendation 2010-2. The Board's May 20, 2011, letter which reaffirmed the Defense Nuclear Facilities Safety Board Recommendation 2010-2, *Pulse Jet Mixing at the Waste Treatment and Immobilization Plant*, identified the following residual concerns; progress in achieving clarification on each of those concerns is provided:

- *Testing must be done at the proper scale to demonstrate the limits of performance of the vessel mixing and transfer systems.*

WTP will perform the first Large Scale Integrated Tests (LSIT) at 4, 8 and 14-foot scale. The project has identified commercially available vessels to support this increment of testing. If test results indicate a larger scale test than the 14-foot vessel is beneficial, a decision point will be included in the implementation plan to determine the scope and benefit of testing at a larger scale. A full technical justification will be provided that will support our decision.

- *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.*

WTP has issued a charter and formed a panel of subject matter experts to review and advise on all aspects of large-scale mixing including the simulants to be used for LSIT that address the physical parameters of testing and represent known properties of tank waste. There are concerns with selection of simulants which include manufacture, use and disposal of large volumes of potentially very hazardous simulant materials that would require a significant waste disposal effort of its own; and potentially prohibitive cost for manufacture and disposal of simulants. It is understood these considerations represent tradeoffs, but the goal is to ultimately not undermine the representative accuracy of the simulants required for testing.

- ***Testing must demonstrate that pulse-jet mixed vessels can be adequately operated using prototypic equipment (e.g., control systems) during multi-batch operations.***

DOE has approved an additional scope of work to release the contractor to initiate design, procurement and perform “informational testing” activities that will be the predecessor to the more formalized testing; conducted in accordance with NQA-1 requirements, to support design confirmation.

- ***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.***

Components of large scale testing that will result in a better understanding of mixing characteristics such as bottom motion, zones of influence and partial particle separation will be performed early within the testing program to better define what is required for heel removal and cleanout system designs. The project then intends to test heel removal and cleanout very early in the testing phase and in every scale of LSIT in order to inform design decisions for process vessels

- ***The Board considers that DOE has rejected sub-Recommendation 3 associated with the use of large scale tests to verify and validate computational fluid dynamic (CFD) models of full-scale WTP mixing 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.***

DOE agrees that it is necessary that the CFD model adequately represent full-scale mixing systems, but has not yet concluded that data from future near-full-scale tests is necessary to complete model verification and validation (V&V). DOE is in the process of determining if existing data sets are sufficient to complete V&V requirements of the CFD model for pulse jet-mixed vessels in accordance with the ASME V&V 20-2009, *Standard for Verification and Validation in Computational Fluid Dynamics and Heat Transfer*. The DOE review is ongoing, including evaluation by subject matter experts from the National Energy Technology Laboratory. If necessary, additional data sets, that may include the upcoming near-full-scale tests, will be collected to support the V&V.

- ***The Board also considers that DOE has rejected sub-recommendation 4 associated with the capability of WTP and tank farms to obtain representative samples. The DNFSB also stated that: Testing must demonstrate that representative samples can be taken from waste feed delivery tanks to meet the Waste Acceptance Criteria (WAC), and from WTP process vessels to meet safety related operating requirements.***

WTP distinguishes between *safety samples* and *process samples*, and has plans to accomplish both in a manner that will result in meeting the WAC and conducting safe and reliable operations in WTP. The current control strategy for the Pretreatment Facility safety basis requires confirmatory samples for criticality safety and inventory control samples for the Low-Activity Waste Facility safety basis. The sampling portion of the control strategy for

criticality safety is in revision based on previous mixing tests results, which concluded that the assumptions in the Criticality Safety Evaluation could not be sufficiently verified in pulse jet mixed vessels. The samples for Low-Activity Waste Facility safety basis compliance can be obtained with the current sampling design. DOE will continue to work closely with the Board staff to establish a common definition of *representative* samples as applied to the discussion above.