The Secretary of Energy
Washington, DC 20585

June 6, 2013

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

Dear Mr. Chairman:

Enclosed is the Department of Energy's (DOE) Implementation Plan (IP) responding to the Defense Nuclear Facilities Safety Board's Recommendation 2012-2, *Hanford Tank Farms Flammable Gas Safety Strategy,* identifying the need to take actions to reduce the risk posed by flammable gas events at the Hanford Tank Farms.

On January 7, DOE accepted Recommendation 2012-2; and on April 19 notified the Board that additional time to complete the IP would be needed and that the Department's response would reach the Board by June 6.

In February, DOE implemented a revision to the Documented Safety Analysis by adding a new control that measures ventilation flow through each tank on a periodic basis, supplementing the existing flammable gas monitoring control. This revision also placed requirements on operability of the in-service and standby primary ventilation trains. DOE is currently working towards installation of safety-significant (SS) instrumentation for real-time monitoring of the ventilation exhaust flow from each double-shell tank (DST). DOE will ensure that DST primary ventilation systems are SS to support mixer pump operations to supply waste to the Waste Treatment and Immobilization Plant as part of the overall Office of River Protection Project.

The IP details a pragmatic and graded approach to address the sub-recommendations to improve the flammable gas controls in the near term. DOE is confident that this is the most appropriate approach to implementing a more robust safety control for DSTs ventilation monitoring, consistent with Recommendation 2012-2.

If you have any further questions, please contact me or Mr. David Huizenga, Senior Advisor for Environmental Management, at (202) 586-7709.

Sincerely,

Ernest J. Moniz

Enclosure

U.S. Department of Energy

Implementation Plan
for
Defense Nuclear Facilities Safety Board
Recommendation 2012-2

Hanford Tank Farms Flammable Gas Safety Strategy

Washington, DC 20585

June 2013

Executive Summary

The purpose of this Implementation Plan (IP) is to specify Department of Energy (DOE) actions for addressing Defense Nuclear Facilities Safety Board (Board) Recommendation 2012-2, *Hanford Tank Farms Flammable Gas Safety Strategy.* DOE agrees with the Board that action must be taken to reduce the risk from the accumulation of flammable gases in the headspace of double-shell tanks (DSTs) at the Hanford Tank Farms.

In developing an IP, DOE has taken a pragmatic and graded approach to address the sub-recommendations to improve the flammable gas controls in the near term. DOE is confident this is the most appropriate approach to implement a more robust safety control for DST ventilation monitoring consistent with Board Recommendation 2012-2.

In February, DOE Tank Farm Operations Contractor (TOC) completed implementation of a revision to the Documented Safety Analysis (DSA) which added a new control that measures ventilation flow through each tank on a periodic basis, supplementing the existing flammable gas monitoring control. This revision also placed requirements on operability of the in-service and standby primary ventilation trains. DOE is currently working towards installation of safety-significant (SS) instrumentation for real-time monitoring of the ventilation exhaust flow from each DST. DOE will ensure that DST primary ventilation systems are classified as SS to support mixer pump operations to supply waste to the Waste Treatment and Immobilization Plant (WTP) as part of the overall Office of River Protection (ORP) Project. The time frames associated with DST waste generating sufficient flammable gas to potentially reach the Lower Flammability Level (LFL) provide the technical basis for using a phased approach for upgrading the DST ventilation systems.

Table of Contents

1.0 Background

The function of the five primary ventilation systems servicing the 28 DSTs at the Hanford Tank Farms is to remove flammable gases that are generated by the tank waste due to radiolysis, thermolysis, and corrosion. The DST primary ventilation systems maintain the concentration of flammable gases below the LFL in the DST headspace resulting from steady state and induced gas releases due to water additions, chemical additions, and waste transfers into DSTs.

In early 2010, DOE evaluated the DST primary ventilation systems as a preventive system and concluded that flammable gas generation rates were sufficiently low that an active ventilation system was not required, relying instead on flammable gas monitoring and the implementation of ignition controls to protect facility workers. DOE reclassified the DST primary ventilation systems as General Service (GS) equipment in the DSA for the Hanford Tank Farms.

Reliability of the existing flammable gas controls was questioned and in early 2011 DOE revised the DSA to require SS active ventilation. The TOC was directed to perform a gap analysis to identify differences between the functional/performance requirements for the systems to perform their safety function as SS systems and the existing system designs. This gap analysis was used to identify planned improvements to the DST primary ventilation systems. DOE also directed that compensatory measures be implemented to ensure worker safety until all the upgrades are completed. The slow flammable gas generation rates and analysis of flammable gas data measured during ventilation outages and AY and AZ tank farms allowed a graded approach to upgrading the ventilation systems.

In 2012, DOE sent a letter to the Board detailing DOE's near-term plans for DST ventilation system upgrades in Fiscal Years 2013 and 2014. This letter provided the compensatory measures in place and planned upgrades to safeguard the operability of the DST primary ventilation systems to ensure that flammable gases cannot accumulate to hazardous levels.

The Board, however, considered the control for flammable gas hazards to be inadequate and that the limited progress made and schedule delays to install hardware upgrades were cause for concern. On September 28, 2012, the Board approved Recommendation 2012-2, *Hanford Tank Farms Flammable Gas Safety Strategy.* The Recommendation identifies the need to take actions to reduce the risk posed by flammable gas events at the Hanford Tank Farms and included the following five sub-recommendations:

1. Take near-term action to restore the classification of the DST ventilation systems to SS. 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 SS 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.

On January 7, the Secretary accepted Board Recommendation 2012-2 and indicated DOE would take a pragmatic and graded approach to address the sub-recommendations that would improve the robustness of the flammable gas controls at the Hanford Tank Farms.

The purpose of this IP is to specify DOE actions for addressing Board Recommendation 2012-2, *Hanford Tank Farms Flammable Gas Safety Strategy.*

2.0 Summary of Hanford Tank Farms Flammable Gas Hazards

As presented in section 3.0 below, DOE will use a phased approach to improve DST flammable gas safety. This discussion of the flammable gas hazards is presented to demonstrate that this phased approach is appropriate and commensurate with the hazards.

Flammable gases are an ongoing hazard in the Hanford Tank Farms. There are three distinct types of hazards, each with different initiators and different applicable controls: (1) steady state gas accumulation; (2) a spontaneous gas release event; and (3) an induced gas release event.

Steady state gas accumulation occurs when flammable gas builds up in an enclosed space. Steady state flammable gas generation is recognized as an output from the stored Hanford DST wastes and all tanks have passive ventilation, which slows down gas build up. If the accumulation of flammable gas reaches 100 percent of the LFL, it could ignite, resulting in a significant facility worker hazard due to shrapnel, overpressure and chemical exposure. Steady state accumulation is a slow phenomenon allowing the active ventilation to remove the flammable gases.

A spontaneous gas release event occurs when flammable gas accumulates in the waste solids to the point where the solids experience a buoyant displacement gas release event (BDGRE). Five tanks (AN-103, AN-104, AN-105, AW-101 and SY-103) currently have the rheological properties to support a spontaneous BDGRE. If the flammable gas in the headspace due to the BDGRE were to exceed 100 percent of the LFL, it could ignite, resulting in a significant facility

worker hazard. Data on these tanks show that to date they have never had a release that approached the LFL and the size of the releases has been decreasing. The only tank that has ever experienced a large gas release event that exceeded 100 percent of the LFL was 241-SY-101; there was no ignition of the gas and no significant worker impact. The last SY-101 gas release event was in June, 1993; the tank waste has since been remediated by transfers and dilution. Tank SY-101 no longer has the waste properties that make a BDGRE possible since the highly concentrated salt crust and supernate have been diluted and material transferred out of the tank with the overall supernate specific gravity reduced from 1.5 to 1.1.

Hydrogen generation rates have been calculated for all 28 Hanford DSTs; the calculated rates range from 0.73 ft^3/day up to 81 ft^3/day. The calculated ventilation flow rate needed to maintain DST vapor space below 25 percent LFL ranges from < 0.1 ft^3/min to < 7 ft^3/min, and the flow rate to maintain tank vapor space below 100 percent LFL ranges from < 0.01 ft^3/min to < 2 ft^3/min. The AY and AZ tanks have the highest generation rates for all DSTs. Tank AY-102 has the highest generation rate of all of the DSTs. The gas accumulation in this tank could reach LFL, with no ventilation flow, within approximately 20 days. The ventilation flow rate in this tank would need to be approximately 1.4 to 1.5 ft^3/min to stay below the LFL.

All other DSTs require less than half that ventilation rate to stay below the LFL. This slow buildup of flammable gases is one of the reasons why a tailored approach to upgrading the DST ventilation system to SS is pragmatic and appropriate.

The third type of flammable gas release is an induced gas release event. This may occur when a significant amount of flammable gas accumulates in waste solids and an operational or external event causes a waste disturbance resulting in a release of the retained gas. Eleven DSTs have waste properties that could result in an induced gas release event. The only currently authorized activities that can induce such a release are water additions, chemical additions, or waste transfers, that result in dissolution of precipitated salts resulting in the release of any gas trapped in the salt.

A special case is a seismically-induced gas release event. The hazard of a seismically-induced flammable gas accident is limited to a subset of five DSTs (AN-103, AN-104, AN-105, AP-108 and SY-101) that are evaluated to potentially reach 100 percent of the LFL in the tank headspace. In a seismic event, a simultaneous gas release could occur and the active ventilation system would provide only a limited benefit since the release and ignition could be concurrent. In this case, the facility worker is protected by the existing requirement to evacuate the tank farms during the seismic event. Tank farm reentry and flammable gas monitoring would be performed in a controlled manner as part of the event response.

In order to support waste feed delivery to the WTP that will meet WTP waste acceptance criteria, mixer pumps are being designed and will eventually be installed at the Hanford Tank Farms. The operation of these pumps will add another activity that could result in an induced gas release event. Mixer pump operations have the potential to release the trapped gas at a rate much higher than is possible from salt dissolution. In addition, mixer pump operation will add significant quantities of energy as heat into the waste. As the temperature of the waste increases, the rate of

gas generation increases. Thus, DOE has committed to upgrade the DST active ventilation systems to support future mixer pump operations (DOE ORP letter from J.D. Dowell to Tim Dwyer, DNFSB, "Path Forward for Hanford Tank Farms Double-Shell Tank (DST) Ventilation System," 11-ORP-004, dated February 10, 2011). Due to the slow flammable gas generation rates, a phased approach is being used as described below.

As the first step, in February a safety basis amendment was implemented that treated the DST primary tank ventilation system like a SS control for the steady state and induced gas release hazards. The amendment requires, for steady state flammable gas hazards, that the flow from each tank be measured annually and immediately after repositioning a tank outlet isolation valve or a flow control valve (depending on the individual ventilation system). The required air flow rate exceeds the flow rate needed to maintain the headspace below 25 percent of the LFL by a factor of five to account for small changes that can impact the flow rate (e.g., High-Efficiency Particulate Air (HEPA) filter loading). The flow rate is measured using hand held probes.

For waste transfers that require induced gas release event controls, the flow will be verified prior to the transfer and once every 30 days thereafter (the frequency is based upon the potential impact of changes to the individual flow rate, including tank air in-leakage and HEPA filter loading). The flow rate will also be measured immediately after repositioning a tank outlet isolation valve (for AN, AP, AW and SY Farms) or a flow control valve (for AY and AZ Farms). In addition to the periodic flow rate verification, the tank headspace is checked every two hours to ensure it is still under vacuum. The revised controls require an operating DST primary tank ventilation system train and an operable back-up DST primary ventilation system train. In addition, a series of planned improvements are documented in the safety basis that are necessary for the DST primary tank ventilation systems to document and fulfill the critical characteristics needed to be fully qualified as a SS system.

Ongoing primary ventilation systems in the AZ/AY, SY, and AP Tank Farms will be upgraded to SS as a planned improvement with functional requirements driven by mixer pump operations. This includes significant modifications to the current systems (if not complete replacement), as well as the installation of permanently installed SS instrumentation to monitor ventilation flow through each tank (measured at the tank outlet) and the provision for installation of a SS backup power system for each ventilation system.

The two ventilation systems servicing the remaining DSTs (AN and AW Tank Farms) were recently replaced, although not as SS. They will be upgraded to SS status through the process for upgrading existing systems and equipment, again to support mixing operations in these DSTs. The TOC will identify the critical characteristics of system components that are required for the system to be designated as a SS system, and document how the system meets the critical characteristics. This includes the installation of permanently installed SS instrumentation to monitor ventilation flow through each tank (measured at the tank outlet) and the ability to provide SS backup power for each ventilation system. These are the most recently installed ventilation systems in the Hanford Tank Farms.

3.0 Summary of DOE Proposed Actions

The Board acknowledged in its Recommendation that some improvements had been made to the Specific Administrative Controls (SACs) used for flammable gas monitoring, but stated that the control remained an inadequate safety control and presented an unnecessary risk to safety. DOE has committed to making the ventilation system SS, but more work is needed to make the ventilation system a credited safety control.

DOE will implement more robust engineered SS flammable gas controls, both in the near term and in the future, to upgrade the remaining portions of the DST primary ventilation systems classified as SS Structure, System and Components (SSCs) to support mixer pump operations for tank waste feed to the WTP. DOE will use a phased approach to address the five sub-recommendations of the Board in order to better define near-term objectives and long-term goals to protect facility workers throughout the lifespan of the Hanford Tank Farm mission. This approach has been subdivided into the following three phases:

Phase 1: Improved Monitoring and Administrative Controls

In advance of the Board's Recommendation, the TOC was implementing the DOE-approved revised DSA. Implementation was completed in February. This included supplementing the flammable gas monitoring control with a new control that measures ventilation flow through each tank on a periodic basis. The safety basis also established priorities for DST primary tank ventilation system repairs for maintenance, commensurate with the importance of maintaining active ventilation on these tanks. Phase 1 is complete. The actions accomplished in Phase 1 were as follows:

1. Installation of sample ports on 28 individual DST primary ventilation exhaust ducts
   Completed December 2012

2. Implement approved Technical Safety Requirements (TSRs) to measure annually the individual DST exhaust air flow rate and verify that it is greater than or equal to 40 ft^3/minute. An annual surveillance periodicity was selected based on the margin in the required airflow and to accommodate HEPA filter loading changes or opening of tank risers, while at the same time minimizing facility worker hazards.
   Completed February 2013

3. Implement TSR Control ensuring the tank headspace for each tank is verified every 36 hours to be under vacuum (i.e., <0 inches Water Gauge). Individual tank airflow rates are required to be re-verified after any repositioning of a tank outlet isolation valve or flow control valve. For waste transfers that require induced gas release event controls, the flow will be verified prior to the transfer and once per 30 days thereafter.
   Completed February 2013

Phase 2: Implementing SS Flow Monitoring

A major improvement in flammable gas control strategy will be the installation of SS instrumentation for real-time monitoring of the ventilation exhaust flow from each DST. This will not involve confined-space, radiological pit entry for data collection as is currently required. This is considered a practical facility worker safety improvement to maintain radiological doses as low as reasonably achievable while also providing a robust safety-significant engineered control to provide exact real-time flow measurement through each tank. When complete, this will provide a significant improvement in the DST safety posture. As indicated below, Phase 2 is in progress.

1. Complete review and identify technologies deployed in both the DOE complex and commercial industry. Due to the required range in flow rates, the nature of the exhaust constituents, limitations due to access or configuration and the required high reliability of the equipment, there is a limited number of technologies that can be deployed for a permanently installed, real-time monitoring system.
   In progress: Work is ongoing to determine whether additional technologies are available; initial selection of differential pressure (pitot tube) and thermal dispersion mass flow technologies has been made.

2. Installation of instrumentation for real-time monitoring of the ventilation exhaust flow from each DST. DOE will install two separate flow monitoring systems in two tanks to evaluate equipment in the Hanford Tank Farms environment. Once a final equipment selection is made that SS system will be installed in all 28 DSTs.
   In progress: Initial selection of pitot tubes with micromanometers and Kurz thermal dispersion mass flow meters has been made. Equipment has been purchased and each type will be installed in both SY-102 and AZ-102. Design and work planning are nearing completion with installation to follow and data collection on track to start in June.

3. Implementation of remote readout to further minimize occupational exposures is a planned improvement.

Phase 3: Mixer Pump Operations at the Hanford Tank Farms

1. DST ventilation systems to support tank waste feed delivery to the WTP will be upgraded or designed and procured as SS. These systems will support mixer and transfer pump operations, which will be the subject of a future safety basis amendment.
   This will be required prior to mixer pump operation on each individual DST.

2. Complete design of the SS ventilation for AY and AZ Farms (as they are currently planned for the first mixer pump operation).
   Completed January 2013

4.0 DOE Resolution Approach to each Sub-Recommendation

The Board's Recommendation included specific sub-recommendations that will be addressed as part of ongoing activities at the Hanford Tank Farms. These actions will fully address the Board's concerns, as reflected in Recommendation 2012-2, regarding the potential hazard of a flammable gas release at the Hanford Tank Farms.

Board Sub-recommendation 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.*

DOE Implementation: The implementation of the safety basis amendment, which was completed on February 21, documents a series of planned improvements to upgrade the DST primary tank ventilation systems to meet SS requirements to prevent hazards due to the steady state generation of flammable gas and induced gas releases caused by solids dissolution (Washington River Protection Solutions LLC [WRPS] letter from M. D. Johnson to K. W. Smith, ORP, "Washington River Protection Solutions LLC Notification of Implementation of the Updated Tank Farms Safety Basis Amendment for Safety-Significant Designation of Double-Shell Tank Primary Tank Ventilation Systems," WRPS-1300382 R1).

Completion of the planned improvements will ensure the necessary attributes of the system are in place to meet the functional requirement of a SS system. Until the DST primary tank ventilation system is upgraded to SS, as discussed above, the safety basis amendment requires the existing DST primary tank ventilation system to be treated very similar to a SS system (see sub-recommendation 4 discussion below) and ventilation flow and flammable gas concentration monitoring is in place to verify the DST primary tank ventilation system is functioning properly (see sub-recommendation 2 discussion below). The implementation of the safety basis amendment requires the DST primary tank ventilation systems to be operating continuously, requiring an operable in-service train and standby train, establishing allowable outage times and associated surveillance frequencies and required actions. The priorities for DST primary tank ventilation system repairs for maintenance are commensurate with the importance of maintaining active ventilation on these tanks.

The revised safety basis documents the planned improvements needed to upgrade the DST primary tank ventilation systems to meet safety significant requirements to prevent hazards due to the steady state generation of flammable gas and induced gas releases caused by planned solids dissolution and/or future waste mixing. Among these planned improvements, the installation of SS instrumentation for real-time monitoring of the ventilation exhaust flow from each DST provides the greatest benefit and thus is given the highest priority (See sub-recommendation 2 discussion below).

DOE has directed the TOC to develop the following approach for upgrading the DST primary tank ventilation systems on a priority basis.

- Provide simplified back-up power systems and architecture that allows the Variable Frequency Drives (VFDs) and the basic process control system to be bypassed, thereby streamlining the current planned improvements related to emergency diesel generator systems, SS VFDs and SS control systems.
- Develop non-destructive examination methods to inspect the below grade ductwork.
- Complete the system interaction (two over one) evaluations.
- Eliminate single active failures in interfacing systems that could prevent operation of both primary tank ventilation system trains.
- Replace the existing AP and SY primary tank ventilation systems with the units that have been procured and are on site. Given that these units were procured as GS, the planned improvements discussed above are included in this activity.

Milestones and Deliverables:

Action 1-1: Implement the DOE-approved DSA and associated TSRs for DST Primary Tank Ventilation Systems.

Deliverable: A letter to the Board informing them the DSA Implementation is complete.

Expected Delivery Date: **Completed March 2013**

Lead: Assistant Manager Tank Farms Project

Action 1-2: Develop a streamlined approach to implementing the planned improvements for upgrading the DST primary tank ventilation systems to meet SS requirements.

Deliverable: A report describing the executable strategy, cost, and schedule for upgrading each DST primary tank ventilation system to meet SS requirements. This process will be documented and will include an evaluation of the approach described above, including the simplified back-up power system and architecture.

Expected Delivery Date: June 2014

Lead: Assistant Manager Tank Farms Project

Action 1-3: Develop a feasibility study for inspecting the condition and integrity of DST primary tank ventilation ductwork between the tank and flow monitoring locations.

Deliverable: The feasibility study for inspecting the condition and integrity of DST primary tank ventilation ductwork that will be upgraded to meet SS requirements.

Expected Delivery Date: This will be determined as part of Action 1-2.

Lead: Assistant Manager Tank Farms Project

Action 1-4: Upgrade the remaining DST active ventilation systems to meet SS requirements.

Deliverable: A letter to the Board informing it when each ventilation system has been upgraded to SS.

Expected Delivery Date: This will be contingent on when each DST ventilation system is upgraded prior to mixer pump operation for any DST served by that ventilation system.

Lead: Assistant Manager Tank Farms Project

Sub-recommendation 2: *Take near-term action to install safety-significant instrumentation for real-time monitoring of the ventilation exhaust flow from each DST.*

DOE Implementation: As noted above, on February 21, DOE completed the implementation of a safety basis amendment that requires periodic measurement of the flow rate in each DST ventilation exhaust duct. The measurement will be performed by hand-held instrumentation maintained and controlled under the measuring and test equipment program. This is an interim step until DOE can install real-time monitoring of the ventilation exhaust flow from each DST.

During this interim phase, the TOC will continue periodic flammable gas monitoring as a specific administrative control to provide an additional level of assurance that sufficient ventilation is being provided to maintain the DST headspace below 25 percent of the lower flammability limit. This SAC is written as a limiting condition for operation with a surveillance frequency based on the time for the DST headspace to increase by 25 percent of the LFL assuming no ventilation (i.e., the time to increase by 25 percent of the LFL is calculated as if the DST headspace was airtight). If flammable gases are ever detected above 25 percent of the LFL, ignition prevention controls are implemented.

DOE has directed the TOC to install and test flow meters to ensure that they will meet the needed requirements under conditions of the DST exhaust. WRPS has identified and purchased two instrument models that use different technologies based on thermal dispersion and pressure-differential measurement. Consideration was given to commercially available instruments used in a variety of industrial applications, including those currently in use at existing DOE facilities located at the Hanford and Savannah River sites. Each type of instrument selected will be installed on two different tanks to demonstrate that real-time flow measurements can be taken. The tank selection process also used a decision analysis approach, which rated all 28 DSTs in order to make a final selection of AZ-102 and SY-102 as the test locations. The test is planned to include 3 months of data gathering. The 3-month duration was selected based upon experience at the Hanford Tank Farms and the conditions (e.g., humidity, material carryover, and harsh chemical additions) which challenge the instruments over time. The test program will ensure the chosen instruments perform satisfactorily and potentially avoid significant

maintenance costs and downtime for cleaning, calibration or replacement. The test will result in a recommendation for installation of permanent SS real time flow measurement in the DST Tank Farms (Action 2-1).

Once the flow measuring instrumentation is identified, the instruments will be installed so that each of the 28 DSTs will have real-time monitoring of its exhaust flow (Action 2-2). At this point, a robust SS engineered system will be in place to provide flow measurement through each tank in real-time. A DSA/TSR change will incorporate this as a control (Action 2-3).

Milestones and Deliverables:

Action 2-1: Install and test flow meters in selected DST ventilation exhausts to evaluate instrument performance.

Deliverable: A letter to the Board providing the testing results and the expected implementation schedule for installation of permanent SS real-time flow measurement in the DST Tank Farms.

Expected Delivery Date: January 2014

Lead: Assistant Manager Tank Farms Project

Action 2-2: Install SS instrumentation for real-time monitoring of the ventilation exhaust flow from each DST.

Deliverable: A letter to the Board reporting the completion of the installation of flow measuring instrumentation.

Expected Delivery Date: October 2015

Lead: Assistant Manager Tank Farms Project

Action 2-3: Approve the safety basis amendment revising the flammable gas controls to use SS real-time flow monitoring instrumentation.

Deliverable: A copy of the safety evaluation report approving the safety basis amendment revising the flammable gas controls to use SS real-time flow monitoring.

Expected Delivery Date: October 2015

Lead: Assistant Manager Technical and Regulatory Support

Action 2-4: Implement a safety basis amendment revising the flammable gas controls to use SS real-time monitoring.

Deliverable: A letter to the Board forwarding the notice of implementation.

Expected Delivery Date: December 2015

Lead: Assistant Manager Tank Farms Project

Sub-recommendation 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.*

DOE Implementation: Installation of SS equipment for monitoring ventilation exhaust flow from each DST is discussed above. The double-contained receiver tank level indicators and the DST annulus level indicators are the only permanently installed pieces of equipment relied upon to fulfill a SS function. Currently, this instrumentation is maintained and controlled under the measuring and test equipment safety management program.

Improvements to upgrade the double-contained receiver tank level indicators and the DST annulus level indicators to SS will be completed (Action 3-1).

Milestones and Deliverables:

Action 3-1: Upgrade the 4 double-contained receiver tank level indicators and the 84 (three for each of the 28 DSTs) annulus level indicators that are used to fulfill safety functions to safety significant.

Deliverable: A letter to the Board reporting upgrade is complete

Expected Delivery Date: January 2015

Lead: Assistant Manager Tank Farms Project

Sub-recommendation 4: *Identify compensatory measures in case any existing DST ventilation systems become unavailable at the Hanford Tank Farms.*

DOE Implementation: On February 21, implementation of a safety basis amendment was completed. This amendment requires an operating DST primary tank ventilation system train (except for outages not to exceed 24 hours). To emphasize the importance of operating the DST primary ventilation systems continuously, limiting conditions for operation (LCO) are in place with required actions to restore ventilation in the event the primary tank ventilation system train is inoperable. In addition, the amendment requires a standby train that can be started within 8 hours (except for outages not to exceed 10 days). Should both the primary and standby train be inoperable, an LCO Action requires increased flammable gas monitoring (every 72 hours after the initial reading). Actions, including ignition controls, must be taken prior to the concentration of flammable gas exceeding 60 percent of the LFL. Furthermore, if there is an induced gas release hazard in a DST being ventilated by the system, the applicable LCO requires that any ongoing water additions, chemical additions, or waste transfers must be stopped within 4 hours if

active ventilation is lost. Stopping the addition/transfer limits the induced gas release rate from the dissolution of soluble settled solids to rates that are encompassed within the LCO Actions for the normal steady-state flammable gas hazard.

As part of phase 3 discussed in section 3.0, above, DST ventilation systems will be upgraded or designed and procured as SS. Completion of the planned improvements for each of the DST primary tank ventilation systems will document the necessary attributes of each system to meet the functional requirement of a SS system. That will include the applicability of redundant electrical power or a supplemental portable ventilation system to provide compensatory measures. Simplified back-up power systems and architecture would allow the VFDs and the basic process control system to be bypassed, thereby streamlining the current planned improvements related to emergency diesel generator systems, SS VFDs, and SS control systems.

Milestones and Deliverables:

Action 4-1: Implement the DOE-approved DSA and associated TSR for DST Primary Tank Ventilation Systems.

Deliverable: Notification to the Board of implementation of the DSA revision. (See Reference Number 5)

Expected Delivery Date: **Completed February 2013**

Lead: Assistant Manager, Tank Farms Project

Action 4-2: Demonstrate current capabilities to recover from a loss of ventilation.

Deliverable: A report describing the process for demonstrating the ability to recover from a loss of ventilation to include schedule, scope, depth, and process/approach. Once this approach is fully developed, reviewed, and approved, the plan will be executed and an evaluation report on the results will be completed that will include tank ventilation response to a loss of power, both historically and based upon current capabilities, including emergency management drill implementation. The report will include a corrective action plan to address any deficiencies and any required compensatory measures.

Expected Delivery Date: February 2014

Lead: Assistant Manager, Tank Farms Project

Action 4-3: Implement DST Primary Tank Ventilation System Compensatory Measures that will include the applicability of redundant electrical power or a supplemental portable ventilation system.

Deliverable: A letter to the Board informing them when each ventilation system is upgraded to SS that will include documentation of the planned improvements.

Expected Delivery Date: This will be contingent on when each DST ventilation system is upgraded prior to mixer pump operation for any DST served by that ventilation system.

Lead: Assistant Manager, Tank Farms Project

Sub-recommendation 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.*

DOE Implementation: Initial evaluation of approaches to address this concern are being performed. DOE will direct the contractor to evaluate potential means to reduce the inventory of retained flammable gases in DSTs in a controlled manner. This evaluation will consider methods to perform periodic mixing operations and other options to reduce gas retention (building upon the lessons learned from remediation of 101-SY, reference WHC-EP-0516, *Mitigation/Remediation Concepts for Hanford Site Flammable Gas Generating Waste Tanks*).

Milestones and Deliverables:

Action 5-1: Evaluate potential means to reduce the inventory of retained flammable gases in DSTs in a controlled manner.

Deliverable: A report evaluating potential options for reducing the inventory of retained flammable gases in DSTs in a controlled manner.

Expected Delivery Date: June 2014

Lead: Assistant Manager, Tank Farm Project

In summary, the DOE considers that these actions are technically and economically appropriate to achieve the overall objective of reducing the risk posed by flammable gas events at the Hanford Tank Farms and implement the overall intent of Board Recommendation 2012-2 in a manner commensurate with the risk.

5.0 Organization and Management

The Manager of ORP is the Responsible Manager for the execution of this IP. The Assistant Manager Tank Farms Project is the point-of-contact for the specific actions of this IP.

The ORP Manager will review the status of IP actions through periodic reports and regular briefings from the Tank Farms Integrated Project Team. When each IP action is complete, the ORP Manager will provide the specified notification to the Board.

To ensure that the various departmental implementing elements and the Board remains informed of the status of plan implementation, the DOE will provide an annual written report that identifies milestones completed during the year and summarizes progress made that year on open milestones.

Complex long-range plans require sufficient flexibility to accommodate changes in actions, or expected completion dates due to additional information, improvements, or changes in baseline assumptions. The DOE policy is to: (1) provide prior, written notification to the Board on the status of any IP deliverables that will not be completed by the planned date; (2) have the Secretary of Energy approve all revisions to the scope and schedule of plans; and (3) clearly identify and describe the revisions and basis for the revisions. Fundamental changes to the Plan's strategy, scope, or schedule will be provided to the Board through formal revision and reissuance of the IP. Other changes to the scope or schedule of IP will be formally submitted in appropriate correspondence approved by the Secretary of Energy, along with the basis for the changes and appropriate corrective actions.

6.0 References

1. DNFSB Recommendation 2012-2, *Hanford Tank Farms Flammable Gas Safety Strategy*, dated September 28, 2012

2. DOE Response to Recommendation 2012-2, dated January 7, 2013

3. HNF-SD-WM-TSR-006 Rev 7-P, Tank Farms Technical Safety Requirements

4. RPP-13033 Rev 4-T, Tank Farms Documented Safety Analysis

5. WRPS letter from M. D. Johnson to K. W. Smith, ORP, "Washington River Protection Solutions LLC Notification of Implementation of the Updated Tank Farms Safety Basis Amendment for Safety-Significant Designation of Double-Shell Tank Primary Tank Ventilation Systems," WRPS-1300382 R1, dated February 28, 2013

6. DOE ORP letter from J.D. Dowell to Tim Dwyer, DNFSB, "Path Foward for Hanford Tank Farms Double-Shell Tank (DST) Ventilation System." 11-ORP-004, dated February 10, 2011

7. WHC-EP-0516, Mitigation/Remediation Concepts for Hanford Site Flammable Gas Generating Waste Tanks