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Interim Salt Processing Strategy Planning Baseline

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Table of Contents

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1. Summary

The Interim Salt Processing Strategy Planning Baseline contained in this document describes the planning basis for processing salt solutions through the Liquid Waste and Waste Solidification System until the start-up of the Salt Waste Processing Facility (SWPF) in April 2009. The purpose of the document is to provide a basis for planning salt processing activities during this period. The Planning Baseline is based on the Salt Processing Strategy, which has the following objectives:

- Maintain sufficient space in the Tank Farms to allow continued Defense Waste Processing Facility (DWPF) Operations at a rate of 250 canisters per year
- Support Sludge Batch preparation for DWPF
- Provide tank space to support staging of salt solution adequate to feed 5 Mgal of salt solution to SWPF during the initial year of operation starting in April 2009
- Ensure that the curies to Saltstone during the Interim Salt program are acceptably low (less than 5 MCi total).
- Meet DOE Contract Minimum Gate of 500 kgal of salt solution dispositioned at Saltstone

Preliminary modeling showed that meeting all these objectives requires dispositioning the tetraphenylborate waste in Tank 48 so that the 1.3 Mgal of space in this tank can be used for Tank Farm service in staging salt solution for processing. Thus, Tank 48 must be dispositioned in some manner for the strategy to be successful. The two possible methods are 1) aggregate Tank 48 waste with other wastes going to Saltstone in such a manner that all Waste Acceptance Criteria (WAC) limits are met, or 2) chemically and thermally degrade the tetraphenylborate so that the Tank 48 waste can be processed with other Tank Farm wastes.

Four cases were examined with different methods and degrees of difficulty in dispositioning the material in Tank 48:

1. Aggregate Tank 48 waste with negligible issues
2. Aggregate Tank 48 with modest modifications and technical issues (recommended planning case)
3. Aggregate Tank 48 waste with more extensive modifications and technical issues
4. Thermally and chemically degrade the tetraphenylborate so that this waste can be sent to the Tank Farm.

Case 2 is the recommended case for the Planning Baseline. This case allows a reasonable amount of time to begin dispositioning the waste in Tank 48, considering the risks and technical uncertainties involved.

This case has the following attributes:

- Processes salt solutions originating from Tanks 25, 28, 38, 41 and 48
- Assumes that Tank 48 can be dispositioned through aggregation to Saltstone
- Processes about 12 Mgal of salt solution to Saltstone containing less than 5 MCi (total of all radionuclides)

- Requires the start-up of Modular Caustic Side Solvent Extraction (CSSX) Unit (MCU) and Actinide Removal Process (ARP) by August 2007
- Includes disposition to Saltstone of 400 kgal of Low-Level Waste from processing unirradiated Highly Enriched Uranium (HEU) fuel, which reduces the amount of waste that must be managed in the Tank Farm
- Assumes regulatory issues and permits are completed per the schedule described in this document
- Accommodates current sludge batching plans, SWPF startup schedule, and Tank Farm minimum space requirements
- Feeds salt solution to Saltstone at a planned maximum activity of 0.2 Ci/gal of Cs-137.
- Assumes the use of Tank 24 to store concentrated recycle that is within limits for Type IV tank storage.

Case 4 is the backup case for the Planning Baseline. The main difference between this case and Case 2 are that Case 4 assumes the Tank 48 tetraphenylborate waste is thermally and chemically degraded, then sent to the Tank Farm, whereas Case 2 assumes the Tank waste is aggregated with the wastes going to Saltstone. Case 4 has a high technical risk—at this time, conditions required to adequately degrade the tetraphenylborate so that it can be managed as normal Tank Farm waste have not been identified.

These cases, their bases (including technical bases and assumptions), associated risks, and opportunities for improvement are described in the sections that follow. The opportunities for improvement identified in this document include continuing to pursue Tank 48 disposition by thermal and chemical degradation (the backup case) to minimize the amount of material requiring aggregation, acceleration of MCU operational start-up, increasing the Saltstone processing rate, and Slurry Mix Evaporator Condensate Tank (SMECT) stream processing. The Planning Baseline described in this document will be used in the Contract Execution development for all of the associated facilities.

This document will be revised when significant changes occur in the planning bases that impact successful implementation of the Planning Baseline. The document and any subsequent revisions will be incorporated into future HLW System Plan revisions. It will be maintained as a controlled document.

2. Glossary

ARP—Actinide Removal Process—A planned process that will remove actinides and Sr-90 from Tank Farm salt solution using MST and filtration

Ci—Curie

CSSX—Caustic Side Solvent Extraction—A process for removing Cs-137 from a caustic (alkaline) solution. The process is a liquid-liquid extraction process using a crown ether.

D&R – Decontamination and Removal

DF – decontamination factor

DOE—the United States Department of Energy

DSA—Documented Safety Analysis—the Authorization Basis Document that describes the systems and controls needed to maintain safety in a facility

DWPF—Defense Waste Process Facility—the SRS facility in which HLW is vitrified (turned into glass)

EIS – Environmental Impact Statement

ETP—Effluent Treatment Project (Formally called Effluent Treatment Facility)—the facility at SRS for treating contaminated wastewaters in F- & H-Areas

EPA – Environmental Protection Agency

GDL – Gravity Drain Line

GWSB—Glass Waste Storage Building—a steel-frame building with a below ground vault for storing glass filled canisters

FFA—Federal Facility Agreement

HEU—Highly Enriched Uranium

HEU campaign—Highly Enriched Uranium campaign—a canyon campaign to recover highly enriched uranium from unirradiated fuel tubes

HLW—High Level Waste

Interim Salt Processing Strategy—the strategy for processing SRS Tank Farm salt until the startup of the SWPF in 2009

Interim Salt Processing Strategy Planning Baseline—the basis for planning operations in accordance with the Interim Salt Processing Strategy

ISWLF—Industrial Solid Waste Landfill

IL—Interstitial Liquid – Concentrated salt solution in the salt cake matrix

IW—Inhibited Water—Well water to which small quantities of sodium hydroxide and sodium nitrite have been added to prevent corrosion of carbon steel waste tanks

LCS—Low Curie Salt—salt that is low enough in radioactivity that it can be sent to Saltstone without further treatment

LFL – Lower Flammability Limit

LLW—Low Level Waste

LW—Liquid Waste

kCi—thousand curies

kgal—thousand gallons

M – Molar (moles/liter)

MAVRC—Mixer At Vault Roof Concept—a process for preparing Saltstone grout in which the Saltstone ingredients are mixed in a mobile mixer placed either on the roof of the Saltstone vault or nearby

MCi—million curies
MCL—Maximum Contaminant Level—a concentration level set by EPA for a particular chemical that is used in determining the type of landfill required to dispose of a particular waste
MCU—Modular CSSX Unit—a small-scale modular unit that uses a CSSX process similar to SWPF
Mgal—million gallons
MST—Monosodium Titanate—A finely divided solid used in ARP that absorbs actinides and Sr-90
NRC—the United States Nuclear Regulatory Commission
NWPA—Nuclear Waste Policy Act
PISA – Potential Inadequacy in the Safety Analysis
PMP—Performance Management Plan
ppm – parts per million
PRG – Primary Remediation Goal
ROD – Record of Decision
SAS – Steam Atomized Scrubbers
SCDHEC—The South Carolina Department of Health and Environmental Control—the regulatory agency with the authority to regulate hazardous wastes at SRS
SCT—Shielded Canister Transporter—a piece of equipment used to move highly radioactive canisters from DWPF to a GWSB
SCIF—Schedule Change Information Form—a form used to authorize changes to project or facility schedules
SFT – Saltstone Feed Tank
SMECT—Slurry Mix Evaporator Condensate Tank—a tank in the DWPF that receives overheads from the Sludge Receipt and Adjustment Tank and the Slurry Mix Evaporator. The solutions in this tank are mildly contaminated
SPF—Saltstone Production Facility
DOE-SR – DOE – Savannah River
SRNL—Savannah River National Laboratory
SRS—Savannah River Site
SWPF—Salt Waste Processing Facility—A planned facility that will remove Cs-137 from Tank Farm salt solutions by the CSSX process and remove Sr-90 and actinides by ARP
TCLP—Toxicity Characteristic Leach Procedure—a procedure for determining if a waste is hazardous in which an aliquot of waste is leached with a test solution and the leachate is sampled for hazardous constituents
TPB - Tetraphenylborate
WAC—Waste Acceptance Criteria—a document describing the characteristics of waste (composition, temperature, etc.) that can be accepted at a waste processing facility
WCS—Waste Characterization System—a system for estimating the inventories of radionuclides and chemical in SRS Tank Farm tanks using a combination of process knowledge and samples
WIR – Waste Incidental to Reprocessing
WSRC—Westinghouse Savannah River Company

3. Purpose

This is a planning document. The purpose of this document is to describe the recommended Interim Salt Processing Strategy Planning Baseline in sufficient detail to establish project objectives and execution schedules for the affected facilities. The document describes 1) the assumptions required in the development of the Planning Baseline and 2) identified technical and programmatic risks and opportunities.

The Interim portion of the program includes the processing of all salt solution planned prior to the start up of the SWPF. The Planning Baseline identifies the material to be processed as Low Curie Salt (LCS) directly through Saltstone and the materials to be processed through Actinide Removal Program (ARP), the Modular Caustic Side Solvent Extraction Unit (MCU) and the schedules for those operations. The overall Life-Cycle Salt Processing Planning Baseline (which will be part of the System Plan) that includes both the Interim portion and the SWPF portion will be developed in 2005, when the new Integrated Flowsheet Model, Attainment Analysis, and Optimization Studies have been completed to incorporate the newly available information for the SWPF.

Also included in this document are the alternatives that were evaluated. Additional detail is provided on both the recommended Interim Salt Processing Planning Baseline and a backup case if Tank 48 material can be processed through thermal and chemical degradation in a timely manner.

The key bases and assumptions used in the development of the Planning Baseline including Nuclear Waste Policy Act (NWPA) and Permit assumptions are documented. Several of the key attributes that are instrumental to the Interim Planning Baseline success are discussed in detail. Also documented are some of the major Planning Baseline risks and opportunities.

This document will be revised when significant changes occur in the planning bases that impact successful implementation of the Planning Baseline (e.g., a delay in NWPA implementation or permitting, or if modifications were identified that would allow significant increases in Saltstone processing rate). Revisions to this document will be managed by issuing a revision to the document approved by all the indicated organizations. When the document is revised, each approver has the responsibility to determine if further documentation changes are needed in the facility they are responsible for (such as a facility Schedule Change Input Form (SCIF)).

This Interim Salt Strategy Planning Baseline and any subsequent revisions will be incorporated into future HLW System Plan revisions.

4. Background

This document assumes that the reader is familiar with the Liquid Waste and Waste Solidification System. For an overview of the Liquid Waste and Waste Solidification System, see ATTACHMENT B.

In March 2002, SRS issued HLW System Plan Rev. 13, a plan for disposing of the wastes remaining in the SRS Tank Farms. The plan presented three cases for disposing of the salt portion of the Tank Farm wastes.[1] In December 2002, a modified plan, called the PMP Supplement to Rev. 13, was issued.[2] This plan called for disposing of SRS salt wastes through one of three paths, with approximately one-third of the salt waste going through each path:

- Low Curie Salt—salt low enough in radioactivity that it can be sent directly to Saltstone without further treatment after the interstitial supernate has been drained
- Low Curie Salt with higher actinides—salt that is low enough in radioactivity that it can be sent directly to Saltstone after actinides are removed
- High Curie Salt—salt too high in radioactivity to be sent to Saltstone without treatment to remove Cs-137. This salt must be decontaminated in the SWPF or MCU before it is sent to Saltstone.

The plan was not executed because a number of stakeholder groups, including SCDHEC and the South Carolina Governor's Nuclear Advisory Council, expressed concern that the plan would cause significant quantities of radionuclides to be left in the State of South Carolina as a result of using the first two paths.[3] The plan was also impacted by litigation relative to the DOE order concerning radioactive waste management. The plaintiffs successfully argued that the Nuclear Waste Policy Act (NWPA) does not give DOE authority to classify the waste going to Saltstone as not being High-Level Waste. SCDHEC decided it would not be prudent to issue any new operating permits for Saltstone until the issues surrounding this litigation were resolved.

There is considerable incentive to dispose of SRS salt waste before the startup of SWPF in 2009. This is because if salt disposition is delayed until 2009 the Tank Farms will not have enough Type III space to accommodate salt waste generated as a result of washing sludge to feed DWPF and DWPF operation. This could cause a shutdown of the DWPF. Shutting down the DWPF would stop the vitrification of HLW into glass canisters, which is a significant risk-reduction activity at SRS. Shutting down the DWPF and then restarting it later would also mean a major increase to the life-cycle cost of the program.

Since 2002, the Salt Processing Planning Baseline has been revised frequently in an attempt to deal with the uncertainties associated with resolution of the NWPA issues and other issues. With the submission of the M120 contract modification, a new baseline for this program is needed. This document will serve as the new baseline.

5. Objectives

The objectives that were used in the development of the Planning Baseline are as follows:

- Maintain sufficient space in the Tank Farms to allow continued DWPF Operations at 250 canisters per year
- Support Sludge Batch preparation for DWPF
- Provide tank space to support staging of salt solution adequate to feed 5 Mgal of salt solution to SWPF during the initial year of operation starting in April 2009.

- Ensure that the curies to Saltstone during the Interim Salt program is acceptably low (less than 5 MCi total)
- Meet Contract Minimum Gate of 500 kgal of salt solution dispositioned at Saltstone (Note: with current planning assumptions, this objective does not affect the planning case chosen).

6. Major Planning Baseline Assumptions and Bases

The following are key assumptions and bases to the successful Interim Planning Baseline implementation.

- The salt processing program is being developed based on assumptions provided by DOE for the NWPA Resolution timing as follows:
  1. NWPA legislation issues are resolved by January 1, 2005
  2. NWPA implementation occurs early enough that processing can begin by October 1, 2005.
- Permitting will be received on a schedule that supports Planning Baseline implementation.
- Process enough salt solution as LCS and eventually by the ARP/MCU process to support readiness of Tanks 41, 42, 48, 49, 50, and 28 to support preparation and staging of salt solution feed to SWPF.
- Disposition Tank 48 to Saltstone by aggregation. Continue to pursue thermal degradation of Tank 48 to minimize aggregation impacts on Saltstone.
- Use Mixer At Vault Roof Concept (MAVRC) concept and existing vault at Saltstone to process feed up to 0.2 Ci/gal Cs-137.
- Implement the 2H Evaporator system de-liquoring program including the use of Tank 24 to store concentrated DWPF recycle.
- Based on successful implementation of the 2H Evaporator system de-liquoring program, utilize the space created in Tank 41 from initial salt dissolution batches to temporarily store initial higher Cs-137 salt dissolution batches from Tank 25.

See Attachment A for a more detailed list of assumptions and bases used in the Planning Baseline development. Also, see Section 9, “Discussion of Major Assumptions, Bases, and Risks” for a more detailed discussion of the key attributes of the major assumptions and bases summarized above.

7. Evaluated Alternatives

Preliminary modeling showed that dispositioning the waste in Tank 48 is critical to any planning baseline that meets strategy objectives. Tank 48 is critical because:

- Dispositioning the waste in Tank 48 allows the use of up to 1.3 Mgal of space in this tank. Without this space, there is not enough space in Type III tanks to meet all the objectives within the other constraints
- The location of Tank 48 makes it an integral part of staging feed for SWPF; if Tank 48 cannot be used for this purpose, the feed rate to SWPF will be limited.
- Tank 48 is the planned feed tank for ARP and MCU.

Therefore, four cases were developed that reflect various degrees of difficulty and methods for dispositioning the waste in Tank 48. Cases 1-3 assume that the Tank 48 material is dispositioned in Saltstone using aggregation. Case 4 assumes that the Tank 48 material is dispositioned using thermal and chemical degradation. The differences between Cases 1, 2, and 3 is the amount of time and effort assumed necessary to begin dispositioning the waste in Tank 48.

Case 1 assumed that no modifications and/or technical issues would require resolution prior to processing the Tank 48 material using the aggregation method through Saltstone. This case would use the following initial feed sequence to Saltstone:

Initial Batch(es)	Tank 48 material
Next Batches	Tank 41 dissolved salt
Subsequent Batches	Tanks 25 and 28 dissolved salt, then Tank 24 (concentrated recycle from Tank 38)

While this case had the attractive attribute of providing the most timely space recovery of Tank 48 for normal service, it appears too optimistic to use for planning (It is likely that the aggregation of the Tank 48 material will require modifications or technical issue resolution at Saltstone and/or within the Tank Farms that would take longer to implement than assumed in this case).

Case 2 (Recommended as the Planning Baseline) assumed that only modest modifications and/or technical issues would require resolution prior to processing the Tank 48 material using the aggregation method through Saltstone, i.e., the start of dispositioning Tank 48 waste would take longer than Case 1. This case would use the following initial feed sequence to Saltstone:

Batch 1	Tank 41 dissolved salt (initial dissolutions)
Batches 2 and 3	Tank 48 material
Batches 4 and 5	Tank 25 dissolved salt
Subsequent Batches	Tanks 41 (additional dissolutions), 25, and 38 dissolved salt, then Tank 24 (concentrated recycle from Tank 38)

The case was also developed in a manner to provide flexibility by providing decision points that allow adequate time to switch to an alternate path if required. It also maintained all preparation activities to ensure that: 1) movement to an alternative path can be made with minimal schedule impacts, 2) improvement in Saltstone production rates would not result in a feed break, 3) alternate feed would be available if the Tank 48 material is handled successfully using thermal and chemical degradation, and 4) ARP and MCU schedules are maintained to support success for either Case 2, 3, or 4.

This case was selected as the Planning Baseline because it has a reasonable level of risk while still allowing Tank 48 to be used in Tank Farm service at a reasonably achievable date. It also provides the flexibility to be more successful if the Tank 48 material does not require processing through Saltstone. The Planning Baseline will be described in Section 8. This case has been successfully modeled to provide confidence that it can be executed.

Case 3 assumed that more extensive modifications and/or technical issues would require resolution prior to processing the Tank 48 material using the aggregation method through Saltstone. (Note that if Tank 48 disposition takes longer than anticipated, this case will be executed by default). This case would use the following initial feed sequence to Saltstone:

Batches 1 and 2	Tank 41 dissolved salt
Batches 3 and 4	Tank 48 material
Subsequent Batches	Tanks 25 and 38 dissolved salt, then Tank 24 (concentrated recycle from Tank 38)

This case was not selected as the Planning Baseline because it delays the disposition of the Tank 48 waste, which delays when Tank 48 can be beneficially used for normal Tank Farm service (i.e. the case may be unnecessarily pessimistic). Also, this case is easily bounded by Cases 2 & 4. In the interest of time, this case was not fully detailed.

Case 4 (Backup Case) assumed that thermal and chemical degradation of the Tank 48 material will be successful and therefore, this material will not need to be processed through Saltstone. If this path is successful, then dissolution of salt from other tanks can be accomplished earlier. (It is for this reason that preparations for Tank 25 are scheduled so early in the recommended case. Having Tank 25 ready early is a contingency for the event that thermal and chemical degradation is successful.)

This case would use the following initial feed sequence to Saltstone:

Batches 1 and 2	Tank 41 dissolved salt
Subsequent Batches	Tanks 25 and 38 dissolved salt, then Tank 24 (concentrated recycle from Tank 38)

This case was not selected as the recommended case because it has a high level of technical risk. No acceptable conditions have been identified that will cause the Tank 48 waste to degrade at a sufficiently high rate. However, research is currently ongoing to identify the right conditions at which the Tank 48 waste will degrade. This case was selected as the Backup case. This case provides an alternative to returning Tank 48 to service that does not require processing Tank 48 waste through Saltstone.

The Backup case is more fully described in Section 8 and 10.1 "Tank 48 Disposition by Thermal and Chemical Degradation."

8. Recommended & Backup Cases

Of the cases evaluated, Case 2 (Recommended Case) was selected as the recommended case for the Planning Baseline since it provides an early date for dispositioning salt solution in Saltstone (and meets the Contract minimum gate), provides a reasonable date for Tank 48 return to service with a reasonable level of risk, and provides the flexibility to be more successful if the Tank 48 material does not require processing through Saltstone. Due to the potential of dispositioning Tank 48 by thermal and chemical degradation, Case 4 (Backup Case) was selected as the backup case. This case will be employed if the decision is made that the Tank 48 material does not require processing through Saltstone or cannot be processed through Saltstone. In general, these two cases bound the potential results for the Interim Salt Processing Strategy.

Both strategies are detailed in Figures 2 and 3, respectively. These are the large, fold-out schedule charts that accompany this document. Significant activities, permit requirements, estimated durations, key milestones, decision points, and a general logic for implementation are included.

A more detailed breakdown of the salt solution batches for the recommended and backup strategies is reflected in Tables 8-1 and 8-2, respectively. The tables reflect the source tanks for each batch along with projected volumes, Cs-137 concentrations, molarity and estimated total curies.

The recommended case was designed to be flexible. Decision points and preparation activities are scheduled such that if the need arises to move to another Planning Baseline, it is likely that this movement could be accomplished with acceptable schedule impacts. It was also developed such that it provided the decision points that would allow the Planning Baseline to be successful if key milestones were reached earlier than expected (e.g., earlier NWPA resolution, higher Saltstone production rates, or successful identification of conditions needed to degrade the tetraphenylborate at a sufficient rate).

Table 8-1

Recommended Case

Salt Planning Baseline (v1.0 — Tank 48 Aggregation)

(0.2 Ci/gal (Cs-137) Feed to Saltstone)

Strategy Batch No.	Source Tanks	Feed to Saltstone (kgal) LCS	ARP/ MCU	Total Salt	ETF	LLW Direct [h]	Total	Total Curies to Saltstone (kCi) [a] LCS	ARP/ MCU	Total	Cs-137 Ci/gal
B0	(Tk 50 material from ETF & LLW)				420	330	**750**				
B1	41	1,250		1,250	44	157	**1,451**	460		**460**	0.2
B2	48	775		775	31	113	**919**	310		**310**	0.2
B3	48	1,800		1,800	56	120	**1,976**	523		**523**	0.1
B4	25	1,140		1,140	35		**1,175**	438		**438**	0.2
B5	25	1,135		1,135	25		**1,160**	431		**431**	0.2
B6	28 & 25 (High Cs)		1,440	1,440	29		**1,469**		180	**180**	0.06
B7	25	1,225		1,225	65		**1,290**	45		**45**	0.02
B8	Concentrated Recycle (Tk 24 via 2H Evap tanks 38 & 43)		1,400	1,400	21		**1,421**		105	**105**	0.04
B9	28	1,230		1,230	29		**1,259**	259		**259**	0.1
		8,555	**2,840**	**11,395**	**755**	**720**	**12,870**	**2,466**	**285**	**2,751**	[i]

Salt Feed to Saltstone

(LCS & ARP/MCU Only)

Strategy Batch No.	Transfers	Sodium Molarity	Salt Volume (kgal)	Total Curies (kCi) [a]	Cs-137 Concentration (Ci/gal)
B1	41 —> 49	7.9	929	1,012	0.5
	49 —> 50[e]	7.9	422	460	0.5
	23 —> 50	0.5	828	[b]	[b]
	50 —> Z	**2.7**	**1,250**	**460**	**0.2**
B2	48 —> 50	2.9	91	310	1.7
	Recycle [c] —> 50	0.5	653	[b]	[b]
	NaOH —> 50		31		
	50 —> Z	**0.8**	**775**	**310**	**0.2**
B3	Recycle —> 48	0.5	1,800	[b]	[b]
	48 —> 50 —> Z	**0.5**	**1,800**	**523**	**0.1**
B6 [d]	25 —> 41	8.0	619	1,747	1.4
B4	49[e]	7.9	422	460	0.5
	25 —> 49 [f]	8.0	507	377	0.4
	49 —> 50	7.4	502	438	0.4
	Recycle —> 50	0.5	638	[b]	[b]
	50 —> Z	**3.3**	**1,140**	**438**	**0.2**
B5	49 —> 50	7.4	494	431	0.4
	Recycle —> 50	0.5	641	[b]	[b]
	50 —> Z	**3.2**	**1,135**	**431**	**0.2**
B6	28 —> 48	8.0	407	1,108	1.4
	41+25 —> 48	8.2	454	1,044	1.2
	Recycle —> 48	0.5	222	[b]	[b]
	48 —> ARP/MCU [g]	6.44	1,083	2,151	1.0
	ARP/MCU —> 50 —> Z	**4.8**	**1,440**	**180**	**0.06**
B7	25 —> 49	8.5	958	45	0.02
	Recycle —> 49	0.5	267	[b]	[b]
	49 —> 50 —> Z	**6.6**	**1,225**	**45**	**0.02**
B8	24 —> 48	6.2	1,000	1,260	0.6
	Recycle —> 48	0.5	53	[b]	[b]
	48 —> ARP/MCU	6.44	1,053	1,260	0.6
	ARP/MCU —> 50 —> Z	**4.8**	**1,400**	**105**	**0.04**
B9	28 —> 49	8.5	868	259	0.1
	Recycle —> 49	0.5	362	[b]	[b]
	49 —> 50 —> Z	**6.0**	**1,230**	**259**	**0.1**

Comments

[a] For planning purposes, total curies estimated by doubling Cs-137 curies per the methodology documented in CBU-SPT-2004-00038. In more detailed modeling, the total curies are estimated by summing individual radionuclides.

[b] Radionuclide contribution to total curies from recycle stream is insignificant and was not included in the "Total Curies" calculation.

[c] Recycle from Tank 23 will be used for Batch B1. After the first batch, recycle from any Type IV tank may be used.

[d] Tank 25 salt solution "parked" in Tank 41 and later processed as part of B6.

[e] Tank 41 is transferred into Tank 49 and approximately half the volume in Tank 49 is transferred to Tank 50. The other half remains in Tank 49 and is blended with Tank 25 material in Batch B4 and Batch B5.

[f] Tank 25 is transferred into Tank 49 and the volume in Tank 49 is transferred to Tank 50 in two batches to make Batch B4 and Batch B5.

[g] 241-96H, 512-S, and MCU shown as one unit for simplicity. A DF of 12 for Cs-137 is used for MCU.

[h] LLW Direct stream includes processing unirradiated HEU material (see section 12.2 Assumption 11).

[i] Due to salt waste characterization uncertainty, total curies to Saltstone could be as high as 5,000 kCi.

Table 8-2

Backup Case

Salt Planning Baseline (v1.1 — Tank 48 Thermal Degradation)

(0.2 Ci/gal (Cs-137) Feed to Saltstone)

Strategy Batch No.	Source Tanks	Feed to Saltstone (kgal) LCS	ARP/MCU	Total Salt	ETF	LLW Direct [h]	Total	Total Curies to Saltstone (kCi) [a] LCS	ARP/MCU	Total	Cs Ci/gal
B0	(Tk 50 material from ETF & LLW)				420	330	**750**				
B1	41	1,260	-	1,260	46	165	**1,471**	508		**508**	0.2
B2	41	1,260	-	1,260	36	127	**1,423**	508		**508**	0.2
B3	25	1,020	-	1,020	33	98	**1,151**	410		**410**	0.2
B4	25	1,020	-	1,020	27	-	**1,047**	410		**410**	0.2
B5	25	1,200	-	1,200	58	-	**1,258**	63		**63**	0.03
B6	28 & 25 (High Cs)	-	1,090	1,090	19	-	**1,109**		131	**131**	0.06
B7	25 & 28	1,220	-	1,220	106	-	**1,326**	356		**356**	0.15
B8	Concentrated Recycle (Tk 24 via 2H Evap tanks 38 & 43)	-	1,400	1,400	-	-	**1,400**		86	**86**	0.03
B9	28	950	-	950	25	-	**975**	71		**71**	0.04
		7,930	**2,490**	**10,420**	**770**	**720**	**11,910**	**2,326**	**217**	**2,543**	[i]

Salt Feed to Saltstone

(LCS & ARP/MCU Only)

Strategy Batch No.	Transfers	Sodium Molarity	Salt Volume (kgal)	Total Curies (kCi) [a]	Cs-137 Concentration (Ci/gal)
B1	41 –> 49	8.0	932	1,015	0.5
	49 –> 50 [e]	8.0	466	508	0.5
	23 –> 50	0.5	794	[b]	[b]
	50 –> Z	**3.0**	**1,260**	**508**	**0.2**
B2	49 –> 50	8.0	466	508	0.5
	Recycle [c] –> 50	0.5	794	[b]	[b]
	50 –> Z	**3.0**	**1,260**	**508**	**0.2**
B6 [d]	25 –> 41	8.0	230	799	1.7
B3	25 –> 49 [f]	8.0	740	819	0.6
	49 –> 50	8.0	370	410	0.6
	Recycle –> 50	0.5	650	[b]	[b]
	50 –> Z	**2.9**	**1,020**	**410**	**0.2**
B4	49	8.0	370	410	0.6
	Recycle –> 49	0.5	650	[b]	[b]
	49 –> 50 –> Z	**2.9**	**1,020**	**410**	**0.2**
B5	25 –> 49	8.0	957	63	0.03
	Recycle –> 49	0.5	243	[b]	[b]
	49 –> 50 –> Z	**6.4**	**1,200**	**63**	**0.03**
B6	28 –> 48	8.0	430	1,227	1.4
	41+25 –> 48	8.0	230	341	0.7
	Recycle –> 48	0.5	160	[b]	[b]
	48 –> ARP/MCU [g]	6.44	819	1,567	1.0
	ARP/MCU –> 50 –> Z	**4.8**	**1,090**	**131**	**0.06**
B7	25 –> 49	8.0	528	8	0.007
	28 –> 49	8.0	454	348	0.4
	Recycle –> 49	0.5	238	[b]	[b]
	49 –> 50 –> Z	**6.4**	**1,220**	**356**	**0.1**
B8	24 –> 48	9.7	699	1,022	0.7
	Recycle –> 48	0.5	354	[b]	[b]
	48 –> ARP/MCU	6.44	1,053	1,022	0.5
	ARP/MCU –> 50 –> Z	**4.8**	**1,400**	**86**	**0.03**
B9	28 –> 49	8.0	765	71	0.05
	Recycle –> 49	0.5	185	[b]	[b]
	49 –> 50 –> Z	**6.4**	**950**	**71**	**0.04**

Comments

[a] For planning purposes, total curies estimated by doubling Cs-137 curies per the methodology documented in CBU-SPT-2004-00038. In more detailed modeling, the total curies are estimated by summing individual radionuclides.

[b] Radionuclide contribution to total curies from recycle stream is insignificant and was not included in the "Total Curies" calculation.

[c] Recycle from Tank 23 will be used for Batch B1. After the first batch, recycle from any Type IV tank may be used.

[d] Tank 25 salt solution "parked" in Tank 41 and later processed as part of B6.

[e] Tank 41 is transferred into Tank 49 and the volume in Tank 49 is transferred to Tank 50 in two batches to make Batch B1 and Batch B2.

[f] Tank 25 is transferred into Tank 49 and the volume in Tank 49 is transferred to Tank 50 in two batches to make Batch B3 and Batch B4.

[g] 241-96H, 512-S, and MCU shown as one unit for simplicity. A DF of 12 for Cs-137 is used for MCU.

[h] LLW Direct stream includes processing unirradiated HEU material (see section 12.2 Assumption 11).

[i] Due to salt waste characterization uncertainty, total curies to Saltstone could be as high as 5,000 kCi.

9. Discussion of Major Assumptions, Bases, and Risks

9.1 Nuclear Waste Policy Act (NWPA) Risks and Uncertainties

DOE Order 435.1, "Radioactive Waste Management." was challenged in the Ninth Circuit Court. DOE received an unfavorable ruling in July 2003. At that time, DOE stopped making Waste Incidental to Reprocessing Evaluations for disposition of waste. Both the Tank Closure and the Salt Processing Programs were impacted. DOE has responded by appealing the ruling. Also, South Carolina legislators are seeking legislative clarification of the NWPA intent in an effort to give DOE more authority to classify wastes. Either a favorable ruling or legislative change is required to allow the salt processing program to proceed with dispositioning salt solution at Saltstone.

The Salt Processing Baseline assumes that a legislative solution is promulgated by January 1, 2005. This solution is assumed to be similar in technical content to the existing DOE 435.1 methods and standards.

The risk exists that this legislation is not passed by January 1, 2005. Any delays in this legislation represent a delay in dispositioning salt solution in Saltstone.

The risk exists that the legislation could invoke different methods, standards, or reviews than previously applied. Such impacts could cause schedule delays and potential cost escalation to develop techniques to meet the new methods, standards, or reviews.

It is further assumed that this legislation is implemented by June 1, 2005. Implementation involves such activities as DOE order revision, public comment, rule making, and implementing procedure development and approval. The risk exists that, even if the same standards are in place, that implementation could be delayed by such items as longer than expected public comment periods or independent review. Also, there is a risk that another lawsuit could be filed against either the NWPA legislation or the revised DOE order. These risks have the potential to extend the implementation period and, in so doing, extend the schedule for initiating the disposition of salt solution in Saltstone.

9.2 Permitting

For the Planning Baseline to be successful, the permits shown on Figures 2 and 3 must be received as scheduled.

The construction permits are being requested in advance of the resolution of the NWPA issues described above in order to make the facilities operational as early as possible and therefore maximize the benefit of operation. It is assumed that the operating permits will not be approved until after the resolution of the NWPA issues. By following this approach, DOE is assuming a financial risk for the construction cost of the facilities. This is a large risk in excess of $100 million. The risk exists that DOE will want to minimize this financial risk and will therefore not fund the projects at the cash flow required to meet the Planning Baseline.

SCDHEC has stated that they will not approve permits for activities that are impacted by the NWPA ruling. The salt processing Planning Baseline depends on a determination by DOE that the waste going to Saltstone is classified as Low-Level Waste. There is a risk that SCDHEC will not approve the necessary permits in advance of NWPA issue resolution.

For LCS wastes and the waste from Tank 48 to be processed, SCDHEC must agree to allow an increase in the radioactivity inventory sent to Saltstone, increasing the number of curies disposed in the state from 75,000 to less than 5,000,000. While this increase is much less than earlier proposals, the risk exists that stakeholders and government leaders will not accept this change even when the NWPA issues are resolved. This will delay or prevent the approval of the operating permits for the parts of the Interim Salt Processing Planning Baseline that require the increased limits.

9.3 Salt Tank Characterization and Selection

Success of the Interim Salt program obviously depends on careful selection of the tanks to be processed. The following factors were considered in selecting the tanks to process:

- The concentration of each radionuclide or chemical in the tank must be low enough to meet Saltstone WAC limits when aggregated with other wastes.
- Tanks containing waste that is low in overall radioactivity are desirable to minimize the number of curies going to Saltstone.
- Dispositioning of tanks with a smaller amount of waste has a quicker impact on Tank Farm space than tanks with larger amounts of waste. For example, dispositioning the 250 kgal of waste in Tank 48 will open up a 1,300 kgal tank for use as a Tank Farm tank.
- Constraints on the use of the tanks affect the order in which tanks can be processed. For example, Tank 38 is low in radionuclides but is needed as the 2H Evaporator concentrate receipt tank until the waste has been removed from Tank 41 (the other tank that can be used as the 2H concentrate receipt tank).

9.3.1 Estimating Salt Compositions and Volumes

Until the startup of a CSSX process (MCU and SWPF) there is no process available to remove Cs-137 from the waste. Thus, for LCS it is important to identify tanks that are low in Cs-137. Cs-137 constitutes the bulk of the curies that will be sent Saltstone.

Cs-137 is highly soluble. In Tank Farm saltcake, most of the Cs-137 is in interstitial supernate that is contained in the void space between the salt crystals. Thus, some portion of the Cs-137 can be removed from salt solution by draining the interstitial supernate from the salt. However, there are limits on how much supernate can be drained because some fraction of the supernate is held in the salt matrix by capillary action.

A model has been developed to provide a conservative estimate of the Cs-137 concentration in dissolved salt solution as well as the volumes associated with salt dissolution. Cs-137 concentration data and saltcake levels for the model are taken from the Waste Characterization System (WCS)[4] and are listed in Table 9-1. The tables in this document were prepared using values taken from the August 2001 version of WCS (This version was used for consistency).

Modeling being done at this time is using new supernate information obtained recently, but the modeling work using these new values was not complete at the time this document was prepared. Table 9-1 also shows, for information, the results of recently analyzed samples from these tanks. The results of new samples were close enough to concentrations developed from the model that the results shown in this document are reasonably accurate (Cs-137 concentrations have been well tracked for some time).

Table 9-1

	Undiluted Cs-137 in WCS (Ci/gal)	Cs-137 from recent samples (Ci/gal)[5]	Salt Level (in)
Tank 25	4.3	3.5	316
Tank 28	4.5	4.5	294
Tank 41	2.5	*	350

* Composition has already been altered from tank draining and water addition

Figure 4 shows the evolution of the draining and dissolution process as used in the model. Tank A contains fully saturated salt with free supernate above the saltcake. The model assumes that saltcake contains 40 volume% void space made up of 10 volume% gas and 30 volume% interstitial liquid (IL).[6] The tank is first drained (Tank B) to remove any existing free supernate and to extract as much IL as possible. Above 56", 50% of the IL is assumed to be drained, while below 56" the IL is unaffected. To create the salt solution batches the tanks are then filled with Inhibited Water (IW) (Tank C). The initially salt-free IW dissolves a portion of the saltcake reducing the effective salt level. The volume of IW added is enough so that approximately 24" of salt solution exists above the new effective salt level (Tank D). This salt solution refills the drained void space, both the 15% that formerly contained IL and the 10% that was formerly gas, saturating the saltcake. Below 56" the saltcake that was not drained is also saturated to 40% liquid. This salt solution is then drained as before (Tank E), reducing the liquid volume and recreating open void space. This process is repeated until sufficient volume has accumulated to create the desired macrobatch. (Note: the numbers used in this discussion, such as the fraction of IL that drains, are the values currently being used. However, actual results in real tanks may be different, and these numbers will be adjusted as new information becomes available.)

Figure 4: Draining and Subsequent Dissolution of Waste Tanks

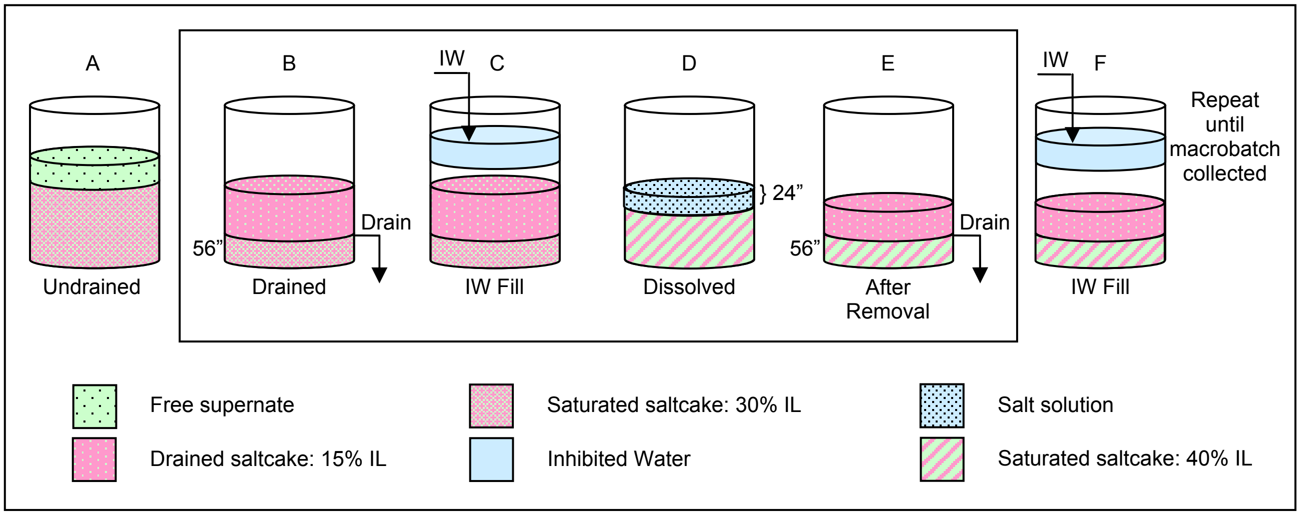
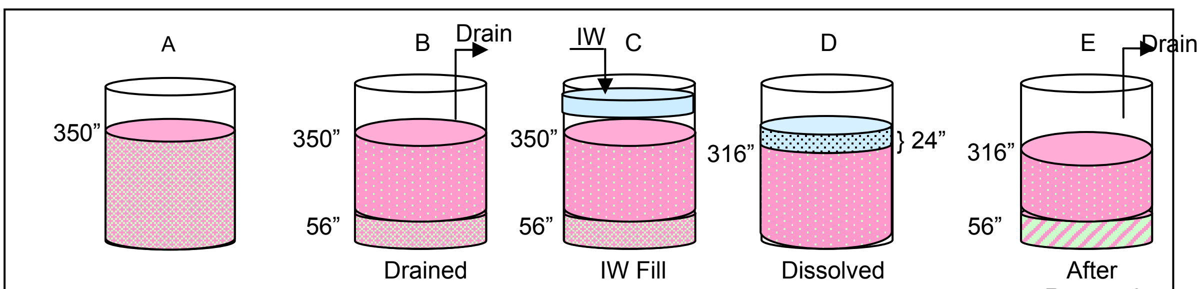


Figure 5 shows the effect of the dissolution process on the liquid activity during the first dissolution of Tank 41. Tank A is saturated saltcake after the free liquid has been removed. In Tank B, the total residual IL is the combination of the IL in saturated salt and in the drained saltcake. Sludge carryover is excluded because the Cs-137 contribution from sludge is deemed negligible compared to the liquid activity. After filling with IW (Tank C), the evacuated void space is replaced with Curie-free liquid. The total activity in the residual IL prior to refilling the tank is distributed evenly throughout the freshly added liquid, decreasing the Cs-137 concentration. The tank is then drained (Tank E), reducing the total activity. The total activity remaining in the tank is reduced proportionately with the liquid volume reduction from draining. Repeating the dissolution further reduces the Cs-137 concentration in the liquid remaining in the tank.

Figure 5: Changes in Curie Content as a Result of Dissolution (Tank 41 Example)



	A	B	D	E
gal liquid:	369,000	214,000	535,000	216,000
Cs Ci/gal:	2.5	2.5	1.0	1.0
Total Ci:	929,000	535,000	535,000	216,000

9.3.2 Risks

The risks associated with salt tank characterization are as follows:

- The model has a number of assumptions about how supernate behaves when it is drained. To date, the draining process has been successfully completed on only one tank, Tank 41. There is some limited data available from Tank 3, but the Tank 3 draining process was not completed. Based on data obtained from Tank 41, the model assumptions have been adjusted. However, how well the assumptions will work for other tanks is unknown at this time. A model uncertainty evaluation is in progress.
- The model does not predict the concentration of constituents other than Cs-137. These must be determined or estimated from other data. There is a risk that some other constituent will exceed Saltstone WAC limits. These risks will be mitigated by the enhanced characterization program.[7]

9.4 Tank 48 Disposition by Aggregation

The Recommended Case assumes the disposition path for Tank 48 is to aggregate this waste along with other waste going to Saltstone such that the radionuclides meet Saltstone limits. The main radionuclides of concern are Cs-137 and actinides.

The risks of aggregation of Tank 48 waste are as follows:

- A new permit with considerably higher limits is required. The Cs-137 concentration in Tank 48 waste is currently 1.7 Ci/gal Cs-137.[13] Plans are to aggregate this waste with other wastes so that the combined concentration is less than 0.2 Ci/gal Cs-137, with an alpha emitter concentration of less than Class C (100 nCi/gm in the grout). However, this is well in excess of the current Saltstone permit and also in excess of Class A for alpha emitters. SCDHEC has previously stated they are reluctant to approve a permit with greater than Class A limits. Although the focus of the SCDHEC statements was total curies, not alpha concentrations, there is a risk that SCDHEC will not grant a permit that allows Cs-137 or alpha concentrations high enough. For example, if Saltstone is limited to Class A limits for alpha emitters (10 nCi/gm), aggregation of Tank 48 waste in a reasonable period of time is not feasible.
- The tetraphenylborate and other constituents in Tank 48 waste may cause unacceptable releases from Saltstone. Toxicity Characteristic Leach Procedure (TCLP) tests have already been conducted for benzene releases from Tank 48 waste. Preliminary results indicate that all benzene TCLP results are well below regulatory limits. Measurements for nitrobenzene and mercury continue.[8] There is a risk these tests will be unacceptable. There is also a risk that benzene releases will cause flammability or toxicity concerns in the area of the vault. When test results are available, a safety basis review of aggregating Tank 48 waste in Saltstone will be conducted to identify any modifications required.
- A revision to the Tank Farm Documented Safety Analysis (DSA) will be required. There is a risk that flammability concerns will lead to modifications being required for Tank 50, Low Point Pump Pit and associated transfer paths

9.5 Saltstone

9.5.1 Processing Salt Solution at 0.2 Ci/gal Cs-137

A Mixer At Vault Roof Concept (MAVRC) has been developed for processing of salt solution feeds greater than 0.1 Ci/gal Cs-137 into Saltstone grout. The concept consists of a mixer at, or near, the vault such that the salt solution feed is combined with the dry material feed at the vault and the grout pumping step is simplified. This locates the radiological hazard away from the control room and minimizes the risk (frequency and consequence) associated with a process rock-up event. Evaluation of the existing Saltstone process with 0.2 Ci/gal Cs-137 feed shows significant dose rates in key operating locations (mixer: 1.2 rem/hr; grout sampler: 0.5 rem/hr. The corresponding dose rates at 0.1 Ci/gal Cs-137 would be mixer: 0.6 rem/hr; grout sampler: 0.25 rem/hr). These high dose rates could be mitigated to allow normal operation of the existing process by addition of shielding. However, a process rock-up event and the associated cleanup would result in significant radiation dose to personnel and significant cost and schedule delay. Therefore, MAVRC is the recommended option for processing greater than 0.1 Ci/gal Cs-137 salt solution at the Saltstone Facility.[9]

Given current funding constraints, designing and constructing a new vault for disposal of Saltstone made from greater than 0.1 Ci/gal Cs-137 salt solution is not possible. Existing Saltstone Vault #4 was modified to allow the facility to accept 0.1 Ci/gal Cs-137 feed, but scoping calculations by Health Physics Technology show that Vault #4 could be used to dispose of grout made from up to 0.2 Ci/gal Cs-137 feed.[10] In order to maintain the radiation dose due to sky-shine from the vault within acceptable limits when processing 0.2 Ci/gal Cs-137, operations will be constrained to have only one cell, 100-feet by 100-feet surface area, with LCS grout exposed at a time.

When limited to one cell exposed at a time, the annual throughput for a MAVRC process deployed at Vault #4 is expected to be approximately four million gallons per year or 83,000 gallons per week of salt solution.[11] The limiting factor for MAVRC throughput is expected to be high grout temperature caused by heat of hydration in the 100-foot by 100-foot Vault #4 cells (the limited surface area, required to limit sky-shine at 0.2 Ci/gal Cs-137, restricts the rate at which heat can escape). The four-million-gallon-per-year throughput accounts for the time required to clean cap a cell (to reduce sky-shine radiation dose) prior to initiating operation in another cell.

The recommended radiological and chemical WAC limits and permit maximum expected concentrations for Saltstone were developed based upon input from numerous sources. The specific basis for each WAC limit and permit maximum expected concentration is listed in WSP-SSF-2004-00030.

For the radionuclides, with a few exceptions (Sr-90 and Cs-137), the permit maximum expected concentrations are based upon the individual NRC Class A waste limits. For Sr-90, Cs-137, and those radionuclides without NRC limits, the permit maximum expected concentrations are based upon the shielding capability of the Saltstone vaults. One exception to these criteria are the limits for the transuranic alpha emitters, which are set to protect the NRC Class C limits for total transuranic alpha emitters with half-lives greater than 5 years. Generally, the respective WAC limits for the radioisotopes of concern are set at 90% of the permit maximum expected concentrations. The radioisotopes of concern were selected based upon waste tank sample analysis and discussions with personnel from the Savannah River National Laboratory.

The chemical limits are based upon the values used in the Tank Farm DSA (Table 1 of calculation S-CLC-G-00280, Rev. 0), the maximum hazardous chemical concentration that allows the grout to pass TCLP, the maximum-recorded chemical concentration data recorded in the Waste Characterization System (WCS), recent analytical data from various waste tanks, and sample analysis data maintained by the Effluent Treatment Project (ETP). Generally, the respective WAC limits for the chemicals of concern are set at 75% of the permit maximum expected concentrations. The chemicals of concern were selected based upon identifying those chemicals that have groundwater concerns (have published Maximum Contaminant Level (MCL) or Primary Remediation Goal (PRG)), and are present in significant quantities (>0.5 moles per liter)). A Class 3 Industrial Solid Waste Landfill (ISWLF) is required for disposal of Saltstone because of the high solubilities and high concentrations of nitrate and nitrite in the salt solution feed stream treated in the Z-Area facility. This is true for Tank 41 LCS solution, the current solution in Tank 50, and any blend of the two wastes. This was confirmed by TCLP results for three process samples collected from Tank 50 and analyzed during the Tank 50 heel retrieval campaign. The nitrate and nitrite concentrations in the TCLP extracts exceeded the Environmental Protection Agency (EPA) MCL-PRG by more than 30 times, and therefore require disposal in a Class 3 ISWLF.[12]

9.5.2 Processing Decontaminated Salt Solution

The salt solutions coming from MCU and SWPF will be decontaminated to much less than 0.2 Ci/gal Cs-137 (the expected maximum for decontaminated salt solution from SWPF is 0.006 Ci/gal Cs-137). It is likely that the MAVRC process will continue to be used for these solutions, and adjustments can be made that will significantly increase the throughput. First of all, because there are no sky-shine restrictions, the vault cells can be designed larger than 100-feet by 100-feet, increasing the surface area available for cooling of the grout as it hydrates. Also, multiple cells can be filled concurrently, which is not possible at 0.2 Ci/gal Cs-137 because of the additive effects of sky-shine from multiple cells.

9.6 2H Evaporator De-liquoring and Recycle Management Plan

9.6.1 Description

The tanks in the 2H evaporator system (Tanks 38 and 43) currently contain waste with very high hydroxide concentration. The bent-tube evaporators used in the Tank Farms do not have the ability to evaporate sodium hydroxide to a dry salt. The solutions currently in the 2H system are very close to the limits of the evaporator, which limits evaporator performance. This thick, high-hydroxide waste is referred to as liquor.

The baseline schedule includes activities for improving the performance of the 2H Evaporator's ability to process DWPF recycle material. Specifically, the baseline includes a transfer of 2H Evaporator liquor (i.e. supernate from the evaporator feed (Tank 43) and concentrate receipt (Tank 38) tanks that has been evaporated to a high specific gravity of 1.45 or greater) to Tank 49 removing approximately ~1 million gallons of concentrated liquor from the 2H system. The 2H liquor will remain inside Tank 49 until February 2005 when this liquor is transferred into Tank 24.

The removal of ~1 million gallons of liquor from Tanks 38 and 43 and restocking the system with fresh Type IV waste will result in processing a significantly lower concentration of feed. Higher rates of space recovery will be achieved while processing more dilute feed. Due to insufficient tank space, the liquor was not removed from the 2H Evaporator after the chemical cleaning campaign was completed in 1QFY02. In fact, the 2H Evaporator system liquor has not been removed since DWPF started sending recycle waste to the tank farms in 1995. The existing concentrations of aluminum and silica in the concentrated supernate create an environment conducive to the precipitation of solids. Removal of the relatively high concentration of aluminum in the liquor is beneficial to evaporator operation because it will reduce the rate at which sodium alumina silicate solids accumulate on the internal surfaces of the evaporator and the gravity drain line (GDL).

Consequently, after the Tank 38/43 transfer to Tank 49, a significant increase in the rate of space recovery in the 2H Evaporator System can be expected. A 10,000 gallon/day rate of space recovery is expected and will result in the ability to posture Type IV waste tanks for the continued long term support of DWPF recycle receipts and potentially freeing up one of the Type IV tanks (e.g. Tank 23) for deactivation. Space recovery rates exceeding 10,000 gallons/day were observed after the initial receipt of DWPF material into the 2H system and also after the chemical cleaning campaign in 2002. However, since June 2003, the maximum rate of space recovery from the 2H Evaporator has been ~7,000 gallons/day, and the rate will probably drop unless liquor is removed from the system.

Tank 49 was emptied in June 2004 and is not needed for the Interim Salt Planning Baseline until February 2005. Therefore, Tank 49 is available to be used for temporary liquor storage until February 2005. Ultimately, the ideal location for staging of the 2H liquor is Tank 24, so that Type III storage space can be used for higher activity wastes. The current baseline includes activities for initiating the 2H de-liquoring program starting in August 2004 with a final transfer from Tank 49 to Tank 24 being completed February 2005. The baseline also includes a contingency plan for transferring the liquor back into the 2H system if using a Type IV tank for liquor storage is not allowed (Note that this would result in reduced evaporator capacity and would negatively impact the plan).

9.6.2 Risks and Uncertainties:

Major risks associated with the plan are discussed below:

- There is a risk that a Type IV cannot be used to store the 2H liquor because the liquor would be too high in radionuclide concentration. The inability to use a Type IV waste tank for storage of 2H liquor will restrict the duration for which premium space recovery rate can be achieved to ~ 140 days. If the 2H liquor which is temporarily stored inside Tank 49 cannot be transferred into Tank 24 and must be transferred back into Tanks 38 and 43, then the space recovery will be reduced to less than 1 million gallons of Type IV space from the planned recovery of greater than 4 million gallons.

- Chemical cleaning of the 2H pot would result in approximately 60 days of downtime and reduce the overall space recovery. The chemical cleaning of the pot and the mechanical cleaning of the Tank 38 GDL, lift line, and separator pot will be completed reactively if the solids re-accumulate on the internal surfaces and the 2H System becomes “lift limited”. The next chemical cleaning campaign is expected to use NaOH as the cleaning chemical rather than nitric acid, which was used in the previous campaign.
- In order to optimize space recovery from the 2H Evaporator after deliquoring and maintain the 10,000 gallons/day space recovery rate, a transfer from Tank 24 will be needed before January 2005. A modification to the existing Tank 24 prime mover will be required to support emptying Tank 24. Evaporating current Tank 24 waste is required to support the ultimate transfer of Tank 49 liquor by February 2005 to Tank 24.

9.7 Storage of Solution from Tank 25 Initial Dissolution

The Planning Baseline includes the use of Tank 41 to temporarily store initial higher Cs salt dissolution batches from Tank 25 (the next tank in the batching sequence after Tank 48). This plan is based on successful implementation of the 2H Evaporator system de-liquoring program.

Based on current characterization and salt dissolution planning information, the initial dissolutions from a tank are the highest in Cs-137. Handling of this material through the low curie salt process would result in Cs-137 concentrations that do not meet the Saltstone processing assumption of 0.2 curie/gallon Cs-137 without a significant increase in volume from aggregation.

As discussed in Section 9.6.2 above, there is a risk that Tank 24 may not be allowed to be used for concentrated recycle storage. If this is the case, then the concentrated recycle staged in Tank 49 would be moved back into the 2H system (Tanks 38 and 43) resulting in an evaporator system full of concentrated liquor. To alleviate this condition the space in Tank 41 created from Batch 1 salt dissolution may have to be used to store concentrated liquor from the 2H system and, therefore, would not be available for use to support receipt of initial higher Cs-137 curie Tank 25 dissolutions. Maintaining the 2H system operational is important for ensuring space is available for DWPF recycle receipts. The realization of this risk may require a change to the Planning Baseline and potentially result in additional curies being sent to Saltstone.

9.8 *Other Risks*

9.8.1 LLW to Saltstone

The Salt Planning Baseline is based on the assumption that about 400 kgal of LLW from the H-Canyon HEU campaign can be sent to Saltstone. This is based on the assumption that the canyon will continue on a slow dissolution rate of two dissolutions per month through October 1, 2004. At that time, LLW will be diverted to Saltstone, and the number of dissolutions will increase to five per month. The purpose of the slowdown is to reduce the volume of waste being sent to the Tank Farm during the period up to October 1, 2004. The estimated quantities of waste going to Saltstone assuming this schedule are 315 kgal of first cycle waste and 84 kgal General Purpose Evaporator waste, for a total of about 400 kgal.

Sending these wastes to Saltstone requires notification to SCDHEC for increased radioactive and chemical constituents in the waste. There is a risk that SCDHEC will object to this change. In this case, a significant fraction (perhaps all) of the LLW will have to be sent to the Tank Farm, which will impact the assumptions for available tank space. There is also a possibility that SCDHEC will concur with the change but later than desired, causing the start date of sending Canyon LLW to Tank 50 to slip past October 1, 2004. This will also increase the amount of waste that must be sent to Tank 39 and eventually to an evaporator system. This could result in the need to dispose of additional salt waste during Interim Salt Processing, leading to additional curies being sent to Saltstone.

9.8.2 Salt and Supernate Characterization

One of the risks associated with the Salt Program Planning Baseline is that its success depends on the predicting the composition of transfers of waste from individual tanks. As described above, uncertainties in the draining process will affect the actual results. Errors in the estimated composition of waste in a tank or inhomogeneous regions in a tank will also affect the results.

For this reason, a program of salt and supernate sampling is planned to reduce the risk that incorrect information will impact the program. Overall, the technical objectives of sampling is to be able to understand chemical and radionuclide composition and physical attributes of material stored in the salt tanks to effectively select the proper treatment options for final processing and disposal. Inherent to this objective is an understanding of insoluble solids that form during dissolution and an understanding of species solubility. This information will be useful during heel removal activities.

Salt tank characterization will consist of performing a baseline annulus gamma scan (if required), development of a tank history, and collection and analysis of a full length salt core sample (excluding the last 36 inches of the tank) for selected salt tanks.

The results of this salt cake analysis will be used in the models to predict dissolved batch characteristics, determine process selection (Saltstone, ARP with or without an MST strike, MCU, and/or SWPF), as well as any other required process feed specification information. Information for each dissolution batch will be essential to establish an aggregation strategy to meet appropriate process feed specifications and the Saltstone WAC.

As the waste in the tank is dissolved, dip samples will be collected and analyzed to support the blending strategy and to provide validation data for models.

This current plan will focus on characterizing Tanks 25, 28, and up to six additional tanks by Fiscal Year 2006 (FY06). The additional tanks will be identified based on input from strategic planning and integration teams. A total of up to eight tanks will be characterized between FY04 and FY06.

One other characterization risk concerns the waste currently in Tank 50. New proposed WAC and Permit Tables for Saltstone have been developed. The contents of Tank 50 were last analyzed in early 2003, but this analysis did not include all the WAC constituents that are in the new tables. There is a risk that future analysis of Tank 50 will result in a component concentration that exceeds the WAC limits or permit tables.

9.8.3 Salt Staging Tank Not Available in F-Tank Farm

Disposition of salt from Tanks 25 and 28 is included in the Interim Planning Baseline. These tanks are included in the Planning Baseline since, after Tank 41, they are estimated to contain the lowest curie salt. There is currently no identified salt solution staging tank in F-Tank Farm that can be used to support the salt dissolution campaigns for Tanks 25 and 28 as shown on Figures 2 and 3. The Recommended Case only indicates a two-month duration for removing ~400 kgal of salt solution from Tank 25 to Tank 41. This limited duration is driven by the following constraints: 1) not starting Tank 25 dissolution until NWPA implementation is completed and 2) preparing Tank 25 as a contingency in the event Tank 48 can not be processed as Batch 2 to Saltstone. Due to the limited free space in Tank 25 (it contains over 1 million gallons of saltcake) and the lack of a salt solution staging tank, it will be difficult to complete this activity in the duration shown. The Tank 25 dissolution duration can be extended significantly if Tank 48 can be successfully dispositioned in Batches 2 and 3.

9.8.4 Funding Impacts

Full funding to implement the proposed Planning Baseline has not yet been identified. The new strategy requires significantly more non-labor funding than was originally planned in the contract period. The CBU and site have implemented savings initiatives and are addressing site priorities to make additional funding available for salt. In addition, FY05 spending is likely to be under a continuing resolution until Congress passes FY05 appropriation bills. A continuing resolution means that, until a new budget is authorized, spending for the site is limited to the average spend rate in FY04. This is likely to impact the turn up in spending projected in the Salt program to meet the Planning Baseline.

9.8.5 Type III Waste Tank Space Not Available

A shortage of waste storage space exists in the Type III/IIIA compliant tanks in both F- and H-Tank Farms. There is a risk that a tank leak or other adverse event could occur that would prevent execution of the Planning Baseline. The Planning Baseline assumes that no significant unexpected events reducing available space occur during the Interim period.

The lack of space is especially critical in the 2F and 3H Evaporator Systems. The only viable concentrate receipt tank for the 3H System is Tank 37. During the past 18 months, the salt level in Tank 37 has gone from ~ 195" to ~ 320". The system no longer has the capacity to process sludge batch decants and will be forced to shut down soon until salt can be removed from Tank 37. Although the 2F concentrate receipt tank currently has sufficient salt drop space, following the completion of Sludge Batch 4 preparation it is estimated that the salt level in Tank 27, the last available concentrate receipt tank in the 2F System, will be approaching 300". With the 3H System rendered inoperable due to tank space, significant schedule delays would be realized if the 2F is unable to process waste due to mechanical problems with the system itself, or with the infrastructure supporting F-Tank Farm. In addition, future sludge batch preparation is in jeopardy if sufficient salt cannot be removed from viable concentrate receipt tanks for the 2F and/or the 3H Evaporator Systems.

An additional risk is that sufficient space does not exist in the compliant tanks to allow supernate that has been concentrated to its maximum to be removed from the evaporator systems. This risk has been discussed for the 2H Evaporator System and its unique chemistry. A similar risk exists for the 2F and 3H Evaporator Systems.

The risk of significant impacts in schedule delays and potential interruption of sludge processing activities in DWPF increases with time. The longer salt processing is delayed, the greater the risk of significant impacts due to ever decreasing space in the compliant tanks. In order to efficiently disposition both sludge and salt wastes from the system, sufficient compliant tank space must exist in the right locations to allow the materials to be washed and/or properly dissolved and adjusted for processing. Since the majority of the limited compliant tank space is located at the very top of the tanks, such operations will become increasingly more inefficient and time consuming.

9.8.6 Sludge Batch Preparation Integration

The potential for changes in the sludge batch preparation schedule (e.g. volume of wash water required or the timing of wash water decants) is a risk to the successful implementation of the Planning Baseline. One of the major Planning Baseline objectives is to ensure that sludge preparation can continue at a rate to ensure that there is not a DWPF feed break. Key sludge processing assumptions that were used for integrating sludge batch preparation and DWPF processing needs with the salt Planning Baseline are included in Section 12.6. Impacts on the timing of sludge batch preparation due to the 2004 DSA revision for trapped gas retention in slurried sludge are included for the salt Planning Baseline time period being evaluated (i.e., through the start-up of SWPF). An evaluation is currently in progress to assess the impact of the DSA revision for trapped gas retention in slurried sludge on the overall sludge processing life-cycle.

10. Opportunities

There are a number of opportunities for improving the schedule or recovering from schedule problems, which are described in this section.

10.1 Tank 48 Disposition by Thermal and Chemical Degradation

The Planning Baseline for Salt Processing, which was described above, is to aggregate Tank 48 waste with other wastes going to Saltstone so that the resulting waste meets revised Saltstone WAC, DSA and permit requirements. However, there are a number of risks to this approach.

The backup case is to degrade the tetraphenylborate in Tank 48 using a combination of a catalyst (most likely palladium) and elevated temperatures. The degradation products from this operation, mostly benzene, are released into the vapor space and purged from the tank by the tank's ventilation system. The goal of the process is to reduce the tetraphenylborate inventory to a level that is acceptable for the Tank Farm DSA, about 400 grams.[13] Once the inventory is reduced to this level, the waste in Tank 48 can be treated as normal Tank Farm waste, i.e. it can be evaporated or mixed with other wastes. (Note that degradation may be beneficial even if it is not possible to reduce the tetraphenylborate inventory to less than 400 grams because it could be used to reduce the amount of tetraphenylborate being sent to Saltstone).

Research and development to support this case is currently underway. Preliminary results have not yet identified a combination of palladium catalyst and elevated temperature that will be sufficient to degrade the tetraphenylborate. There are a number of risks.

The risks of thermal and chemical degradation are as follows:

- It might not be possible to find conditions that will cause degradation at a rate high enough to adequately degrade the tetraphenylborate in a reasonable amount of time but not exceed safety limits in Tank 48. The desired rate is about 2 – 7 mg/L/hr. Research is currently ongoing to determine a method for achieving this degradation rate.
- Purposely raising the degradation rate in Tank 48 presents safety hazards. If the reaction were to get out of control, it could cause flammable vapors in Tank 48. The plan currently assumes that the costs of controls to mitigate this hazard are minimal. There is a risk that controls would be prohibitively expensive or burdensome.
- The implementation of this option would result in an estimated 750,000 gallons of waste in Tank 48 that must be transferred to an evaporator system for processing. Though it is expected that the space recovery from evaporation will be high, there is still a risk on the tank space impact on the Planning Baseline.

10.2 Other Opportunities for Dispositioning Tank 48 Waste

Even if it is not possible to reduce the tetraphenylborate inventory in Tank 48 to less than 400 grams, thermal and chemical degradation could be beneficially used. Depending on the results of the ongoing research on degradation, there are a number of possible ways that degradation could be used to enhance the program:

- Degradation could be performed on Tank 48 before aggregation, reducing the concentration of tetraphenylborate in the material being sent to Saltstone. This would mitigate the risks of tetraphenylborate in Tank 50 and Saltstone.
- After most of Tank 48 has been emptied by aggregation, the current plan is to flush the tank to further reduce the inventory of tetraphenylborate. There is a risk that more flushing than currently planned might be needed. Degradation could be used at this point to reduce the inventory of tetraphenylborate and reduce the difficulty of returning this tank to Tank Farm service.
- It may be possible to raise the DSA limit for the tetraphenylborate inventory in Tank 48 as more data on degradation becomes available.

10.3 Acceleration of MCU Startup

The recommended and back-up strategies show a need for the start-up of MCU operation in August 2007. This is based upon the need to start-up the MCU to decontaminate higher activity salt solutions on a schedule that supports several of the program objectives that are described in Section 5.   Specifically, the program objectives supported by MCU start-up in August 2007 are:

- Maintain sufficient space in the Tank Farms to allow continued DWPF Operations
- Support Sludge Batch preparation for DWPF
- Provide tank space to support staging of salt solution adequate to feed 5 Mgal of salt solution to SWPF during the initial year of operation starting in April 2009.
- Ensure that the curies to Saltstone during the Interim Salt program are acceptably low (less than 5 MCi total).

MCU start-up in August 2007 is also supportive of the following key assumption described in Section 6. :

- Process adequate salt solution as LCS and eventually by the ARP/MCU process to support Tanks 41, 42, 48, 49, 50, and 28 as SWPF feed staging tanks.

Acceleration of MCU startup before August 2007 would benefit the Salt Program in the following ways:

- It would reduce the number of curies sent to Saltstone as outlined in the Planning Baseline. Earlier operation of MCU would allow additional Salt batches to be processed through the MCU instead of being sent directly to Saltstone. The resulting decontaminated salt solution would then be sent to Saltstone.
- It would provide experience with operating a solvent extraction process on a production scale prior to operation of SWPF. Application of lessons learned during the operation of MCU provides risk reduction for SWPF startup and initial operations (The information will probably be received too late to have a significant impact on SWPF design).

- It would provide ability to process initial higher Cs-137 curie salt dissolutions from Tank 25 if Tank 41 space must be used for storage of 2H system concentrate.
- It would be a mitigator if salt solutions are prepared that are higher in Cs-137 concentration or actinides than expected. An unexpectedly high batch, which could not be sent to Saltstone, could be processed through MCU.

The following risks are associated with being able to accelerate MCU:

- Current program execution plans do not support acceleration of the MCU in the contract period. Additional non-labor funding and/or re-evaluation of priorities would be required to accelerate completion into CY06.
- Tank 48 disposition is scheduled for completion in April 2007. Acceleration of the MCU start-up would require initial feed to MCU to be from Tank 49. This acceleration would require modification of the Salt batching plan.
- The solvent extraction process for decontamination of Salt solution has not been operated on a production scale. Start-up of MCU (as is the case for any new process) carries risks associated with the unknowns of operating a process for the first time.
- The schedules developed for the start-up of MCU are very aggressive and have limited contingency. Acceleration of the start-up would increase the difficulty associated with meeting schedule commitments for facility start-up.

10.4 Saltstone Processing Rate Increase

The recommended and back-up strategies show Saltstone processing salt solutions at the following maximum rates:

- Start-up through July 2005 – 62,500* gallons salt solution processed per week
- August 2005 through March 2007 – 83,000* gallons salt solution processed per week
- April 2007 through April 2009 – 100,000* gallons salt solution processed per week for the recommended case. The back-up case remains at 83,000 gallons per week.
- April 2009 through End of Program – capable of processing salt solution at a rate that is consistent with and supportive of SWPF decontaminated salt solution effluent production rate.

  * Rates are an average throughput based on a 48 week year.

This schedule for increase in production capacity is based upon the assumptions and bases documented in Attachment A for the Saltstone Facility.

The Saltstone processing rate is one of the limiting schedule attributes in the recommended and back-up strategies. Increases in the rate would improve schedule contingency, i.e., unexpected schedule delays could be more easily accommodated. This will improve the ability to maintain sufficient space in the Tank Farms to allow continued DWPF Operations and support Sludge Batch preparation for DWPF.

The following risks are associated with being able to increase Saltstone processing rates:

- Current program execution plans do not support increasing the Saltstone processing rate. Additional non-labor funding and/or re-evaluation of priorities would be required to increase processing rates sooner or to a greater extent.

- Technologies/methods have not been developed that support increasing the Saltstone processing rates. Start-up of new equipment/processes (as is the case for any new process) carries risks associated with the unknowns of operating a process for the first time.
- The schedules that must be developed for the start-up of equipment and processes that are supportive of the increased processing rate will be very aggressive and have limited contingency. Acceleration of the start-up will increase the difficulty associated with meeting schedule commitments for facility start-up.

10.5 Minimize Influents to the Tank Farm

10.5.1 Slurry Mix Evaporator Condensate Tank (SMECT) Stream Processing

Currently, the contents of the DWPF SMECT are collected in the Recycle Collection Tank, neutralized, and sent to the Tank Farm. To reduce the impact of the DWPF on the Tank Farms, this stream could be diverted to Tank 50. About 600,000 gallons per year could be diverted. The stream can be diverted until about three months before the startup of the MCU. The diversion must stop at this time because operation of the MCU will use transfer paths in 512-S that are needed to transfer the SMECT contents to Tank 50.

The Planning Baseline assumes that the SMECT stream will not be diverted to Tank 50. This is because the Planning Baseline can be successfully implemented without it, so the effort to divert the stream is not currently warranted.

Diverting the SMECT could become critical if other risks prevent part of the program from proceeding—e.g., if the NWPA issues are not resolved, if SCHDEC does not grant the required permits, or if deliquoring of the 2H Evaporator system is not possible. In this case, a shutdown of the DWPF may eventually be required because there would not be sufficient space in the Tank Farm to receive the DWPF recycle. Diverting the SMECT stream would reduce the volume of waste going to the Tank Farm and would extend the period of time that DWPF could continue to operate.

The following risks are associated with being able to divert the SMECT stream to Tank 50:

- Diverting this stream will require new permits at Saltstone.
- Sludge carryover from upstream tanks can cause the SMECT stream to be contaminated with sludge, which would prevent the stream from going to Saltstone. Controls are in place to ensure that the stream is sent to the Tank Farm rather than Saltstone if a large carryover event (hundreds of gallons) occurs. However, there is the possibility that small carryover events (a few gallons) could make the stream unsuitable for Saltstone.
- For this stream to go to Saltstone requires that DOE determines the stream is LLW. Since the stream is occasionally contaminated with sludge carryover, there is a risk that the stream could not be classified as LLW.

10.5.2 LLW Streams from Canyon

Currently, the plan is to send 400 kgal of LLW from the canyon to Saltstone, which includes the first cycle waste (formerly High-Activity Waste) and the General Purpose Evaporator Bottoms. There is the potential to divert other streams, currently planned to go to the Tank Farms, to Saltstone. One example is the second cycle and other wastes (formerly Low-Activity Wastes). If this stream could be produced with concentrations that meet the Saltstone WAC, the additional Tank Farm space could be used to mitigate Tank Farm space concerns.

Both the recommended case (Case 2) and the backup case (Case 4) plan for 720 kgal of LLW from the canyons to Saltstone. Thus, there is the provision to divert additional streams to Saltstone (beyond the 400 kgal currently approved) without impacting the Planning Baseline.

11. References

[1] HLW-2002-00025, "Savannah River Site High level Waste System Plan," Revision 13, March 2002

[2] HLW-2002-00161, "PMP Supplement to HLW System Plan, Rev. 13," December 18, 2002

[3] "Governor's Nuclear Advisory Committee Comments on Accelerated Cleanup Program," Letter, Ben Rusche, Chairman, to Charles A. Hanse, Assistant Manager for Waste Disposition Project, July 30, 2004

[4] Paul d'Entremont and Ameya Acharekar, "Closure Business Unit Waste Characterization System (WCS) 1.5 Functional Performance Requirements and Design Specification," B-RS-H-00118, March 2003

[5] M. A. Rios-Armstrong et.al., "Waste Characterization System (WCS) Supernate Baseline Composition Development in Support of Integrated Flowsheet Modeling Efforts," WSRC-TR-2004-00375, July 20, 2004

[6] Flach, G.P., "Porous Medum Analysis of Interstitial Liquid Removal from Tank 41 and Tank 3", WSRC-TR-2003-00533, Revision 0, February 3, 2004

[7] John Sessions, "Enhanced Characterization Project PEP Execution Plan," CBU-SPT-2004-00119, May 24, 2004

[8] Alex Cozzi, Chris Langton, and Sam Fink, "Tank 48H Saltstone Benzene TCLP Data," SRNL-LWP-2004-00016, Presentation at Tank 48H POW, August 3, 2004

[9] WSP-SSF-2004-00027, Engineering Position on the Feed Stream Input and Strategy for the MAVRC and Vault #2 Projects, D.C. Sherburne, July 29, 2004

[10] WSP-SSF-2004-00031, Rev. 0, Dose Rate Estimates for Saltstone Project Vault #4 Receipt of 0.2 Ci/Gallon Low Curie Salt (U), C.M. Lunsford, August 12,2004

[11] WSP-SSF-2004-00029, Projected Saltstone Attainment for MAVRC Operation on Vault 4, D.C. Sherburne, August 9, 2004

[12] Christine A. Langton, "Technical Basis for LCS Saltstone Disposal Vault Classification," WSRC-TR-2003-00431, September 18, 2003

[13] CBU-SPT-2004-00115, Tank 48 Disposition Project Preliminary Flowsheet Aggregation Option, S. J. Strohmeier, May 19, 2004

12. ATTACHMENT A: Assumptions and Bases

Key assumptions and bases for the salt Planning Baseline are outlined below.

12.1 NWPA and Permitting

1. SCDHEC concurrence for sending LLW from unirradiated HEU processing to Saltstone is received by 8/31/04. At Saltstone, notification of processing is sufficient in lieu of receiving vault equivalency approval.

2. Demonstration permit for MCU received prior to 10/1/04 to support construction D&R activities.

3. Construction permits approved by 11/30/04 for
   - MAVRC Industrial Waste Water
   - MAVRC Air Permit

4. NWPA issues resolved (legislation) by 1/1/05 with implementation requirements unchanged from current Waste Incidental to Reprocessing (WIR) process.

5. Final approvals for the Interim Salt processing WIR (including LCS and Tank 48) received by 8/31/05.

6. NWPA implemented and DOE approval to proceed with low curie salt disposition in Saltstone by 10/1/05.

7. Operating permits approved by 6/1/05 for use of the new MAVRC equipment with current waste tables
   - MAVRC Industrial Waste Water
   - MAVRC Air Permit

8. Operating permits approved by 10/1/05 for use with LCS and ARP/MCU waste
   - MAVRC Industrial Waste Water
   - MAVRC Air Permit
   - Vault Equivalency for Vault 4
   - Solid Waste Landfill Permit for Vault 4

9. Construction permits approved by 11/15/05 for
   - Vault 2 Industrial Waste Water for Saltstone Production Facility (SPF)
   - Vault 2 Air Permit for SPF

10. Operating permits approved by 11/30/06 for
    - Vault 2 Industrial Waste Water for SPF
    - Vault 2 Air Permit for SPF
    - Solid Waste Landfill Permit for Vault 2

12.2 Minimize Influents

11. A forecast total of 400 kgal of LLW (unirradiated HEU) is planned to be sent to Tank 50 for processing at Saltstone. The stream will be sent beginning by the end of September 2004 at a rate of 30 kgal/month. For planning purposes, this rate was forecast for two years.

12. LLW DWPF SMECT stream is **not** sent to Tank 50. A decision point has been added to the Planning Baseline in 1/05 to evaluate the need for diverting the SMECT stream based on the success of the 2H de-liquoring program and the status of NWPA resolution and implementation.

13. ETP will continue to send its concentrate stream to Tank 50 at a rate of ~100 kgal/yr until the start of the SWPF. Post SWPF startup, ETP concentrate will be sent directly to the feed staging tank for Saltstone that is provided at that time. Careful integration of transfers from ETP to the staging tank will be required due to the small volume of waste concentrate sent in an ETP transfer as compared to the length of the piping and its volume.

14. Canyon waste transfers to Tank Farms are assumed as follows:

H-Canyon

Thru FY06	Support planned processing of unirradiated HEU as described above. Used 6/04 forecast.
FY07	Process remaining stored irradiated HEU solution. Assume 12 kgal/mo.
FY08 (6 mo.)	Assume shutdown flows of 10 kgal/mo.

Note: Additional Np dispositioned after Sludge Batch 4 processing will be treated in H-Canyon to remove most of the sulfates to eliminate impacts on DWPF operations. No new missions (spent fuel) that result in waste to the Tank Farms are assumed.

F-Canyon
Waste volumes per 7/04 forecast.

15. The Steam Atomized Scrubbers (SAS) at DWPF are not operated until the startup of the SWPF. However, the receipt of the Cs-137 stream from the MCU may require the SAS to be operational. Elevated rates would require either one or both stages of the SAS's to be put on-line.

12.3 Saltstone Modifications & Operations

16. Saltstone MAVRC design mature enough to support Construction permit approval by 11/30/04

17. Material processed at Saltstone will not exceed 0.2 Ci/gal Cs-137 prior to SWPF operations. After SWPF startup, material processed will be <0.006 Ci/gal Cs-137.

18. Available cells in Vault #4 can be used for decontaminated salt solution and potentially up to 0.2 Ci/gal Cs-137 low curie salt, depending on details of the process used. Six (6) cells in Vault #4 are equipped with LCS modifications.

19. Saltstone WAC, DSA and permits can be revised to accept feed material.

20. Existing Tank 48 material can be dispositioned at Saltstone through aggregation. Saltstone WAC, DSA and permits can be revised to accept material from Tank 48. If required, Saltstone modifications to mitigate Saltstone Feed Tank (SFT) flammability issue (e.g. blowers, purge, Lower Flammability Limit (LFL) monitoring, backshift monitoring by DWPF) will be funded and implemented to support processing needs.

21. Modifications and DSA changes, as required, can be completed in the Tank Farms to support aggregation of Tank 48 material to Saltstone.

22. Saltstone will use existing Tank 50 waste (ETP concentrate and canyon LLW) for checkout of modifications to demonstrate the planned initial LCS processing rate of 83 kgal/wk.

23. Tank 50 must be ready to support the initial receipt of LCS waste by 9/1/05. To empty Tank 50 to a minimal heel, 750 kgal or less will be processed by Saltstone. Note: Some of this material may be used for initial adjustment of the first LCS batch, if required, resulting in a smaller volume that must be processed.

24. It is assumed that Saltstone can increase its processing rate to 100 kgal/wk by 4/1/07 to support the interim salt Planning Baseline needs.

25. It is assumed that Saltstone can increase its processing rate again in 4/09 to support planned SWPF operating rates. Note: The amount of decontaminated salt solution sent to Saltstone from SWPF is estimated to be at a ratio of 1.3:1 of the feed (at 6.44 M Na) to SWPF.

12.4 Salt Solution Batching

26. LCS and ARP/MCU processing will be performed until adequate feed is staged for the SWPF or two months (2/09) before the SWPF goes hot in 4/09. Tanks to be used for preparation of SWPF feed include all or some of the following: Tanks 41, 42, 48, 49, 50 and one F-Area tank.

27. MCU facility will operate with the following attributes
    - flowrate of 4 gpm @ 75% attainment
    - 50% of normal production for initial quarter of operation
    - feed stream is 5.6 M Na
    - process target will be Class C waste
    - target a decontamination Factor (DF) of 12 for Cs-137

- Decanters will reduce organic carryover to <50 ppm and no feed staging tank will be required between MCU and DWPF. Tank 50 and DWPF will not be impacted.

28. Residual Tetraphenylborate (TPB) levels in Tank 48 will not impact ARP and MCU operations.

29. During LCS processing, sufficient space will be maintained in Tank 50 to accommodate a LLW stream from H-Canyon consisting of waste generated from unirradiated fuel and for continued receipt of ETP concentrate.

30. To ensure Saltstone WAC requirements are met, the material balance approach for Tank 50 management will be acceptable for canyon LLW and, if required, diverted SMECT recycle (DWPF) processing.

31. A minimum of 30 days will be maintained in Tank 49 for settling of insoluble actinides before a WAC sample is pulled. It is assumed that dissolutions will meet WAC limits for actinides without ARP processing (settling will be sufficient). This requires that the Tank 49 feed pump be raised. Note: For later dissolutions from salt in Tanks 25 and 28 where actinide levels are expected to be higher, a minimum of 45 days was allowed for settling.

32. WAC sample results can be obtained in 30 days to allow processing of LCS to Saltstone.

33. A minimum of 30 days are allowed for potential enrichment control in the staging tank of feed streams to ARP/MCU. Modifications will be provided to support the tank's use for enrichment control.

34. Move LCS from Tank 49 to Tank 50 not earlier than 9/1/05 (6/1/05 plus 90 days) after public comment period on Saltstone permits.

35. Initial Tank 25 salt dissolution and associated transfer to Tank 41 can be accomplished without the benefit of a salt solution staging tank in F-Tank Farm.

36. After the completion of Tank 48 aggregation, a minimum six month period is provided to restore Tank 48 to Tank Farm service (revise DSA, equipment modifications, etc.). The tank is assumed empty at the end of a heel removal campaign. Any waste generated in the heel removal campaign can either be handled in an evaporator system or disposed of as part of the initial salt solution batch(es) processed through Tank 48.

37. If thermal and chemical degradation can be implemented to disposition the Tank 48 waste, then the TPB end state will allow the resultant Tank 48 waste stream (estimated to be ~750 kgal) to be processed through an evaporator system.

38. After LCS/MCU processing campaigns are completed, Tank 50 may be returned to Tank Farm service to support feeding SWPF at up to 7 Mgal/yr or to support tank closure activities. When Tank 50 is returned to Tank Farm service, used for staging salt solution feed for SWPF, then a new decontaminated salt solution hold tank for SWPF must be available.
    - Operable mixing pumps will remain in Tank 50.
    - Use of Tank 50 for salt solution feed staging will require shielding upgrades to transfer and slurry pump risers and potentially at associated above grade transfer lines.
    - After receiving stream from MCU operation, adequate flushing can be performed to remove Tank 50 from organic tank status.

39. Including Tank 50, a total of five Type III staging tanks will be required to support SWPF and ARP operations. Tank 41 and 42 will have operational mixing pumps (4 each) to support enrichment control. Tank 49 must have operational mixing pumps to support feed to SWPF.

40. After SWPF starts up, the transfer line between Tank 49 valve box and SWPF must be flushed prior to MST/Sludge transfers from 512-S to 511-S.

12.5 Transfer Planning Integration

41. The 12-month Transfer Plan, Rev. 4.0, approved on 8/12/04, was used for input of movements of waste within the Tank Farm and evaporator operations. This plan identifies movements of waste and evaporator performance requirements to support the program through 8/05.

42. ARP (512-S) will have a dedicated path to SWPF for clarified salt solution.

43. Transfer path from HDB-7 to Tank 49 is impacted during installation of new 241-96H valve box (scheduled from 5/05 – 9/05). During the first and last two weeks of this duration no transfers can be performed through HDB-7 due to required work in the diversion box to install and later remove a nozzle blank. In other weeks from 5/05 to 9/05, any transfers to Tank 49 must be integrated so as not to impact valve box installation.

44. The 8/12/04 Transfer Plan assumes that concentrated DWPF recycle can be transferred and stored in Tank 24 by 2/1/05 to support the use of Tank 49 for receipt of initial Tank 41 LCS dissolution. No technical or regulatory impacts prevent the use of Tank 24 for storing concentrated recycle.

45. Transfers into or out of Tank 49 will impact ARP/MCU operations due to a shared transfer path. These operations will be integrated to minimize impacts.

46. No tank leaks or other adverse events occur that require removal of some or all of the waste from a tank. (Note: there is some contingency in the schedule to accommodate

minor adverse events, but a major tank leak would require revising the Planning Baseline.)

12.6 Sludge Batch Preparation Integration

One of the major salt Planning Baseline objectives is to ensure that sludge preparation can continue at a rate to ensure that there is not a DWPF feed break. Therefore, it is important to also document the sludge processing assumptions that will be integrated in with the salt Planning Baseline. Impacts on the timing of sludge batch preparation due to the 2004 DSA revision for trapped gas retention in slurried sludge are included for the salt Planning Baseline time period being evaluated (i.e., through the start-up of SWPF).

47. Sludge Batches
- Sludge Batch 4 — Tanks 4, 5, 6 and 11 and heels from 8, 51, and 40. Must be split into a 4a and 4b due to limitations for staging a fully prepped batch in Tank 40 due to sludge level restrictions of 90".
- Sludge Batch 5 — Tanks 12 and 13 (60%) Must be split into a 5a (Tank 12 only) and 5b (Tank 13 – 60%) due to limitations for prepping full batch in Tank 51 due to sludge level restrictions of 90".
- Sludge Batch 6 — Tanks 13 (40%) and 15

48. The following bases were used in the determination of batches.
- Transfers to the DWPF feed tank (Tank 40) are limited to allow minimum of 7 days to LFL.
  Note: This is why Sludge Batch 4 must be split.
- Washing batch size is limited to allow at least 20 days seismic quiescent time (Q time) in the wash tank (Tank 51).
  Note: This is why Sludge Batch 5 must be split.
- Sludge Batch 4 is washed in parts and combined in Tank 51. Tank 7 is used as an additional wash tank for washing of the Tank 4 sludge.
- Sludge masses and compositions for Sludge Batch 3 and Tank 11 (part of Sludge Batch 4) are based on WCS corrected for sample data and measured slurry volume. The remaining data for other tanks is based on WCS.
- Because all of Sludge Batch 4 can not be moved out of Tank 51 in the Contract period, Sludge Batch 3 is used until 9/30/06 so as not to impact waste loading in the contract period. Note: Sludge Batch 3 has a waste loading potential up to ~38 wt% while the addition of Sludge Batch 4 reduces the waste loading to ~30 – 34 wt%.

Canister Production Assumptions:
- Exactly 1100 equivalent canisters are made in the Contract period. Waste loading is selected to make exactly 880 actual canisters.

- End dates for Sludge Batches 4a and 4b are based on vitrifying at the rate of 250 actual cans per year and at loadings limited by processing constraints.
- Sludge Batches 5 and 6 loading is limited to a maximum of 38 wt% for DWPF processing considerations. Note: There may be potential to increase this loading for some of the sludge batches following experimental testing and after gaining additional processing experience.
- Sludge Batch 3 is in Tank 40 and is being fed to DWPF.
- Sludge Batch 4 will be washed, qualified, and entirely in Tank 51 by June 2006. The first transfer (SB4A) to Tank 40 is limited by time to LFL in Tank 40 and can be made on 10/2006. Tank 40 can receive the remainder (SB4B) on 7/2007.
- Batch 5A can be received in Tank 51 on 7/2007 for washing and qualification. SB5A can be moved to Tank 40 on 8/2008.
- SB5B can be received in Tank 51 on 8/2008 and transferred to Tank 40 on 7/2009.
- Sludge Batch 6 does not have to be split. It can be made up and washed in Tank 51 on 7/2009 and can be moved to Tank 40 on 2/2011.

Sludge Batch Canister Production and Timing

Sludge Batch	Sludge Tanks Fed	Actual Canisters	End Date	Actual Canisters Per Year	Sludge Oxide Loading, wt. %	Tank 40 heel, inches
3	7, 18, 19	633	10/2006	252	33.94%	90.2
4A	4, 5, 6, 11	193	7/2007	250	34.20%	157.5
4B	4, 5, 6, 11	281	8/2008	250	33.10%	113.5
5A	12	227	7/2009	250	38.00%	112.4
5B	13(60%)	397	2/2011	250	38.00%	78.6
6	13(40%), 15	550	5/2013	250	38.00%	40.0

49. Disposition of remaining Np from H-Canyon does not increase Sludge Batch 4 decant volumes greater than forecast and the SB4/Np combined sulfate concentrations will be low enough to meet the DWPF sulfate solubility limit.

12.7 Salt Waste Processing Facility

The following assumptions for the SWPF were provided by DOE-Savannah River (DOE—SR).

50. SWPF hot operations by 4/1/09
    Note For Information Only: The project date for the start-up of SWPF is 7/9/09. Parsons is incentivized to accelerate the start date to as early as 12/08

51. SWPF Operating Rates

    - Initial Year of SWPF ops: 5 Mgal/yr salt solution

- Remaining Years of SWPF ops: Up to 7 Mgal/yr salt solution for ARP/ SWPF processing with ARP providing about 1 Mgal of the 7 Mgal/yr total

52. SWPF will accept 5.6 M Na salt solution from ARP which has been actinide processed to Class A (assume 24 hr MST strike) and internally be able to actinide process 5.0 Mgal/yr of 6.44 M Na salt solution

13. ATTACHMENT B: System Description

13.1 Background

The Savannah River Site (SRS) in South Carolina is a 300-square-mile Department of Energy (DOE) complex that has produced nuclear materials for national defense, research, and medical programs since it became operational in 1951. As a waste by-product of this production, there are approximately 36 million gallons of radioactive liquid waste currently stored in underground waste storage tanks. Continued, long-term storage of these liquid, radioactive wastes in underground tanks poses an environmental risk. Therefore, the Closure Business Unit at SRS has, since FY96, been removing waste from tanks; pre-treating it; vitrifying it; and pouring the vitrified waste into canisters for long-term disposal. By the end of FY03, over 1,450 canisters of waste have been vitrified. The canisters vitrified to date have all contained sludge waste. Salt waste processing is still being developed.

The Liquid Waste & Waste Solidification (LW&WS) System is the integrated series of facilities at SRS that convert waste stored in the tanks into glass at DWPF and grout at Saltstone. This system includes facilities for storage, evaporation, waste removal, pre-treatment, vitrification, and disposal. These facilities are shown in Figure 6 and are briefly described in the text that follows.

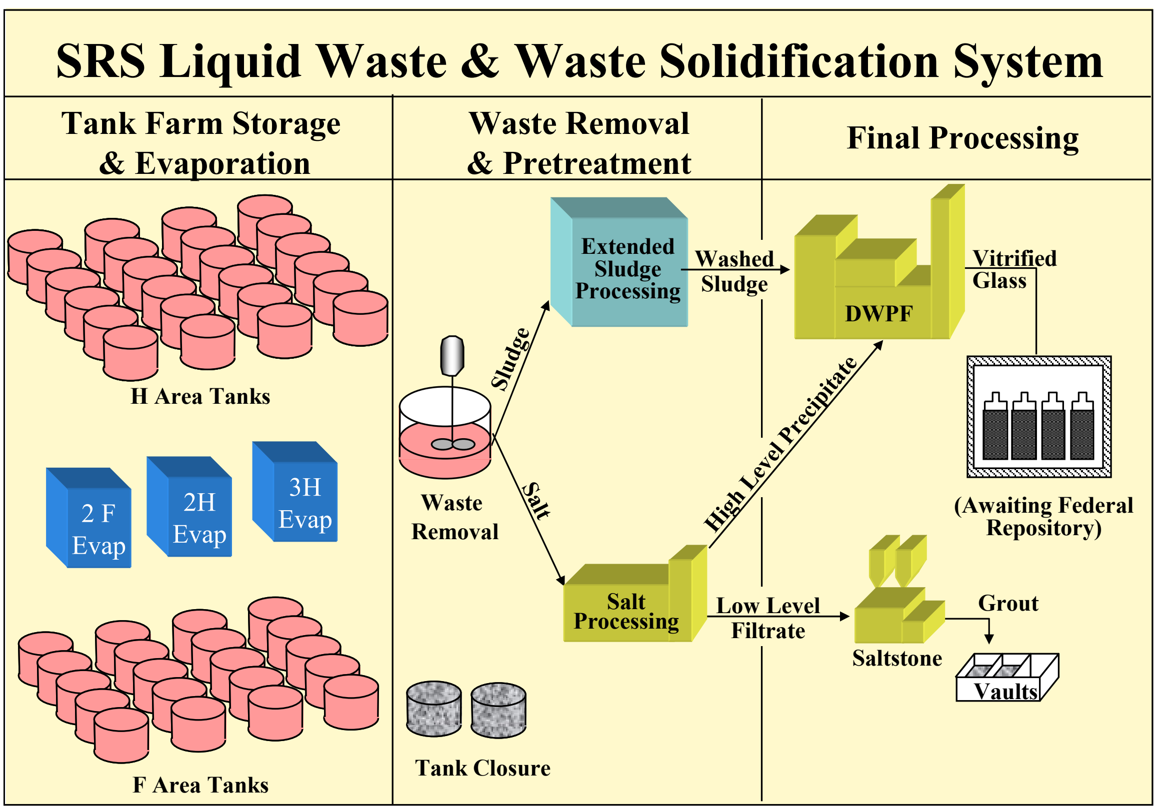


Figure 6 – SRS LW&WS System

13.2 Tank Storage

The 36 million gallons of radioactive liquid waste at SRS are stored in 49 underground waste storage and processing tanks. In addition, there are two waste storage tanks that have been emptied and closed for a total of 51 tanks. The waste storage tanks are located in two separate "tank farms," one in H-Area and the other in F-Area. The stored waste contains ~417 million curies of radioactivity.

There are four types of underground waste storage tanks at SRS. The 16 Type I and Type II tanks do not meet current secondary containment and leak detection standards. They are described as higher risk and sit at or near the water table level. The age and condition of the Type I and II waste storage tanks at SRS is of increasing concern. They were placed in service between 1954 and 1964 and, over the years, ten of these tanks have leaked waste from the primary tank into the secondary pan. In one case, tens of gallons of waste leaked from the secondary pan into the environment. Removing waste from these tanks as soon as possible is important, given the environmental risks posed by continuing to store liquid waste in these aging tanks. There are eight Type IV tanks. Four Type IV tanks, of which four are used for low activity waste, two are closed, and two are empty and being closed. The 27 Type III tanks are RCRA compliant, having full secondary containment.

The waste stored in SRS tanks is broadly characterized as either "sludge waste" or "salt waste." Sludge waste consists of insoluble solids that settle to the bottom of a waste tank, typically beneath a layer of liquid supernate. Sludge generally contains the radioactive elements strontium, plutonium, and uranium in the form of metal hydroxides. Sludge is only 7% of the SRS waste volume (~3 million gallons) but is 51% of the waste radioactivity (~213 million curies).

Salt waste is soluble and is dissolved in the liquid. Salt generally contains the radioactive element cesium and trace amounts of other soluble radioactive elements in the form of dissolved salts. Salt waste is 93% of the SRS waste volume (33.5 million gallons) and 49% of waste radioactivity (~204 million curies). Salt waste can be further described as being "supernate" (in normal solution), "concentrated supernate" (after evaporation has removed some of the liquid), or "saltcake" (previously dissolved salts that have now crystallized out of solution). A single waste tank can contain sludge, supernate, and salt cake, although an effort is made to segregate sludge and saltcake into different tanks.

13.3 Volume Reduction — Evaporation

To make better use of available tank storage capacity, incoming liquid waste is evaporated to reduce its volume. This is critical because most of the SRS Type III waste storage tanks are already at or near full capacity. Since 1951, the tank farms have received over 140 million gallons of liquid waste, of which over 100 million gallons have been evaporated, leaving the 36 million gallons in the storage tanks. Projected available tank space is carefully tracked to ensure that the tank farms do not become "water logged," a term meaning that all of usable tank space has been filled. A portion of tank space must be reserved for Contingency Transfer Space and for working space within the tanks. Waste receipts and transfers are normal tank farm activities as the tank farms receive new waste from the F and H Separations Canyons, stabilization and de-inventory programs, recycle water from DWPF processing, and wash water from sludge washing. The tank farms also make routine transfers to and from tanks and evaporators. With the continued receipt of new waste and continued sludge processing, the working capacity of the tank farms will be steadily reduced each year until salt processing becomes operational.

Three evaporator systems are currently operating at SRS – the 2H, 3H, and 2F systems.

13.4 Waste Removal & Tank Closure

13.4.1 Waste Removal from Tanks

During waste removal, water is added to waste tanks to facilitate removing the waste. If the tank contains salt, this water and agitation, if required, dilutes the concentrated salt or re-dissolves the salt cake. If the tank contains sludge, this water and agitation suspends the insoluble sludge particles. In either case the resulting liquid slurry, which now contains the dissolved salt or suspended sludge, can be pumped out of the tanks and transferred to waste pre-treatment tanks.

13.4.2 Tank Closure

Once bulk waste has been removed from a tank, a series of activities are needed to prepare it for closure. Tank closure involves heel removal and water washing, isolation, and filling with grout. Heel removal and water washing are used to remove the residual waste "heel" in the tank (the last several inches at the bottom) to the maximum extent practical. Spray nozzles wash down the tank sides and bottom, and specialized equipment removes this residual waste. The tank is then isolated by cutting and capping all service lines (power, steam, water, and air) and sealing all tank risers and openings. Finally, the tank is filled with layers of grout, which bind up any remaining waste, leaving the tank safe for long-term surveillance and maintenance. The schedule for waste removal and tank closure is part of the Federal Facility Agreement (FFA) between DOE, the Environmental Protection Agency (EPA), and the South Carolina Department of Health and Environmental Control (SCDHEC).

13.5 Safe Disposal of the Waste

The goal of Liquid Waste (LW) disposition is to convert all the waste into one of two final waste forms: Glass, which will contain most of the radioactivity; and Saltstone, which will contain most of the volume.

Each of the waste types at SRS needs to be treated to accomplish disposal in these two waste forms:

- The sludge must be washed to remove non-radioactive salts that would interfere with glass production. The washed sludge can then be sent to glass.
- The salt must be treated to separate the bulk of the radionuclides from the non-radioactive salts in the waste. Starting in 2009, this separation will be accomplished in the SWPF. However, until the startup of the SWPF, Interim Salt Processing will be

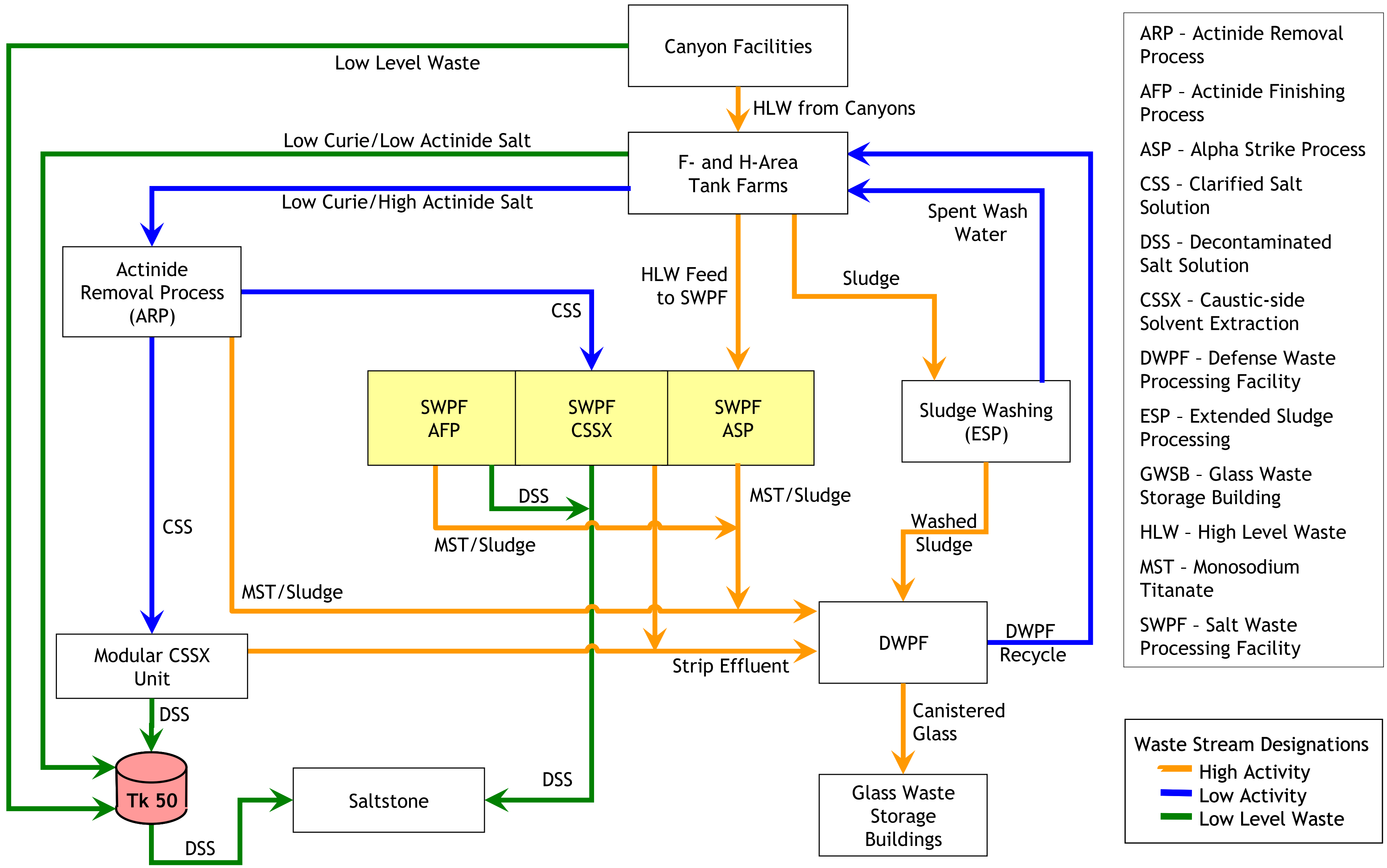
used to accomplish this activity. Figure 7 shows the interrelationships of all the processes that are planned for treating salt.

- In one tank (Tank 48) containing tetraphenylborate left over from In-Tank Precipitation processing, the waste must be treated either by aggregating this waste with other wastes or degrading the tetraphenylborate to low enough levels that it can be handled by the other processes.

13.5.1 Sludge Processing

Sludge is "washed" to reduce the amount of non-radioactive soluble salts remaining in the sludge. This ensures that the sludge meets DWPF Waste Acceptance Criteria and Federal Repository requirements as well as reducing the overall volume of high-level waste to be vitrified. The processed sludge is called "washed sludge" and is sent to DWPF. During sludge processing, large volumes of wash water are generated and must be returned to the tank farms where it is volume-reduced by evaporation. Over the life of the waste removal program, the sludge currently stored in a number of tanks at SRS will be blended into separate sludge "batches" to be processed and fed to DWPF for vitrification.

Figure 7 - Liquid Waste Disposition at the SRS



13.5.2 Salt Processing

A final DOE technology selection for HLW salt solution processing was completed and a Salt Processing Environmental Impact Statement (EIS) Record of Decision (ROD) was issued in October 2001. The ROD designated Caustic Side Solvent Extraction (CSSX) as the preferred alternative to be used to separate cesium from salt waste. In parallel, SRS evaluated the implementation of other salt processing alternatives for specific waste portions that would not need to be processed in the CSSX facility and could be processed before the CSSX facility was operational. The evaluation of alternatives and potential operations would be undertaken to maintain operational capacity and flexibility in the LW&WS system and meet commitments for closure of liquid waste tanks.

The Salt Processing Planning Baseline calls for using four different processes to treat salt:

- Low-Curie Salt—for salt in a few tanks that are relatively low in radioactive content, the treatment of draining the interstitial liquid is sufficient to produce a salt that meets the Saltstone WAC. This process works because the primary radionuclide in salt is Cs-137, which is highly soluble. By exploiting the solubility of Cs-137 and isolating the insoluble fraction, a low-level waste salt stream can be produced. This low-level waste salt is then dissolved and sent to Saltstone.
- Low Curie/High Actinide Salt—for salt in some tanks, even though draining the interstitial liquid sufficiently reduces Cs-137 concentrations, the actinide concentrations of the resulting salt are too high. Salt from these tanks will be sent to an actinide removal process (ARP). In ARP monosodium titanate (MST) is added to the waste as a finely divided solid. Actinides are sorbed on the MST and then filtered out of the liquid to produce a low-level waste stream that is sent to Saltstone or the MCU. After SWPF startup, ARP will send clarified salt solution to SWPF from cesium removal.
- Modular CSSX Unit (MCU)—for tanks with salt that is too high in activity for interstitial draining to sufficiently reduce Cs-137 concentrations, the salt in these tanks must be further treated to reduce the concentration of Cs-137 using the CSSX process. After 2009, this will be done in a new facility, the SWPF. However, so that some of these wastes can be treated before 2009, plans are to build a small-scale modular CSSX unit. Salt to be processed will first be processed through ARP and then through the modular unit. This unit will allow processing of higher curie salt at a relatively low rate.
- Salt Waste Processing Facility (SWPF)—this is the full-scale CSSX process. The facility incorporates both the ARP and CSSX process in a full-scale, shielded facility capable of handling salt with high levels of radioactivity. After startup of the SWPF in 2009, all remaining salt will be processed through this facility.

13.6 Final Processing

13.6.1 DWPF Vitrification

Final processing for the highly radioactive washed sludge and salt waste occurs at the DWPF facility. This waste includes MST/Sludge from ARP or SWPF, the cesium strip effluent from MCU or SWPF, and the sludge stream from the Extended Sludge Processing (ESP) facility. In a complex sequence of carefully controlled chemical reactions, this waste is blended with glass frit and melted at 2,100 degrees Fahrenheit to vitrify it into a borosilicate glass form. The resulting molten glass is poured into 10-foot-tall, 2-foot-diameter, stainless steel canisters. As the filled canisters cool, the molten glass solidifies, immobilizing the radioactive waste within the glass structure. The vitrified waste will remain radioactive for thousands of years. After the canisters have cooled, they are permanently sealed and the external surfaces are decontaminated to meet US Department of Transportation requirements. A low-level recycle waste stream is returned to the tank farms.

Once the DWPF vitrification facility has filled, sealed and decontaminated the canisters, a Shielded Canister Transporter (SCT) moves the highly radioactive canisters from DWPF to a Glass Waste Storage Building (GWSB) for interim storage. The GWSB is a standard, steel-frame building with a below ground seismically qualified concrete vault with vertical storage positions for 2,159 canisters. A five-foot thick concrete floor separates the storage vault from the operating area above ground. The canisters are stored pending shipment to a Federal Repository for permanent disposal.

13.6.2 Saltstone: On-site Disposal of Low-Level Waste

Final disposition of the low-level decontaminated "salt solution" from salt processing occurs at the Saltstone Facility. In the Saltstone process, this low-level waste is mixed with cement, fly ash, and slag to form a grout that can be safely and permanently disposed in on-site vaults. The grout mixture is transferred to disposal vaults where it hardens into "Saltstone," a non-hazardous solid. The vaults are constructed on a "just-in-time" basis, in coordination with salt processing production rates.

Figure 2

Recommended Case — Salt Processing Strategy Schedule (v1.0 Tank 48 Aggregation)

CBU-PED-2004-00027
Revision: 0

Figure 3

Backup Case — Salt Processing Strategy Schedule (v1.1 — Tank 48 Thermal Degradation)

CBU-PED-2004-00027
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