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Department of Energy

Washington, DC 20585

March 19, 2010

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

Dear Vice Chairman:

This is in response to your January 7, 2010, letter to Dr. Steven Chu, Secretary of Energy, requesting additional information prior to acceptance of Revision 5 of the Department of Energy's (DOE) Implementation Plan (IP) for Defense Nuclear Facilities Safety Board's Recommendation 2001-1, *High-Level Waste Management at the Savannah River Site (SRS)*. Your letter expressed concern with two commitments in Revision 5: 1) Startup of the Salt Waste Processing Facility (SWPF) and; 2) Return of Tank 48 to waste service being delayed by approximately four and five years, respectively.

Specifically you asked that DOE provide:

- An updated and thorough assessment of the risks associated with the delays proposed in Revision 5 of the IP for Recommendation 2001-1. This assessment should include impacts to available tank space over time, impacts to salt and sludge processing, and impacts on aging equipment (See Enclosure 1).

- A list of the risk-handling strategies (beyond the Risk Management Plan) necessary to prevent or mitigate the risks identified by the risk assessment (See Enclosure 1).

- The analytical basis for accepting the risk: rather than mitigating the risk of a leak from a high-level waste tank that uses all contingency tank space Risk #149 in Revision 4 of the Risk Management Plan (See Enclosure 2).

- Proposed new interim milestones for the recovery of Tank 48 and for activities leading to radioactive operations of the SWPF.

For Tank 48, Revision 5 of the IP added new Commitment 3.9b, to provide an updated baseline and projection for returning Tank 48 to service based on the approval of Critical Decision 2 (CD-2) that is planned for November 2010. As noted in Revision 5 of the IP, the forecast CD-2 date was a best estimate due to the fact that subcontract vendor proposals for design and process module fabrication had not been received. Therefore, Environmental Management (EM) Headquarters (HQ) and SRS look forward to continuing discussions with your staff during execution of the Tank 48 project, including quarterly updates:

Progress toward achievement of Critical Decisions 2 and 3.
Completion of SWPF Salt Batch 1 preparation, prior to the start up of SWPF.

For SWPF, the approved baseline for CD-4, Approve Start of Operations or Project Completion is October 2015, which includes 126 weeks of scheduled contingency. This date is included in Revision 5 of the IP which was submitted to the Board on September 22, 2009. EM HQ and SRS look forward to continuing discussions with your staff during construction of the SWPF, including semi-annual updates regarding the use of schedule contingency and the resulting effect on the current forecasted dates of achieving the following interim milestones:

- Roof at Elevation 154': Early finish date - November 30, 2011; Late finish date - June 30, 2013.
- Cold Commissioning Start: Early finish date - September 30, 2012; Late finish date - September 30, 2014.

If you have any questions, please contact me at (202) 586-7709, or Dr. Steven L. Krahn, Deputy Assistant Secretary for Safety and Security Program at (202) 586-5151.

Sincerely,

Inés R. Triay
Assistant Secretary for
Environmental Management

Enclosures

SEPARATION

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ENCLOSURE 1: RESPONSE TO DEFENSE NUCLEAR FACILITIES SAFETY BOARD LETTER REGARDING IMPACTS OF DELAYS IN SWPF STARTUP AND TANK 48 RETURN TO SERVICE

INTRODUCTION

A Defense Nuclear Facilities Safety Board (DNFSB) letter dated January 7, 2010, identified the need for an assessment of the risks associated with delays to Salt Waste Processing Facility (SWPF) startup, Tank 48 return to service, and list of risk-handling strategies [1]. These concerns are as follows, excerpted from Reference 1.

- **Assessment of the risks associated with the delays to SWPF startup and Tank 48 Return to Service, including impacts to available tank space over time, impacts to salt and sludge processing, and impacts on aging equipment.**
- **A list of the risk-handling strategies (beyond the Risk Management Plan) necessary to prevent or mitigate the risks identified by the risk assessment.**

This document briefly outlines the approach and results of the assessment that address the effects of these delays on the specific areas of concern.

BACKGROUND

The Savannah River Site (SRS) Liquid Waste (LW) system consists of several facilities to safely receive and store radioactive waste, treat, and permanently dispose waste as shown in Figure 1.

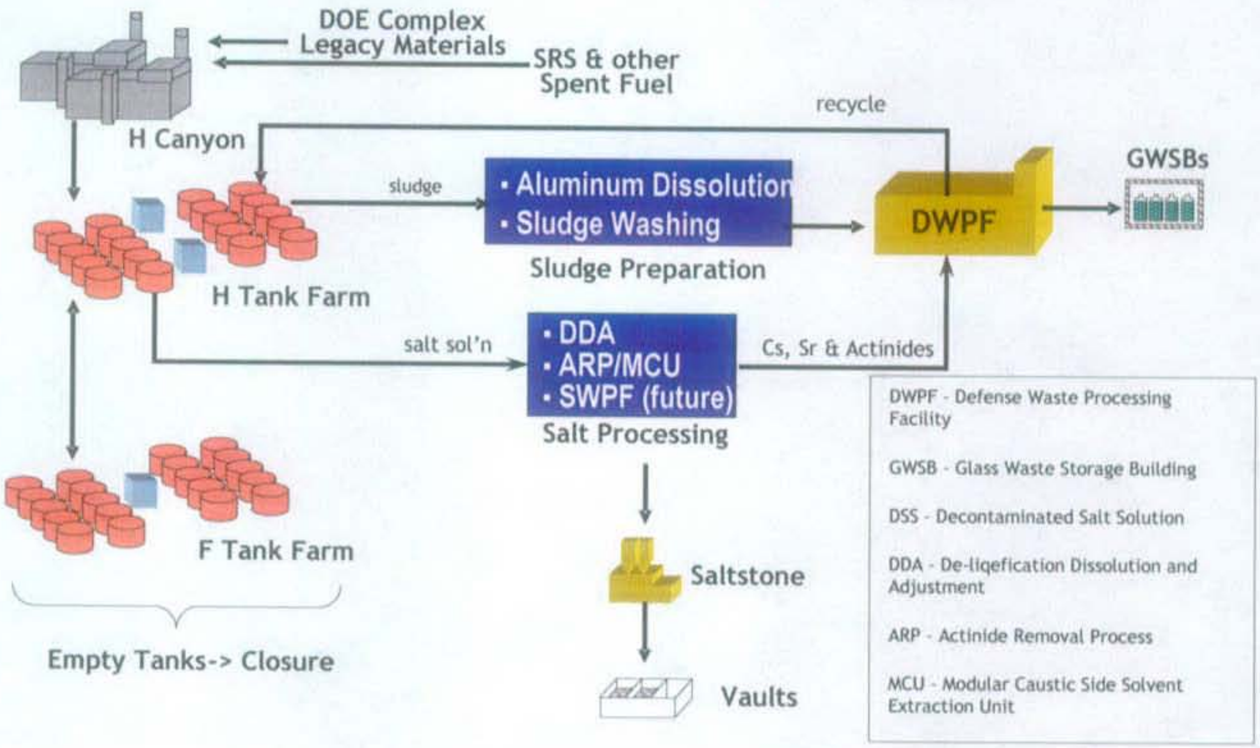

Figure 1: Liquid Waste System

Distributed between F and H tank farms are 51 underground waste storage tanks of which 45 are operational, two are closed, and four are in final cleaning being prepared for final closure. The 51 waste tanks at SRS are of four types:

- Type I/II tanks are "old-style" tanks that have partial secondary containment and 12 of 16 have leaked into the annular space. ***These tanks are a high priority for closure.***
- Type IV tanks are "old-style" single shell tanks. ***These tanks are a high priority for closure.***
- Type III/IIIA tanks are "new-style" double shell tanks with full secondary containment and no history of leakage.

The waste from these tanks is retrieved and treated as sludge or salt. Once the waste is retrieved and processed, the tanks are prepared for closure. Closure consists of removing the bulk of the waste, chemical cleaning, heel removal, stabilizing remaining residuals with tailored grout formulations and severing/sealing external penetrations. The waste retrieval and tank closure process requires the use of tank space to permanently dispose of salt and sludge waste. The focus of the significant overall risk reduction is through disposition of sludge and salt from the old-style tanks, of which 12 of 16 have leaked into the partial secondary containment.

As a result of this waste removal from the high priority tanks, of the 12 SRS tanks with leakage history:

- One contains only dry waste (with no free liquid supernate that could leak) and no further cleaning is required.
- Eight are currently stable (with little or no free liquid supernate that could leak).
- Three that contain free liquid supernate are (and will remain) under SRR surveillance program until emptied.

A summary of the remaining contents of the old-style tanks is shown in Figure 2.

Figure 2: Current Old-Style Tank Contents

From FY1996 through August 2009, over 2,700 canisters of waste have been vitrified. This represents approximately 40% of the total projected 7,235 canisters. The canisters vitrified to date have contained sludge waste, and since April 2008 they have also contained processed salt waste. These canisters represent:

- ~40% of sludge waste mass immobilized
- ~1% of salt waste volume dispositioned

The processing of salt and sludge utilizes new-style tank space to process waste in old-style tanks, and therefore new-style tank space will only become available once all waste in old-style tanks is processed. Sludge processing through the Defense Waste Processing Facility (DWPF) removes the highest risk material from the old-style tanks. However, for every 1.0 gallon of sludge processed, 1.3 gallons of salt waste is formed due to sludge washing and DWPF processing operations to return the resulting low hazard salt waste to the tank farm. Similarly, salt processing typically requires the use of four gallons of tank space per gallon of salt waste processed. As such, it is well recognized that the "key to reducing the overall risk is processing high-level waste as expeditiously as possible and managing the total tank space efficiently" [1].

ASSESSMENT APPROACH

Revisions 14 and 15 of the System Plan and the coincident Risk Management Plan were used to assess the impacts of the SWPF and Tank 48 Return to service delays on available tank space over time, impacts to salt and sludge processing, and impacts to aging equipment [2,3]. The assessment also includes on-going risk handling strategies.

The current Revision 15 of the SRS Liquid Waste System Plan documents the current operating strategy of the LW system. A comprehensive identification and analysis of risks and opportunities identified with the execution of the System Plan are documented within the *Radioactive Liquid Tank Waste Stabilization and Disposition Technical and Programmatic Risk Assessment Report* [4]. It is developed concurrently with the System Plan and documents a correlation between System Plan assumptions and individual risks, and presents strategies for handling risks and opportunities for the near–term and outyears.

Revision 15 of the System Plan, in contrast to Revision 14, reflects the strategy of the newly awarded DOE LW contract "...to optimize Liquid Waste system performance, i.e., accelerate tank closures and maximize waste throughput at DWPF". The System Plan assumes deployment of several new technologies and approaches to meet these objectives:

- Enhanced chemical cleaning of tanks after bulk waste removal (BWR) is complete.
- Melter bubbler technology to improve the throughput of the DWPF melter.
- DWPF feed preparation improvements to reduce processing time within DWPF.
- Rotary microfiltration to decrease wash water generated during sludge batch preparation.
- Low temperature aluminum dissolution of sludge to minimize DWPF canister count.
- Optimization of the tank closure documentation process to enable a reduction in the tank closure process cycle time.

Revision 15 of the System Plan also performs alternatives analyses, e.g. Modular Salt Processing (MSP), which provides the basis for new initiatives to reduce the life-cycle of the LW mission at SRS. These base and alternatives analyses are summarized as results in the context of risk-handling strategies.

RESULTS

Impacts to Available Tank Space Over Time

Figure 3 compares a forecast of usable tank space from the present through completion of the cleanup mission, as displayed in appendices of Revision 14 and Revision 15 of the System Plan. The reduction in usable tank space after 2023 is indicative of tank closure. The graph also indicates the unit operations that either create usable tank space or utilize tank space. Figure 3 indicates a near term minimum of 4 Mgal of usable tank space, or 2.7 Mgal after deducting the reserved contingency space, which is a result of efficiently managing the unit operations which produce or consume space.

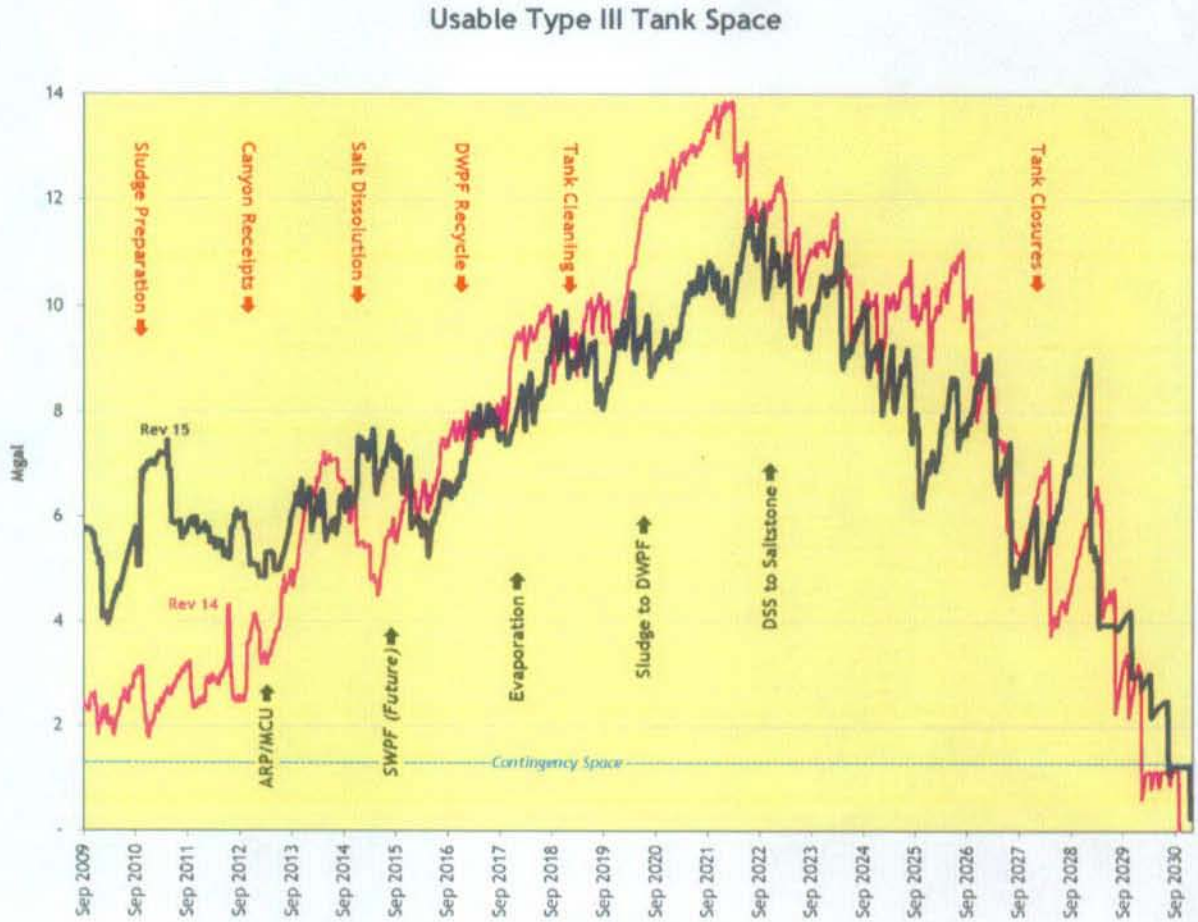

Figure 3: Usable Type III Tank Space Impacts

Ongoing Risk Handling Strategies: Data shown in Table 1 indicate that approximately 12 millions gallons of usable space have been created over the last three years from (1) evaporator operations, (2) DWPF vitrification, (3) Interim Salt Disposition Process Treatment; and (4) saltstone disposal. This valuable space has been used to: (1) remove waste from and clean old-style tanks; (2) prepare, qualify, and treat sludge waste for disposal; (3) prepare, qualify, treat, and dispose salt waste; and (4) support nuclear materials stabilization and disposal through H-Canyon.

Table 1: Gallons (in 1000s) of Usable Tank Space Recovered

	FY07	FY08	FY09	Total
Evaporator Operations	1,908	2,348	3,827	8,083
DWPF Vitrification	169	280	227	676
ISDP Treatment	N/A	144	560	704
Saltstone Disposal	253	1,289	1,556	3,098
Total	**2,330**	**4,061**	**6,170**	**12,561**

Since July of 2006, as a result of the above unit operations, 9 million curies of sludge and 4 million curies of supernate have been removed from the old-style tanks, thereby reducing the radiological risks of storing waste in those tanks.

Impact to Salt/Sludge Processing

Revision 15 of the system plan documents impacts to salt and sludge processing from the delays as presented in Table 2. Revision 5 of the *Radioactive Liquid Tank Waste Stabilization and Disposition Technical and Programmatic Risk Assessment Report* identifies mitigative actions to delays in Tank 48 return to service (Risk 184) and SWPF operation (Risk 205).

Table 2: Impacts to Salt/Sludge Processing and Risk Handling Strategies (RHS)

	Rev. 5 IP (8/2009)	Impact to Salt Processing	Impact to Sludge Processing	RHS
Tank 48	Return to Service Delayed to 12/2014 from 1/2010	Delay to 12/2014 was a realization of Risk 184 in RMP rev 4. The Risk Handling Strategy (RHS) identified in the RMP to mitigate this risk was to "develop a plan for SWPF feed preparation that avoids reliance on Tank 48 availability." This RHS was implemented in revision 15 of the System Plan which utilizes Tanks 35, 41, and 50 for SWPF feed preparation at SWPF startup.	None identified	Implemented with revision 15 of the System Plan
SWPF	Radioactive Materials introduced for Processing at SWPF delayed to 12/2015 from 11/2011 Current RMP assumes SWPF 5/2013	Rev. 15 system plan assumes 5/2013 startup, but performs alternative analysis for 9/2015 A delay in SWPF startup to 9/2015 • Delays waste removal from all tanks from 2030 to 2034 • Delays waste removal and closure	Rev. 15 system plan assumes 5/2013 startup, but performs alternative analysis for 9/2015 A delay in SWPF startup to 9/2015 • Reduces DWPF canister production from 400 canisters per year to 200 canisters per year for a	Extend ARP/MCU operations to continue up to 6 months prior to SWPF startup (implemented with revision 15 of the System Plan) Mature and deploy WD compliant salt processing and disposal technologies

	Rev. 5 IP (8/2009)	Impact to Salt Processing	Impact to Sludge Processing	RHS
		of Old-Style Tanks 1,2,3,9,10,21 which contain salt waste. • Delays closure of last old-style tank from 2018 to 2021	period of four and half years which delays the date at which all sludge waste is vitrified from 2023 to 2027	to supplement SWPF and Saltstone processing capability (in progress)

Disposition of salt waste is the critical path to program completion, and SWPF is the cornerstone of the salt processing strategy. During the period prior to startup of the SWPF, salt waste disposition will continue through the ARP/MCU facilities. DDA processing was required prior to startup of the ARP/MCU facilities to enable continued tank closure activities, to sustain sludge disposition activities in DWPF, and to minimize continued limited use of old-style tanks. During the DDA phase, approximately 2.8 million gallons of dissolved salt solution from Tank 41 and associated adjustment streams were dispositioned. Approximately 850,000 gallons of salt waste have been dispositioned through ARP/MCU since startup in April 2008.

Revision 15 of the System Plan forecasts the production of approximately 250 salt-only canisters during the period from May 2023 (when all sludge has been depleted) to December 2030. An opportunity exists to reduce or eliminate this "salt-only" campaign by augmenting the total salt processing capacity of the liquid waste system. Modular Salt Processing (MSP) through addition of small column ion exchange (SCIX) having the capacity to treat approximately 2.5 million gallons per year of salt solution is proposed, which, when combined with SWPF, would bring the total salt processing annual capacity of the liquid waste system up to 8.5 million gallons. MSP could begin operating as soon as October 2013 and would enable completion of salt processing in 2024, a full six years sooner than in the base case. Increasing the salt processing rate by 2.5 million gallons per year increases the requirements for Saltstone processing beyond its current attainment. The current SRS baseline (as reflected in System Plan, Rev. 15) includes "reliability upgrades" to targeted Saltstone process components to support SWPF processing at its instantaneous rate. These improvements include upgrades to:

- Dry feed control system
- Feed pumps
- Air compressors
- Grout hopper design
- Grout mixture

To achieve the additional throughput increase needed to support MSP in addition to SWPF, an additional set of improvements will be required. These additional improvements may include:

- Increased staffing to support around-the-clock (24/7) operations.
- More comprehensive upgrade of the feed pumping and supply system.
- More comprehensive upgrade of the dry feed supply system.

Impacts to Aging Equipment

Most equipment will be replaced upon failure, with the exception of items with long lead times, for which a spare will be available on-site. The Structural Integrity program reduces likelihood of tank leak and monitors tank condition. Additional mitigative features are described in the Savannah River Remediation (SRR) Viability Program, as outlined in white paper WSRC-TR-2009-00081, which provides broad guidance to accomplish system viability assessments with respect to the predicted operational demand of each facility [5]. The Viability program includes safety and high impact non-safety systems and is closely tied to the Structural Integrity Program, which will implement any resulting aging management programs.

Elements of the Viability Program include:

- System Health Analysis and Reporting
- Structural Integrity Program
- TSR surveillances
- Installed Process Instrumentation (IPI)
- Preventive, Predictive and Corrective Maintenance
- Spare Parts Management Practices

<u>Risk-Handling Strategies (beyond the Risk Management Plan) Necessary to Prevent or Mitigate the Risks Identified by the Risk Assessment</u>

For delays in recovery of Tank 48, the risk handling strategy to mitigate this risk was to "develop a plan for SWPF feed preparation that avoids reliance on Tank 48 availability." This RHS was implemented in Revision 15 of the System Plan which utilizes Tanks 35, 41, and 50 for SWPF feed preparation at SWPF startup.

For delays in startup of SWPF, two risk handling strategies were formulated to mitigate this risk. The first is to extend ARP/MCU operations to continue up to six months prior to SWPF startup. The second strategy is to mature and deploy Waste Determination compliant salt processing and disposal technologies to supplement SWPF and Saltstone processing capability. Implementation of this second strategy is in progress. On November 5, 2009, Department of Energy (DOE) Savannah River (SR) issued formal Contracting Officer direction to SRR to execute supplemental salt processing and enhanced low activity waste disposal scope up to CD-1. On January 14, 2010, SRR transmitted to DOE-SR documentation of agreement on key input bases and assumptions for Modular Salt Processing (i.e. the small column ion exchange project) and Enhanced Low Activity Waste Disposal (ELAWD) Projects. The ELAWD Project will include the Saltstone processing upgrades required to support simultaneous processing at both SWPF and SCIX.

SUMMARY

It is recognized that efficient tank space management is critical to permanent salt and sludge disposition per the SRS liquid waste System Plan. Revision 15 of the System Plan [3] in concert with Revision 5 of the Risk Management Plan [4] addresses the realization of delays to SWPF and Tank 48 Return to Service and identifies risk handling strategies and opportunities to reduce the life-cycle, e.g. Modular Salt Processing. The impact to aging equipment is addressed through aggressive modification/implementation of current site programs that control the viability of the critical systems, structures, and components of the liquid waste system.

REFERENCES

[1] DNFSB Letter Dated January 7, 2010.

[2] D.P. Chew, *et.al., Life-cycle Liquid Waste Disposition System Plan*, LWO-PIT-2007-00062, Revision 14.1, October 2007.

[3] D.P. Chew & B. A. Hamm, *Liquid Waste System Plan*, SRR-LWP-2009-00001, Revision 15, January 2010.

[4] G.C. Winship, *PBS-SR-0014, Radioactive Liquid Tank Waste Stabilization and Disposition, Technical and Programmatic Risk Assessment Report to Support System Plan Revision 15*, Y-RAR-G-00022, Revision 5, January 2010.

[5] A.G. Kennedy, *System Viability Evaluation Improvements for Liquid Waste Facilities*, WSRC-TR-2009-00081, February 2009.

SEPARATION

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ENCLOSURE 2: ANALYTICAL BASIS FOR RISK #149

The analytical basis of accepting the risk of a tank leak that requires use of all contingency space is contained in the modeling performed during development of the system plan. Available storage space in Type III waste tanks throughout the program lifecycle is modeled during the development of the system plan and is presented in Appendix G of Revision 15 of the System Plan. The worst case scenarios for this risk would be for a leak to occur in either the DWPF feed tank (Tank 40) or the SWPF feed tank (Tank 49). As evaluated in *PBS-SR-0014, Radioactive Liquid Tank Waste Stabilization and Disposition, Technical and Programmatic Risk Assessment Report to Support System Plan Revision 15*[1] (RAR), disruption of sludge processing could result in extending DWPF operations by up to five years. As discussed in Revision 15 of the System Plan, sludge processing is projected to be completed seven years before salt processing is finished, therefore, a five-year delay in sludge processing will not impact the program lifecycle. A leak in Tank 49 would require modifications to convert one of the SWPF blend tanks into the new feed tank which could delay salt processing and extend the program lifecycle by up to one year. As discussed in the Risk Assessment Report, a comprehensive structural integrity program is already in place to reduce the likelihood of a tank leak. To further mitigate this risk would require construction of an additional waste tank. Due to the expense of constructing an additional tank, the very low probability of a leak in a Type III tank, and an impact of only one year to the lifecycle, construction of an additional tank was deemed to not be necessary.

Evolution of Risk 149 – HLW Tank Requires the Use of Contingency Space

Initial 2006 Risk Management Plan

Assessable elements are used to ensure all the functions of the HLW System are assessed in a logical manner. The assessable element 2.0 "Store Radioactive Waste" was assessed during *PBS-SR-0014, Radioactive Liquid Tank Waste Stabilization and Disposition, Risk Management Plan*[2] (RMP) development as part the 2006 initial RMP Revision 0. Risk 149 was developed to address the risk of a HLW tank leak event which in the worst case uses the available contingency space. The assessment documented in Y-RAR-G-00022 Revision 0, concluded that the risk event was unlikely and in the worst case a leak close to the bottom of a full HLW tank, critical to system plan execution would result in available contingency space being used, and processing being impacted when the contents are dispersed throughout several tanks. The impact was assessed as being up to five years, based on the need to incrementally gain tank space, establish a contingency space for remaining tanks and remediate tank contents prior to the resumption of macro-batch processing. Based on the threshold criteria this was considered "crisis" and when combined with the likelihood of "Unlikely" and using the standard risk grading matrix, was determined to be a High risk. The evaluation team concluded the risk would be

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[1] Winship. G.C., Y-RAR-G-00022, *PBS-SR-0014, Radioactive Liquid Tank Waste Stabilization and Disposition, Technical and Programmatic Risk Assessment Report to Support System Plan Revision 15*, Revision 5, January 2010.

[2] Winship, G.C., Y-RAR-G-00022 , *PBS-SR-0014, Radioactive Liquid Tank Waste Stabilization and Disposition, Risk Management Plan*, Revision 0, July 2006.

accepted based on the anticipated space gain from bringing Tank 50 and 48 into HLW service and that the current corrosion control programs prevent the conditions favorable to leak development.

In future RMP updates, the assessment of this element included the following:

- Review and update of all risks in this assessable element.
- Review and resolution of all items in the Interim Risk Log.
- Brainstorming of assessable element.

2007 RMP Update[3]

During the review and resolution of items in the Interim Risk Log an entry, (ID #17, dated 11/28/2006), questioned acceptance of this risk as the consequences are severe. The evaluation team concluded that no changes were necessary. The Interim Risk Log entry was dispositioned as follows:

> "This risk is unique in that there are currently no effective strategies to reduce the risk level. The loss of required safety basis contingency space would require all operations to halt. Currently, it is graded as a crisis because there is insufficient tank space available to provide the additional required contingency after the reserved contingency has been used. Salt processing will eventually provide more useable tank space, and when the space is available, the consequence of this risk should drop sharply. However, at this point in time the assessment addressed the worst case consequence. This risk will be re-assessed in future risk assessment cycles. Changes in conditions that impact risk consequences, such as the start of interim salt waste processing, will be reflected in risk consequence grades and in the next revision of the RMP. No action required."

2008 RMP Update[4]

The evaluation team embarked on an exhaustive brainstorming of possible risk handling strategies that could be applied to mitigate this risk. Several strategies were identified, and after investigation were concluded to be either candidates for development under the "Waste Processing Multi-year Program Plan" external to PBS-SR-0014 or were not determined practical at this time. The team took the approach of accepting the risk, provided that the risk owner would monitor the progress of research being performed under the "Waste Processing Multi-year Program Plan," and should positive results be achieved, evaluate the approach for use as a mitigation strategy at SRS. These were listed under "other strategies" as follows:

> Evaluation into the construction of a LW tank to be reserved for use only in the event of an emergency as contingency storage was completed. DOE review of the evaluation concluded that cost and schedule impacts made a new tank not feasible. Develop new methods of repairing tanks in-situ. Develop an RFP to design and test technologies for tank repair. Perform experimental studies and develop a less conservative corrosion control program.

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[3] Winship, G.C., Y-RAR-G-00022, *PBS-SR-0014, Radioactive Liquid Tank Waste Stabilization and Disposition, Risk Management Plan*, Revision 2, July 2007.

[4] Winship, G.C., Y-RAR-G-00022, *PBS-SR-0014, Radioactive Liquid Tank Waste Stabilization and Disposition, Risk Management Plan*, Revision 4, September 2008.

2009 RMP Update[1]

The evaluation team reviewed this risk, and determined that all feasible mitigation strategies were already being implemented as part of the current program, e.g. corrosion control, monitoring etc. The team concluded that the "other handling strategies" had not been developed sufficiently (as part of the "Waste Processing Multi-year Program Plan") to be relied upon for risk mitigation and should remain in the "other strategies" section. The team therefore accepted the risk as documented in Y-RAR-G-00022, Revision 5.

DOE reviewed the Revision 5 to the Radioactive Liquid Tank Waste Stabilization and Disposition Technical and Programmatic Risk Assessment Report, Y-RAR-G-00022, Revision 5, including Risk #I49 and related risk handling strategies and approved it on January 20, 2010.