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**DEFENSE NUCLEAR FACILITIES
SAFETY BOARD**

Washington, DC 20004-2901



September 28, 2012

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

Dear Secretary Chu:

On September 28, 2012, the Defense Nuclear Facilities Safety Board (Board), in accordance with 42 U.S.C. § 2286a(a)(5), unanimously approved Recommendation 2012-2, *Hanford Tank Farms Flammable Gas Safety Strategy*, which is enclosed for your consideration. This Recommendation identifies the need to take actions to reduce the risk posed by flammable gas events at the Hanford Tank Farms.

After you have received this Recommendation and as required by 42 U.S.C. § 2286d(a), the Board will promptly make it available to the public. The Board believes that this Recommendation contains no information that is classified or otherwise restricted. To the extent that this Recommendation does not include information restricted by the Department of Energy (DOE) under the Atomic Energy Act of 1954, 42 U.S.C. §§ 2161-2168, as amended, please arrange to have it placed promptly on file in your regional public reading rooms. The Board will also publish this Recommendation in the *Federal Register*.

The Board will evaluate DOE's response to this Recommendation in accordance with the Board's Policy Statement 1, *Criteria for Judging the Adequacy of DOE Responses and Implementation Plans for Board Recommendations*.

Sincerely,

Peter S. Winokur, Ph.D.
Chairman

Enclosure

c: Mr. Scott L. Samuelson
Mrs. Mari-Jo Campagnone

RECOMMENDATION 2012-2 TO THE SECRETARY OF ENERGY
Hanford Tank Farms Flammable Gas Safety Strategy
Pursuant to 42 U.S.C. § 2286a(a)(5)
Atomic Energy Act of 1954, As Amended

Dated: September 28, 2012

Background

The Defense Nuclear Facilities Safety Board (Board) believes that current operations at the Hanford Tank Farms require safety-significant active ventilation of double-shell tanks (DSTs) to ensure the removal of flammable gas from the tanks' headspace. A significant flammable gas accident would have considerable radiological consequences, endanger personnel, contaminate portions of the Tank Farms, and seriously disrupt the waste cleanup mission. Further, the Board believes that actions are necessary to install real time monitoring to measure tank ventilation flowrates as well as upgrade other indication systems used to perform safety-related functions.

On August 5, 2010, the Board sent a letter to the Department of Energy (DOE) outlining issues related to the safety strategy for flammable gas scenarios at the Hanford Tank Farms. In its letter, the Board identified that the safety analyses for accident scenarios used non-bounding values for (1) the radiological inventory of the tanks and (2) the amount of waste that could be released in a major accident. Notwithstanding these non-conservatisms, DOE's safety analyses show that all of the DSTs generate flammable gas in sufficient quantities to reach the lower flammability limit (LFL) for hydrogen. Further, many of the tanks contain sufficient quantities of gas trapped in the waste such that the LFL could be exceeded if the gas were spontaneously released, which is possible under both normal operating and accident conditions. The current control strategy does not include any measures to periodically release the trapped gases in a controlled manner to preclude the accumulation of flammable concentrations.

DOE's safety analyses show that the potential flammable gas scenarios warrant a credited safety control due to the dose consequences to workers and the public. Accordingly, the ventilation systems for the DSTs were previously classified as safety-significant and credited in the documented safety analysis for the Tank Farms to address flammable gas scenarios. The revision of the safety analysis approved by DOE on January 21, 2010, and implemented on March 30, 2010, reduced the DST ventilation systems from safety-significant to defense-in-depth and replaced them with a specific administrative control (SAC) for flammable gas monitoring.

In its August letter, the Board noted that DOE's SAC for flammable gas monitoring exhibited a number of weaknesses that collectively rendered it inadequate as a safety control. The reliance on an administrative control in lieu of an engineered feature is also contrary to DOE's established hierarchy of controls as well as sound engineering practice. Further, the Board noted that a number of other installed systems that are (1) necessary to provide accurate and reliable indications of abnormal conditions associated with flammable gas events, and

(2) serve as a direct input to determining whether an operator action is required were not appropriately classified in accordance with their safety function.

In response to these issues, DOE, in a letter dated February 25, 2011, informed the Board that it had revised its decision to downgrade the DST ventilation systems and would take action to restore the systems to their former safety-significant status. Additionally, DOE indicated that the level indication systems for the DST annuli and the double contained receiver tank would be upgraded to safety-significant.

During the last year, the Board reviewed DOE's progress in meeting these commitments and addressing the Board's safety concerns. The Board noted that while some improvements had been made to the SAC used for flammable gas monitoring, it remained inadequate as a credited safety control. The SAC is less reliable than an engineered feature, remains susceptible to undetectable false low readings, and lacks independent verification.

Although DOE maintains a commitment to upgrading the DST ventilation systems and other installed non-safety-related instrumentation used to perform safety functions, the Board has concluded that no progress has been made in these areas, and the schedule for upgrades continues to slip. The latest schedule, outlined in a letter to the Board dated April 2, 2012, reflects a commitment to completing the upgrades to three of the five DST ventilation systems by fiscal year 2014. During the Board's June 2012 review, DOE indicated that even this was no longer a realistic schedule. DOE's current path forward is to upgrade only one of the DST ventilation systems (AY/AZ Tank Farm) by fiscal year 2015 to support mixer pump testing that is currently anticipated in 2016. No near-term procurement or installation plans are in place for the four other DST ventilation systems. Similarly, no plans or activities are proposed to upgrade the installed non-safety instrumentation systems being used in safety-related applications (e.g., the level indication systems for the DST annuli and the double container receiver tank).

Conclusions

The Board believes that DOE needs to upgrade the DST ventilation systems and other instrumentation systems used for safety-related functions at the Hanford Tank Farms. Further, the continued reliance on an inadequate SAC for flammable gas control presents an unnecessary risk to safety. At this time, DOE does not have a means to provide alternate ventilation if the existing ventilation system becomes inoperable. The hazards posed by flammable gas releases in DSTs and the challenges they pose to any ventilation system are directly proportional to the volume of flammable gas retained within the DST wastes. Reducing the current inventories of flammable gases retained in the DST waste and keeping them small would reduce the future hazards posed by gas release events.

Recommendation

Accordingly, the Board recommends that DOE:

1. Take near-term action to restore the classification of the DST ventilation systems to safety-significant. In the process, determine the necessary attributes of an adequate

active ventilation system that can deliver the required flow rates within the time frame necessary to prevent and mitigate the site-specific flammable gas hazards at the Hanford Tank Farms.

2. Take near-term action to install safety-significant instrumentation for real-time monitoring of the ventilation exhaust flow from each DST.
3. Take near-term action to upgrade the existing installed non-safety-related equipment that is being used to fulfill safety functions at the Hanford Tank Farms to an appropriate safety classification. This includes instrumentation and control equipment whose indications are necessary for operators to take action to accomplish necessary safety functions.
4. Identify compensatory measures in case any existing DST ventilation systems become unavailable at the Hanford Tank Farms.
5. Evaluate means to reduce the existing inventory of retained flammable gases in a controlled manner. Since these gases will continue to be generated until the tank contents are processed, evaluate methods to reduce the future retention of flammable gases in these tanks or to periodically mix them to prevent the future accumulation of flammable gas inventories that could cause the tank headspace to exceed the LFL if rapidly released.

The Board urges the Secretary to avail himself of the authority under the Atomic Energy Act (42 U.S.C. § 2286d(e)) to “implement any such recommendation (or part of any such recommendation) before, on, or after the date on which the Secretary transmits the implementation plan to the Board under this subsection.”

A handwritten signature in black ink, appearing to read 'P. S. Winokur', written over a horizontal line.

Peter S. Winokur, Ph.D., Chairman