The Secretary of Energy
Washington, D.C. 20585

September 22, 2009

The Honorable John Mansfield
Vice Chairman
Defense Nuclear Facilities Safety Board
625 Indiana Avenue, NW, Suite 700
Washington, DC 20004-2901

Dear Vice Chairman:

Enclosed is the Department of Energy's revised Implementation Plan (IP) which addresses the remaining open commitments for Defense Nuclear Facilities Safety Board's Recommendation 2001-1, High-Level Waste Management at the Savannah River Site (SRS). This revision reflects completion of commitments that were enabled by resolution of several regulatory and legal issues. This IP revision also addresses the three remaining open commitments identified in the March 31, 2009, letter from former Chairman Eggenberger: 1) Commitment 2.14, "Startup the Salt Waste Processing Facility (SWPF)"; 2) Commitment 3.9a; "Return Tank 48 to Unrestricted Tank Farm Service"; and 3) Commitment 3.10, "Startup a Defense Waste Processing Facility (DWPF) evaporator."

First, this IP revision reflects a new date of October 2015 for CD-4, Approve Start of Operations or Project Completion for SWPF, based on a new baseline. The subsequent introduction of radioactive salt waste for processing in SWPF (i.e., begin SWPF radioactive operations) is forecast for December 2015. Second, the revision reflects a new date for returning Tank 48 to unrestricted service (Commitment 3.9a) of December 2014, based on selection of a new technology that was not reflected at the time of the previous IP revision. Third, this IP revision replaces Commitment 3.10 "Startup of a DWPF Evaporator" with a new commitment, Commitment 3.12 "Reduce DWPF Recycle by 1.25 million gallons per year." Finally, this IP includes several additional planned measures to mitigate the risks of delaying the remaining commitments.

If you have any further questions, please call me or Dr. Inès R.Triay, Assistant Secretary for Environmental Management, at (202) 586-7709.

Sincerely,

Steven Chu

Enclosure

DOE REVISED PLAN CONCERNING SAVANNAH RIVER SITE'S HIGH LEVEL WASTE MANAGEMENT STRATEGY

DNFSB RECOMMENDATION 2001-1 IMPLEMENTATION PLAN

REVISION 5

August 2009

Executive Summary

On March 23, 2001, the Defense Nuclear Facilities Safety Board (DNFSB) issued Recommendation 2001-1, *High-Level Waste Management at the Savannah River Site.* The recommendation addressed the need for the Department of Energy (DOE) to ensure that the margin of safety and amount of tank space in the Savannah River Site (SRS) High Level Waste (HLW) system is sufficiently maintained to enable timely stabilization of nuclear materials at SRS.

The DOE accepted this recommendation as appropriately highlighting the need to vigorously address the significant management challenges that SRS faces in accomplishing the strategic mission of waste stabilization in light of the failure of the In-Tank Precipitation (ITP) process, tank leaks, and other equipment problems. These events precipitated major changes in mission planning and identified the need to regain operational flexibility, increase system margins to deal with potential future system upsets, and proceed with an alternative salt disposition process. DOE agreed with the DNFSB that addressing these issues should ensure continued safe storage of wastes, as well as continued stabilization of both high level waste and nuclear materials at SRS.

The original plan outlined the actions that DOE and its contractor were going to take to ensure continued safe storage of waste while maintaining operational flexibility and progress in the stabilization of material currently held in waste storage tanks. Actions included pumping down liquid levels to below the lowest leak sites in two tanks, implementing an alternative salt disposition process, re-evaluating waste treatment and storage options, and conducting an independent assessment of the contractor incentives.

Revision 2 of this Implementation Plan (IP) was submitted to the Board on May 10, 2002, as specified in Commitment 2.6 to provide additional commitments related to the implementation of a revised salt processing program. Six new commitments and the associated background discussion were added to the end of the subrecommendation 2 section.

Revision 3 of the IP, which was submitted to the Board on January 17, 2006, was generated as a result of delays in meeting Commitments 2.9, Demonstrate the Viability of Deliquification, Dissolution, and Adjustment (DDA) and Commitment 2.10, Demonstrate the Viability of the Actinide Removal Process (ARP). Because of the delays in these activities, the changes in facility conditions, and other changes impacting tank space management, Revision 3 re-evaluated the DNFSB's original concerns and recommendations in light of the circumstances in the early calendar year 2006 timeframe and set forth a modified strategy to address the issues.

Revision 4 of the IP, submitted to the Board on July 11, 2006, was generated to reflect continuing delays in implementing Commitment 2.9, Demonstrate the Viability of the Deliquification, Dissolution, and Adjustment (DDA) process. These delays were the result of ongoing discussions with the State of South Carolina regarding the DOE's January 2006 *Section 3116 Determination for Salt Waste Disposal at the Savannah River Site.* Subsequent legal challenges to a South Carolina modified permit needed to dispose of treated salt waste at the

Saltstone Facility further delayed DOE's progress in meeting Commitments 2.9 for DDA; as well as Commitment 2.10 "Demonstrate the viability of the actinide removal process (ARP); and Commitment 2.13 "Begin Modular CSSX (Caustic Solvent Side Extraction) Unit (MCU) radioactive operations. Following resolution of the legal issues in August 2007, the modified Saltstone operating permit was issued, and DOE completed these three commitments (Commitment 2.9 in February 2008; and Commitments 2.10 and 2.13 in May 2008). DOE has slightly refined its approach for treating the SRS salt waste. Under the refined approach, DOE plans to: 1) treat and dispose of less waste with DDA, the least effective of the interim processes, by limiting the DDA material to waste contained in Tank 41 as of June 9, 2003, (along with associated waste streams used to adjust salt to meet processing requirements as described in the permit); 2) further process some waste with ARP/MCU that was originally planned to be processed with DDA alone; 3) pursue the treatment and destruction of organic laden material in Tank 48 (originally planned to be processed at the Saltstone Facility along with DDA waste); and 4) construct new lag storage vessels for the Saltstone Production Facility, subject to compliance with the National Environmental Policy Act. This refined approach is consistent with the National Academy of Sciences (NAS) recommendation to limit the use of DDA, will decrease the curies disposed of at SRS, and will be consistent with the conclusions in the 3116 Determination.

This document, Revision 5, addresses the three remaining open commitments, which the DNFSB commented on in their March 31, 2009, letter. Those three remaining commitments are: 1) Startup the Salt Waste Processing Facility (Commitment 2.14); 2) Return Tank 48 to unrestricted tank farm service (Commitment 3.9a) and; 3) Startup a DWPF evaporator (Commitment 3.10). This revision deletes the commitment to startup a DWPF evaporator, provides new dates for Commitment 2.14 and Commitment 3.9a and adds two new commitments. The first of the new commitments (3.9b) is for approval of the project baseline for Tank 48 recovery at CD-2. The second new commitment (3.12) stems from the recently awarded contract for management of the SRS Liquid Waste system to Savannah River Remediation, LLC (SRR). SRR has proposed to implement facility modifications at the Defense Waste Processing Facility (DWPF) which are projected to collectively reduce the volume of DWPF recycle to the tank farms by 1.25 million gallons per year. DOE has incorporated this proposed recycle reduction as a contract performance requirement and as a new commitment within this IP revision.

This Plan identifies the responsible manager and provides a due date for completion for each commitment. The responsible manager ensures the activity is satisfactorily completed, including seeking necessary funding, and is formally closed. Mr. Dae Chung, Principal Deputy Assistant Secretary for Environmental Management, is the overall Responsible Manager and Mr. Jeffrey Allison, Manager, Savannah River Operations Office, is the point-of-contact for site-specific activities.

Table of Contents

1. Background

On March 23, 2001, the Defense Nuclear Facilities Safety Board (DNFSB) issued Recommendation 2001-1, *High-Level Waste Management at the Savannah River Site*. The recommendation addresses the need for the Department of Energy (DOE) to ensure that the margin of safety and amount of tank space at SRS is sufficiently maintained to enable timely stabilization of nuclear materials at SRS. The DOE accepted the recommendation as addressed in the Implementation Plan (IP) provided to the Board on May 18, 2001. On May 24, 2001, the DNFSB responded in a letter in which it found the original IP was not responsive to all elements of the recommendation and provided a suggested course of action for consideration by the DOE during the formulation of a revised IP. The DOE evaluated the concerns described in the DNFSB's May 24, 2001, letter and revision 1 to the original plan incorporated and addressed the DNFSB's expected actions.

Revision 2 of this IP was generated as specified in Commitment 2.6 to provide additional commitments related to the implementation of a revised salt processing program. Six new commitments and the associated background discussion were added to the end of the sub-recommendation 2 section. All commitments made in Revision 2 except two were completed. Due to legal and technical issues, delays were experienced in meeting Commitments 2.9, Demonstrate the Viability of Deliquification, Dissolution, and Adjustment (DDA), and Commitment 2.10, Demonstrate the Viability of the Actinide Removal Process (ARP). As a result of these delays, changes in facility conditions, and adjustments in program direction, Revision 3 of this IP was a complete re-evaluation of the original issues in light of circumstances at that time. Neither the text nor the commitment summaries retain all of the original responses and actions (review of Revision 2 is required to understand a number of actions already completed).

Revision 3 of this IP was a complete re-evaluation of the original issues in light of circumstances at that time. Neither the text nor the commitment summaries retain all of the original responses and actions (review of Revision 2 is required to understand a number of actions already completed).

Revision 4 reflected the approach refinements associated with DOE's January 2006 *Section 3116 Determination for Salt Waste Disposal at the Savannah River Site* and provided minor updates as appropriate.

This document, Revision 5, addresses the three remaining open commitments, which the DNFSB commented on, in their March 31, 2009, letter. Those three remaining commitments are: 1) Startup the Salt Waste Processing Facility (Commitment 2.14); 2) Return Tank 48 to unrestricted tank farm service (Commitment 3.9a); and 3) Startup a DWPF evaporator (Commitment 3.10). This revision deletes the commitment to startup a DWPF evaporator (3.10), provides new dates for Commitment 2.14 and Commitment 3.9a and adds two new commitments. The first of the new commitments (3.b) is for establishing the project baseline for Tank 48 recovery at CD-2. The second new commitment (3.12) stems from the recently awarded contract for management of the SRS Liquid Waste system to Savannah River Remediation, LLC (SRR). SRR has proposed

to implement facility modifications at the Defense Waste Processing Facility (DWPF) which are projected to collectively reduce the volume of DWPF recycle to the tank farms by 1.25 million gallons per year. DOE has incorporated this proposed recycle reduction as a contract performance requirement and as a new commitment within this IP revision.

2. Underlying Causes

The underlying causes of the matters highlighted in Recommendation 2001-1 were the failure of the In-Tank Precipitation (ITP) process for pretreating salt waste, a tank leak to the annulus in Tank 6, and other equipment problems within the waste system. These events, along with litigation, forced major changes in the overall system plans and added a level of complexity to the already challenging mission objectives. The actions identified in this Plan are intended to outline the major objectives and milestones to ensure mission objectives are safely achieved.

3. Summary of Completed and Near-Term Actions

With the completion of Commitment 2.9, Demonstrate the Viability of Deliquification, Dissolution, and Adjustment (DDA) in February 2008 and completion of Commitment 2.10, Demonstrate the Viability of the Actinide Removal Process (ARP) in May 2008, all commitments in Revision 2 of the IP are complete. Additionally, Commitment 2.13, Begin Modular CSSX (Caustic Side Solvent Extraction) Unit (MCU) radioactive operations, from Revision 3, was completed in May 2008.

This document, Revision 5, addresses the remaining open commitments of Commitment 2.14, Begin Salt Waste Processing Facility (SWPF) radioactive operations; Commitment 3.9a, Return of Tank 48 to waste service; and Commitment 3.10, Startup a DWPF evaporator. Two commitments are added to this revision to clarify current system status and path forward. The first of the commitments is for establishing the project performance baseline for Tank 48 recovery at CD-2. The second commitment stems from the newly awarded contract for management of the SRS Liquid Waste System to Savannah River Remediation, LLC (SRR). SRR has proposed to implement facility modifications at the DWPF which are projected to collectively reduce the volume of DWPF recycle to the tank farms by 1.25 million gallons per year and DOE has incorporated this proposed recycle reduction as a contract performance requirement.

4. Recommendation Issue Resolution

The Board's subrecommendations and the specific actions to address each are discussed below.

Subrecommendation 1. Initiate actions to remove transferable HLW liquid from Tank 6 to a level below all known leak sites.

Background: After a January 2001 transfer of low activity waste water into an older style (Type I) tank (Tank 6) that had been essentially empty since 1973, alarms were received in the control room indicating liquid in the annulus area (collection space between the tank wall and the

concrete vault that encases the tank). Visual inspections confirmed liquid in the annulus and sampling identified the material as radioactive waste (versus rainwater intrusion). Detailed inspections using a remote crawler and video camera identified 6 leak sites. An initial transfer of 40,000 gallons of liquid from Tank 6 into Tank 8 was completed on March 27, 2001. On May 1, 2001, the contractor was directed to lower the level of waste in Tank 6 to below the lowest known leak site. This activity was completed on May 30, 2001.

Usage of non-compliant tanks: DOE continues to authorize additions and transfers into the Type I and Type II style tanks on a case-by-case basis. Such additions and transfers are limited to only those required to facilitate waste removal activities, waste processing activities, or to provide storage of low-activity, aluminum-rich supernate which has been separated from sludge waste undergoing preparation for feed to DWPF. Typical additions include liquid needed to slurry/mix the sludge, liquid needed to facilitate transfer of the waste from the tank, liquids required to keep a "wet" sludge from "drying", liquids for heel removal, liquids for flushing or cleaning equipment/tank structures, and chemicals for corrosion control. Typical waste transfers include movement of waste or residual heels from another older style tank into a Type I and Type II style tank when those tanks are part of the transfer path to a waste processing unit. Specifically, waste from Tanks 5 and 6 was transferred (and waste from Tank 4 is planned to be transferred) to Tank 7 before being transferred to Extended Sludge Processing (ESP) due to the existing transfer piping arrangements. Similarly, Tank 13 in H Tank Farm is used as the staging and transfer path for waste and residual heel removal for H Area tanks due to its existing piping arrangements. Another waste transfer example was the use of existing Tank 7 supernate to suspend the Tank 5 sludge. This allowed for the beneficial reuse of liquids needed to slurry/mix the sludge from this tank without creating additional "new" waste volumes. Several precautions are followed in use of Type I and II tanks. These include maintaining levels below known leak sites, and implementing measures agreed to with the State of South Carolina for use of these older-style tanks.

Additionally, during sludge batch preparation, aluminum is dissolved from sludge that has been removed from old-style tanks to lessen the number of canisters made at DWPF. This aluminum-rich liquid is temporarily stored in Type I and Type II style tanks with sound structural integrity until it can be processed through SWPF as part of the salt solution feed stream. Tank 11 is currently used for this purpose and Tank 8 is planned to be used for this purpose.

Subrecommendation 2. Reassess the schedule and priority for selecting a technology for a salt processing capability, and vigorously accelerate the schedule leading to operation of a salt processing facility.

Background: At the point of DWPF startup in 1996, the system plan consisted of two waste pretreatment processes – sludge preparation via the ESP and salt preparation via ITP. Due to initial startup issues with the ITP process (see Board Recommendation 96-1), DWPF began operations processing sludge only. In 1998, due to concerns the ITP process could not cost-effectively meet both safety and production objectives, the contractor recommended and the DOE agreed to suspend ITP startup activities and to perform an extensive evaluation of alternative processing options. The alternative evaluation resulted in the selection of a solvent extraction

based process for cesium removal in lieu of ITP. A contract has been established to build and operate a Salt Waste Processing Facility (SWPF) based on this solvent extraction process and the project is currently in the construction stage.

DOE's modified salt processing strategy was described in Revision 4 of the IP. In August 2007 resolution of legal challenges to a South Carolina modified permit needed to dispose of treated salt waste in the Saltstone Disposal Facility resulted in refinement of the approach, consisting of: 1) treating and disposing of less waste with DDA, the least effective of the interim processes by limiting the DDA material to waste contained in Tank 41 as of June 9, 2003, (along with associated low-level waste streams used to adjust salt to meet processing requirements as described in the permit); and 2) processing additional waste with ARP/MCU than was originally planned to be processed with DDA alone. The material to be dispositioned via DOE's salt disposition strategy must meet the proposed Saltstone Production Facility waste acceptance criteria and the solidified waste form disposed at the Saltstone Disposal Facility must not exceed Nuclear Regulatory Commission concentration limits for Class C low level waste as specified in 10 CFR 61.55.

DOE prepared the Saltstone Facility to safely and efficiently process the low activity salt solutions. In order to process the DDA material, modifications were made to the Saltstone Facility to handle higher activity levels than the original design basis of the Saltstone Facility. The primary modifications were related to operating personnel safety. Changes to the facility include increased equipment shielding to reduce radiation exposure, improvements to increase equipment reliability and reduce hands-on maintenance, and modifications to effectively deal with process upsets.

In addition to the tank space recovered by the waste processed through the DDA process, space is also expected to be recovered via proposed operation of two processes that employ the same technologies as SWPF. These two new processes are known as the ARP and MCU. ARP reduces the actinide and strontium content of salt solution via adsorption and filtration. The MCU reduces the Cs-137 concentration via a counter-current solvent extraction process using a highly specialized solvent (BoBCalix) developed by the DOE for this purpose. ARP and MCU are planned to be operated on an interim basis and shut down prior to SWPF startup.

The ARP processing is accomplished by modification of two existing buildings; the 241-96H building (previously known as the ITP stripper building) and the 512-S building (previously known as Late Wash). Tanks in 241-96H allow for a chemical strike of monosodium titanate (MST) and the filter in the 512-S building separates the actinide and strontium laden MST for transfer to DWPF. MCU is a new structure within the H-Tank Farm. While MCU does not have the same throughput or removal efficiency as the SWPF, it operates similarly to the Cs-137 removal process of SWPF, and will provide early feedback on operational issues and opportunities with SWPF. The ARP and MCU began operations in May 2008 and have processed 285,000 gallons of salt waste as of May 15, 2009.

DOE recognizes the importance of SWPF to the long-term completion of its mission. DOE has assigned dedicated resources to manage the design, construction, and initial operation of this

facility in conformance with DOE Order 413.3A, *Program and Project Management for the Acquisition of Capital Assets,* and has utilized an Engineering, Procurement, and Construction (EPC) contractor outside of the traditional Management and Operating (M&O) contract strategy for the SWPF. The July 2006 Revision 4 to the IP preceded establishment of the project baseline at Critical Decision 2 (CD-2), Approve Performance Baseline, in September 2007 and approval of the Critical Decision 3 (CD-3), Approve Start of Construction, milestone in January 2009. This document, Revision 5, adjusts the commitment date for startup of this facility and also clarifies the title of the commitment to "Begin SWPF radioactive operations," as that milestone identifies when significant risk reduction through salt processing in SWPF begins. The approval memorandum for CD-3, Approve Start of Construction, established a new approved baseline for CD-4, Approve Start of Operations or Project Completion, of October 2015, which includes 126 weeks of schedule contingency. The subsequent introduction of radioactive material for processing in SWPF (i.e., begin SWPF radioactive operations) is forecast for December 2015.

In summary, DOE continues to aggressively pursue a multi-phased approach to salt disposition, has identified the project risks, and is working to address the risks identified. DOE continually re-assesses the impacts of issues on program implementation and provides the DNFSB staff periodic updates on program status and timely notification of significant events.

All previous commitments associated with this subrecommendation except 2.14 for startup of SWPF have been successfully completed.

Commitment 2.9:	Demonstrate the viability of the Deliquification, Dissolution, and Adjustment (DDA).
Lead Responsibility:	Manager, Savannah River Operations Office
Deliverable:	Complete disposition of 100K gallons of salt solutions in Saltstone.
Due Date:	90 days after issuance of the low activity Saltstone Facility disposal permit (i.e., Industrial Solid Waste Landfill permit)
Status:	**Completed February 2008**
Commitment 2.10:	Demonstrate the viability of the actinide removal process (ARP).
Lead Responsibility:	Manager, Savannah River Operations Office
Deliverable:	Complete the first batch actinide removal process.
Due Date:	November 2007
Status:	**Completed May 2008**
Commitment 2.13:	Begin Modular CSSX (Caustic Solvent Side Extraction) Unit (MCU) radioactive operations.
Lead Responsibility:	Manager, Savannah River Operations Office
Deliverable:	Radioactive material introduced for processing in MCU.
Due Date:	November 2007
Status:	**Completed May 2008**

Commitment 2.14:	Begin Salt Waste Processing Facility (SWPF) processing operations.
Lead Responsibility:	Manager, Savannah River Operations Office
Deliverable:	Radioactive material introduced for processing in SWPF.
Revised Due Date:	**December 2015** (revised from September 2011)

Technical Justification for the change: The original commitment date provided in January 2006 (Revision 3) and July 2006 (Revision 4) preceded establishment of the SWPF CD-2 project baseline in September 2007 in conformance with DOE Order 413.3A. Per the approval memorandum for the CD-3, Approve Start of Construction, the new approved baseline for CD-4, Approve Start of Operations or Project Completion, is October 2015, which includes 126 weeks of schedule contingency. The subsequent introduction of radioactive material for processing in SWPF (start of radioactive operations) is forecast for December 2015.

Additional Measures: Continue and enhance the efficiency of Interim Salt Processing operations using ARP/MCU by preventive maintenance, incorporation of design improvements, and spare parts to extend service life beyond 2012.

An evaluation of the risk of a delay in startup of SWPF and an identification of risk handling strategies that are being implemented for this risk are provided in Risk #205 of *PBS-SR-0014 Radioactive Liquid Tank Waste Stabilization and Disposition Risk Management Plan, Revision 4.*

To provide additional confidence in the ability to meet construction project milestones for all its major construction projects, the Assistant Secretary for Environmental Management has initiated several practices. These include:

- Establishment of a process to perform periodic independent Construction Project Reviews. The first of these reviews for SWPF is planned for late FY2009. It is expected that these reviews will be performed under the leadership of senior EM Headquarters staff, approximately every six months, and will serve as a mechanism by which potential issues that could jeopardize project cost and schedule baselines can be identified in a timely manner so that necessary corrective actions or resources can be applied to address the issues.
- Performance of rigorous quality assurance audits to identify potential issues with project design, procurement, and construction. Over the last two years EM has performed over twenty such audits and reviews.

Subrecommendation 3. Develop and implement an integrated plan for HLW tank space management that emphasizes continued safe operation of the Tank Farms throughout its life cycle. This plan should include enough margin to accommodate contingencies and reduce overall programmatic risk. The plan should also restore operating margin to the Tank Farms by including actions to: [see sections a- e below]

Background: The Tank Farm space management strategy is based on a set of key assumptions involving projections of DWPF canister production rates, influent stream volumes, Tank Farm evaporator performance, and space gain initiative implementation. Tank space management is a component of the overall integrated Liquid Waste Disposition System Plan and as such is a life-cycle look at the space available to accommodate contingencies and support site missions until closure of the tanks and associated waste processing facilities. Revision 14 of the Liquid Waste Disposition System plan, provided to the Board in October 2007 via commitment 3.11, modeled tank space until mission completion, and incorporated the latest salt strategy, as well as the current planning for sludge processing. Under contractual obligations associated with the newly awarded contract for management and operation of the SRS liquid system, SRR is required to prepare an update to the Liquid Waste Disposition System Plan that reflects their proposed technical approach to management and operation of the SRS liquid waste system within six months of commencing work. SRR assumed full contractual responsibility for the liquid waste system on July 1, 2009. Hence a revision to the Liquid Waste Disposition System Plan is expected by the end of calendar year 2009.

DOE will continue to explore options and develop contingency plans to support the earliest liquid waste system mission completion dates.

a. Reduce or eliminate the DWPF recycle stream

Although DWPF recycle is the largest single contributor of waste volume to the tank farms, DOE has been able to maintain a steady, stable volume of available space, since DWPF startup and recycle began in 1996. This has primarily been achieved by successfully utilizing the 2H Evaporator to manage the recycle volumes over the last 13 years, including four successful chemical cleanings of the 2H Evaporator pot. The average volume reduction of DWPF recycle water transferred to the H Tank Farm has been 1.6 million gallons per year and the 2H Evaporator had to operate at an average utility of only 56% per year during that period to generate those results. Additionally, ARP and MCU are now operational, and the direct beneficial reuse of DWPF recycle for salt dissolution in tanks and sodium molarity adjustment of the salt batch feeds to these processes (on the order of one million gallons per year) has been confirmed. With the start of SWPF operations, DWPF recycle can be applied to help fill the need for up to 4.8 million gallons per year needed for salt dissolution and molarity adjustment. Further, DOE envisions that the recycle could additionally be used for tank heel removal as well as the first wash of the sludge batch preparation process in the ESP.

Two old-style non-compliant tanks are used to receive, store and prepare the DWPF recycle prior to processing in the 2H Evaporator. The low levels of radioactivity and other hazardous constituents in this stream permit the use of these non-compliant tanks in this application to preserve available compliant tank space. Since DWPF recycle is stored in old-style tanks, reducing DWPF recycle waste does not improve the availability of volume in compliant tanks.

Actions taken in the past to reduce DWPF recycle waste sent to the Tank Farms include the isolation of the steam atomized scrubber (SAS) system from the melter off-gas system in January 2000. This resulted in an annual 700,000-gallon reduction in recycle being sent to the Tank Farm. However recent operational experience has resulted in the need to periodically restore scrubber flow to maintain a nominal operational life of the high efficiency mist elimination filters. Implementation of proposals associated with the frit transfer system and reductions in sample line flushes also resulted in additional water generation reductions.

A DWPF Recycle Management Plan (RMP) was developed in June 2008. The plan projects that between the 2H Evaporator system's capability to the reduce DWPF recycle volume and the planned beneficial usage of DWPF recycle for salt dissolution and sodium molarity adjustment of salt solution feeds for salt processing, the Liquid Waste system can adequately accommodate the DWPF recycle volume generated through 2017. Beyond 2017, the projected demand for utilization of recycle in the Tank Farm for salt dissolution and sodium molarity adjustment exceeds the volume of recycle generated by DWPF through the end of the life-cycle.

Further reductions in the volume of DWPF recycle are included in SRR's technical approach to implement facility modifications at DWPF which will collectively reduce the volume of DWPF recycle to the tank farms by 1.25 million gallons per year. These modifications are:

- Installation of a dry (vs. slurry) frit delivery system (250 kgal/yr).
- Installation of an air supply (vs. steam) to the melter off-gas treatment system (400 kgal/yr).
- Installation of a solids/liquid separator for canister decontamination solution (600 kgal/yr).

An evaluation of the risk of a failure of the 2H Evaporator system and an identification of risk handling strategies that are being implemented for this risk are provided in Risk #92 of *PBS-SR-0014 Radioactive Liquid Tank Waste Stabilization and Disposition Risk Management Plan, Revision 4*. The feasibility of various DWPF recycle handling approaches such as modular package evaporators have been evaluated for risk reduction purposes. However, implementation of the recycle handling strategies identified in the DWPF RMP and the initiatives for recycle reduction and beneficial use of recycle included in the SRR's technical approach will result in greater benefit than implementation of a recycle evaporator.

In the interests of ensuring management of DWPF recycle using the two old-style tanks for receipt and storage so as to preclude any potential impact on operating margin in compliant tanks, DOE is adding a new commitment to reduce the DWPF recycle volume by 1.25 million gallons per year by December 2011 by implementation of the 3 modifications to DWPF as described earlier in this IP.

b. Recover former ITP tanks for Tank Farm operations

The three primary tanks associated with the ITP process were Tank 48, Tank 49 and Tank 50.

Tank 49 was returned to service in 2001.

Tank 50 serves as a receipt tank for Effluent Treatment Facility bottoms and as a feed tank to the Saltstone Facility. As the primary interface tank between the Tank Farms and Saltstone, Tank 50 currently serves as a critical resource in salt disposition. This tank is a new-style, compliant tank and its value in being able to provide reserve compliant tank space volume capacity has prompted DOE to begin activities to place this tank in general service. This will require additional low level waste lag storage capability to be installed at the Saltstone Production Facility prior to the start-up of SWPF to receive the higher volume of decontaminated salt solution from that operation.

Tank 48, which contains approximately 250,000 gallons of precipitate from the startup of the ITP process, has been evaluated for possible return to the tank farm system since 2002. DOE intends to recover Tank 48 for waste service unrestricted by organics, to assure sufficient tank space is available to prepare and feed salt solutions to SWPF in an efficient manner. Technical challenges must be resolved in order to safely return Tank 48 to service while precluding unacceptable levels of organics in facilities downstream of the tank farms. In 2005 a team was chartered to define an achievable and allowable end state for the Tank 48H Project. The team divided this major activity into three tasks: 1) identify through a parametric evaluation, a reasonable and acceptable range of potassium tetraphenylborate (KTPB) residual quantities to be left in Tank 48H at the end of recovery actions, along with the technical basis and assumptions through a parametric evaluation; 2) identify a reasonably conservative KTPB degradation rate based on Savannah River National Laboratory studies; and 3) determine the impact of various residual amounts of KTPB on the downstream processes after Tank 48H is returned to service. Based on the results of these work activities, DOE provided to the Board a technical evaluation of acceptable Tank 48 residual levels on April 4, 2006, and closed Commitment 3.8. This approach proposed aggregation of the material with the DDA material to be disposed in the Saltstone Disposal Facility.

Based on discussions with the State of South Carolina and adhering to the principle of minimizing the curies to be dispositioned in the Saltstone vaults, DOE directed the contractor to develop organic destruction as the primary option for Tank 48 material disposition and for aggregation to become the backup alternative. Revision 4 to this implementation plan reflected this change in the approach from aggregation to organic destruction, but did not modify the Commitment 3.9a date of January 2010 for recovery of Tank 48, which was based on the aggregation approach. After receiving direction from DOE, the contractor began feasibility testing for two candidate technologies for organic destruction in late 2006 and 2007. The two technologies were Fluidized Bed Steam Reforming (FBSR) and Wet Air Oxidation (WAO). During 2007 the technology maturity for each was assessed, test reports were reviewed by independent technical teams, and

additional testing was planned in Technology Maturation Plans for each technology to address the issues identified. The system plan provided to the Board in October 2007 assumed a return-to-service date of September 2012, based upon the change in approach from aggregation to organic destruction. Subsequently, in March 2008, the Tank 48 Treatment Project received approval for CD-1, Approve Alternative Selection and Cost Range, in accordance with DOE O 413.3A. The primary technology selected was FBSR, with WAO identified as a backup. CD-1 for this project also established a schedule range for CD-4, Approve Start of Operations or Project Completion from November 2011 to August 2012. On June 2, 2009, following maturation of the two technologies, the contractor submitted its Business Decision to DOE recommending FBSR as the single preferred technology for remediation of Tank 48 and on June 10, 2009, and DOE accepted the contractor's recommendation.

A Board letter of March 5, 2009, to DOE about the Tank 48 Treatment Project notes a concern with "continued delays" in this project. DOE continues to follow the process prescribed in DOE Order 413.3A for this project. Based on a parametric comparison to the Integrated Salt Disposition Project (ISDP), CD-4 for the Tank 48 Treatment Project is projected as August 2012. ISDP was chosen for comparison because, as a project, it had similar scope, rough order of magnitude (ROM) cost, and similar magnitude of technology development challenge as the Tank 48 Project. Additionally, the CD-1 for the Tank 48 project, issued in February 2008, contained a CD-4 date range of November 2011 to August 2012. In order to prepare an update to the IP at this time, the CD-4 date of August 2012 will be formally maintained until CD-2, when the project baseline is formally established. As of June 2009 the planned treatment rate and the subsequent heel removal of the Tank 48 contents are expected to take up to 28 months to complete following approval of CD-4.

For these reasons, Tank 48 return to unrestricted HLW service is projected for December 2014. This revision of the IP therefore changes the due date for Commitment 3.9a "Return of Tank 48 to waste service" to December 2014. This date is based on the current Tank 48 Treatment Project level of maturity and is subject to change in the future, consistent with following the DOE Order 413.3A process, and approval of project Critical Decisions for the Tank 48 Treatment Project.

An evaluation of the risk of a delay in the Tank 48 return to unrestricted HLW service and an identification of risk handling strategies that are being implemented for this risk are provided in Risk #184 of *PBS-SR-0014 Radioactive Liquid Tank Waste Stabilization and Disposition Risk Management Plan, Revision 4.*

In the interests of ensuring that the Board is fully informed of progress for this project, DOE is adding a new commitment (3.9b) related to returning Tank 48 return to service, which is for approval of CD-2, Approve Performance Baseline, in conformance with DOE Order 413.3A.

c. Assess the desirability of adding an additional HLW evaporator to support Tank Farm operations

With three operating evaporators, sufficient evaporator capacity already exists in the Tank Farms. The operational limitations on the existing evaporators are largely support-system related. Operation of the evaporators is heavily dependent on sufficient tank space for storage of saltcake after the waste has been concentrated. These factors are DOE's basis for determining that no additional tank farm evaporators are needed; however, previous revisions of this IP did propose an evaporator at DWPF as a way to minimize generation of new salt waste in the tank farms and reduce DWPF's dependency on Tank Farm evaporator operations – see subrecommendations 3a and 3e.

As noted in the beginning of this subrecommendation, the DWPF RMP projects that between the 2H Evaporator system's capability to the reduce DWPF recycle volume and the planned beneficial usage of DWPF recycle for salt dissolution and sodium molarity adjustment of salt solution feeds for salt processing, the Liquid Waste system can adequately accommodate the DWPF recycle volume generated through 2017 and that the projected beneficial use of recycle in the Tank Farm will accommodate all the volume of recycle from 2018 through the end of the Tank System program life-cycle. DOE considers that implementation of the recycle handling strategies identified in the DWPF RMP along with the initiatives for recycle reduction and beneficial use of recycle included in the SRR's technical approach offer greater benefit than would be realized through implementation of a recycle evaporator. DOE is therefore deleting Commitment 3.10, Startup of a DWPF Evaporator.

d. Assess the feasibility of constructing new waste storage tanks

Given the long lead times to permit and construct a new waste storage tank and the increased costs for closure of an additional tank, no additional waste storage tanks are proposed. It is also expected that system modeling of the integrated liquid waste facilities and processes will confirm that no additional tanks are required to store, treat and manage the high level waste within the requirements put forth by the Federal Facility Agreement. The results of this modeling will be factored into the development of Revision 15 of the Liquid Waste Disposition System Plan scheduled for release in October 2009. Although no new waste storage tanks are proposed, recent integrated flow balance projections between DWPF, SWPF, and Saltstone have indicated a need for reassessment for staging tanks to improve process efficiencies.

e. Resolve waste compatibility and equipment degradation problems to allow unconstrained operation of the three existing evaporators

DOE recognizes that the multiple evaporator systems are critical to liquid volume reduction and managing tank space to support waste disposition operations. Specifically, the 2H Evaporator is dedicated to DWPF recycle waste streams that are typically high in silica, and the 2F/3 H Evaporators are dedicated to non-silica waste volume reduction.

While there are initiatives to reduce the DWPF recycle stream, and clear opportunities for the beneficial reuse of DWPF recycle for salt waste dissolution and salt batch molarity adjustment, DOE continues to maintain a strong focus on ensuring the operability of the 2H Evaporator system to support DWPF operations. Based on 2H Evaporator system operational history, DOE is confident in the continued viability of the 2H Evaporator to perform this role.

Improvements made to the 2F Evaporator system during FY 2000 made that system more reliable, and current performance has met system planning requirements. While the 2F Evaporator pot is currently beyond its projected life expectancy, recent inspections demonstrate it remains in good physical condition. A spare evaporator pot has been procured and is staged onsite for either the 2F or 2H Evaporator in the event one is needed. Modifications are required to the spare pot depending on the needed location. Work packages have been pre-staged to perform these modifications and the activities required to perform a pot replacement have been outlined. The last evaporator pot replacement occurred in the 1990's and was completed within 30 days. Predictive and preventive maintenance programs implemented since that time should extend service life, and lessons learned from that activity and pre-staging of work packages and parts should shorten outage time should such a replacement be required. No impact to continued DWPF operation is expected as a result of an outage for evaporator pot replacement.

The 3H Evaporator system is operating in a limited mode due to the restricted cooling rate of its concentrate receipt tank (Tank 30). However, despite this operational constraint, the 3H Evaporator system received and processed all necessary sludge wash decant wash water in support of the preparation of Sludge Batch 5 (i.e. over 900,000 gallons). Alternatives to ensure sufficient evaporative capacity for Sludge Batch 6 are being pursued including the concurrent use of the 2F Evaporator system, as well as continued operation of the 3H Evaporator system in a reduced capacity. The current availability of space in Tank 37 (the 3H Evaporator system alternate concentrate receipt tank) would permit the 3H Evaporator system to provide the sole evaporative capacity to fully support preparation of Sludge Batch 6.

The 2H Evaporator continues to meet system planning requirements. A total of four chemical cleanings have been performed since DWPF startup (3 using acid; 1 using caustic). The first acid chemical cleaning was completed in late 2001 and was successful in removing solids from the 2H pot. A second chemical cleaning campaign was completed in early 2006 which used NaOH instead of acid. The NaOH chemical cleaning campaign was only marginally effective in removing the solids from the 2H pot. A third acid chemical cleaning campaign was completed late 2006 and was successful in removing the solids from the 2H pot. The fourth (last) acid chemical cleaning campaign was completed late 2008 and was successful in removing 2H solids.

Two de-liquoring campaigns have been performed on the 2H system since DWPF startup. During late 2003, 800,000 gallons of liquor were removed. During early 2009, 400,000 gallons of liquor were removed. The 2H Evaporator demonstrated the ability to operate

at maximum steam flows after each de-liquoring campaign. The liquor removed from the 2H system is being used, in lieu of inhibited water and caustic, in the sludge removal program for the next sludge batch. The 2H Evaporator sustained maximum steam flows for approximately 12 months after the first de-liquoring.

DOE's space management history since DWPF startup and recycle handling began in 1996 has maintained a steady, stable volume of available space. The 2H Evaporator has successfully managed the recycle volumes over the last 13 years, which included four successful chemical cleanings of the 2H Evaporator system. ARP/MCU is now operational, and uses some of the recycle for salt dissolution and sodium molarity adjustment. Additionally, DOE expects that DWPF recycle will be used for tank heel removal and the first wash of the sludge batch preparation process.

Recent past operational history for the 2H evaporator system has demonstrated its capability to reduce the recycle water generated by DWPF operations of up to 2.1 million gallons per year, achieving an average reduction of 1.6 million gallons per year for the period FY05 – FY08). This has been accomplished through reduced frequency and duration of cleaning cycles and improved 2H system health monitoring and predictive maintenance resulting in less unplanned outages.

DOE continues to monitor tank space utilization at SRS on a routine basis. Performance indicators have been developed to provide management the ability to assess performance against the goals of the interim processing strategy. These indicators include waste tank summary reports each year which document waste transfers, evaporator performance, and total space gain. These reports are available back to FY 2001.

All but two previous commitments associated with this subrecommendation have been successfully completed. One of the two commitments is withdrawn, and two new interim commitments are added with the updated status for the two remaining commitments are shown below.

Commitment 3.8:	Complete technical evaluation of acceptable Tank 48 residual levels.
Lead Responsibility:	Manager, Savannah River Operations Office
Deliverable:	Technical report.
Due Date:	March 2006
Status:	**Completed April 2006**
Commitment 3.9:	Develop plan and schedule for return of Tank 48 to waste service.
Lead Responsibility:	Manager, Savannah River Operations Office
Deliverable:	Commitment date to restore Tank 48 to waste service.
Due Date:	March 2006
Status:	**Completed April 2006**
Commitment 3.9a:	Return of Tank 48 to waste service.
Lead Responsibility:	Manager, Savannah River Operations Office

Deliverable:	Disposition of Tank 48 material to residual quantities and authorization to introduce new waste into Tank 48.
Due Date:	**December 2014, revised from January 2010** (subject to revision based upon approved performance baseline at CD-2, in accordance with DOE 413.3A)

Technical Justification for the Change: The original July 2006 Revision 4 commitment date was provided two months after DOE directed the contractor to re-orient the Tank 48 recovery approach from aggregation to organic destruction, and 20 months before the conceptual schedule range was approved in March 2008 at CD-1. At CD-1, the schedule range for CD-4 was identified as November 2011 to August 2012. Similar to projecting SWPF startup before CD-2, there is high uncertainty associated with revising this commitment date prior to completing conceptual design and establishing an approved CD-2 project baseline. For this reason, DOE is adding an interim commitment to obtain Tank 48 Project CD-2 Approval in November 2010. This forecast CD-2 date is a best estimate due to the fact that subcontract vendor proposals for design and process module fabrication have not yet been received. It is expected that upon approval of CD-2, the due date for Commitment 3.9b, Return of Tank 48 to waste service can be revised with more confidence.

Commitment 3.9b:	Return of Tank 48 to waste service.
Lead Responsibility:	Manager, Savannah River Operations Office
Deliverable:	Obtain Tank 48 Project CD-2 Approval.
Due Date:	**November 2010**

Commitment 3.10:	Startup a DWPF evaporator.
Lead Responsibility:	Manager, Savannah River Operations Office
Deliverable:	Begin radioactive operations of a DWPF evaporator.
Due Date:	**This commitment is withdrawn in its entirety (from July 2011 in Rev 4)**

Commitment 3.11:	Issue a program evaluation for integration of processing facilities.
Lead Responsibility:	Manager, Savannah River Operations Office
Deliverable:	Program Evaluation.
Due Date:	November 2006
Status:	**Completed October 2007.**

Commitment 3.12:	Reduce DWPF Recycle by 1.25 million gallons per year.
Lead Responsibility:	Manager, Savannah River Operations Office
Deliverable:	Complete modifications at DWPF associated with recycle reduction – dry frit delivery system, air supply to melter off-gas treatment system, and solids/liquid separator for canister decontamination solution.
Due Date:	**December 2011**

Technical Justification for the Change: At the time that DNFSB Recommendation 2001-1 was written, the tank farm's ability to receive and evaporate DWPF recycle was significantly impacted by unresolved issues relating to formation of sodium aluminosilicate scale inside of the 2H evaporator pot. In 2001 it was uncertain as to whether or not the scale could be removed and could the formation of additional scale be managed. In the years since, the tank farms have demonstrated the ability to manage scale formation and remove accumulated scale such that the evaporating capacity of the 2H evaporator has exceeded influents of DWPF recycle. As a result, storage of DWPF recycle has been able to be limited to only Type IV tanks. These methods of controlling and managing scale formation will continue to provide adequate evaporator utility through SWPF startup. Upon startup of SWPF, beneficial reuse of DWPF recycle for salt batch molarity adjustment and salt dissolution (as described in the *DWPF Recycle Management Plan*) will further reduce the required evaporation capacity of the 2H evaporator. Although additional storage space in a Type IV tank would provide some benefit to the overall liquid waste system health, additional usable storage space in a Type III tank would provide significantly greater benefit. An evaluation of the risk of DWPF recycle volume exceeding the capacity of the 2H evaporator and an identification of risk handling strategies that are being implemented for this risk are provided in Risk #116 of *PBS-SR-0014 Radioactive Liquid Tank Waste Stabilization and Disposition Risk Management Plan, Revision 4.*

Additional Measures: An Unreviewed Safety Question Evaluation (USQE) was performed on the proposed activity of a delaying the completion of Commitments 3.9a and 3.10 as described above. The USQE did not identify a reduction in safety resulting from the delays and, as a result, compensatory measures to mitigate additional safety risks are not necessary. As discussed above, risk handling strategies have been identified in the Risk Management Plan for addressing delay in completion of each of the outstanding Commitments. The adequacy and execution of the risk handling strategies will be continually assessed as part of DOE's robust Risk Management process.

Subrecommendation 4. Reassess contractor incentives to ensure that near-term production at DWPF is not overemphasized at the expense of safety margin in the Tank Farms

Background: The newly awarded contract for management and operation of the SRS Liquid Waste system is a cost plus award fee contract which is a Federal Acquisition Regulation (FAR) based contract that differs from prior contracts for this workscope that were M&O contracts. In this new contract, commitments made in the contract awardee's technical proposal have been incorporated into the contract as contract requirements. The incentive structure to be put in place for this contract will be tied to these contractual commitments. SRR technical proposal comprehensively addresses DOE's stated desire to optimize Liquid Waste system performance, i.e., accelerate tank closures and maximize waste throughput at the Defense Waste Processing Facility while ensuring sufficient tank space for continued long-term operation. SRR technical approach calls for the early operational closure of noncompliant tanks at SRS, the reduction of the DWPF recycle stream by 1.25 million gallons per year, and a number of other initiatives directed at improving the safety margin in the Tank Farms. DOE will, in the development of its Performance Evaluation and Measurement Plan for SRR, incorporate incentives to ensure that near-term DWPF production is not overemphasized at the expense of safety margin in the Tank

Farms.

All previous commitments associated with this subrecommendation have been successfully completed and no additional commitments are planned for this issue.

5.0 Management and Organization

The Principal Deputy Assistant Secretary (PDAS) for Environmental Management is the Responsible Manager for this IP. The PDAS is responsible for ensuring that all associated planning, response, and implementation activities are performed consistent with requirements and guidance provided in *Interface with the Defense Nuclear Facilities Safety Board* (DOE M 140.1-1B). The Manager for the Savannah River Operations Office is the point of contact for the site-specific actions for this recommendation.

To ensure that the various Departmental implementing elements and the DNFSB remain informed of the status of Plan implementation, DOE's policy is to provide periodic progress reports until IP commitments are completed. For this Plan, the Responsible Manager and/or designee is expected to provide annual reports (either in oral briefings or written format) to the DNFSB and/or its staff.

This Plan requires sufficient flexibility to accommodate changes in commitments, actions, or completion dates that may be necessary due to additional information, improvements, or changes in baseline assumptions. DOE's policy is to: 1) provide prior, written notification to the DNFSB on the status of any Plan commitment that is not be completed by the planned milestone date; 2) have the Secretary of Energy approve all revisions to the scope and schedule of Plan commitments; and 3) clearly identify and describe the revisions and basis for the revisions. Fundamental changes to the Plan's strategy, scope, or schedule are expected to be provided to the DNFSB through formal revision and re-issuance of the Plan. Other changes to the scope or schedule of planned commitments are expected to be formally submitted in appropriate correspondence approved by the Secretary, along with the basis for the changes and appropriate corrective actions.