U.S. Department of Energy
Office of River Protection
P.O. Box 450, MSIN H6-60
Richland, Washington 99352

0071911

DEC 21 2006

06-TPD-083

Ms. Jane Hedges, Program Manager
Nuclear Waste Program
Washington State
Department of Ecology
3100 Port of Benton Blvd.
Richland, Washington 99354

Dear Ms. Hedges:

SUBMITTAL OF SINGLE-SHELL TANK RETRIEVAL SELECTION AND SEQUENCE, RPP-21216, REVISION 2, HANFORD FEDERAL FACILITY AGREEMENT AND CONSENT ORDER (HFFACO) MILESTONE M-45-02M

Reference: Ecology letter from J. J. Lyon to R. J. Schepens, ORP, "Hanford Federal Facility Agreement and Consent Order (HFFACO) Milestone M-45-02M, 'Update SST Retrieval Sequence document," dated November 8, 2006. 0071728

Enclosed for your review and approval is the "Single-Shell Tank Retrieval Selection and Sequence," RPP-21216, Revision 2.

In the Reference, the Washington State Department of Ecology (Ecology) requested a meeting by November 9, 2006, to resolve Ecology comments on, *Single-Shell Tank (SST) Retrieval Selection and Sequence Document*, RPP-21216, Revision 1-B, and submittal of an update document within 45 days of the meeting. In response, the U.S. Department of Energy, Office of River Protection and its contractor CH2M HILL Hanford Group, Inc., met with Ecology on November 9, 2006, to address Ecology comments and reach tentative agreement on necessary revisions to RPP-21216. A follow-on meeting was held on November 30, 2006, to finalize the revisions, and Ecology indicated the revised document, RPP-21216, Revision 2, (enclosed) would meet the requirements of HFFACO Milestone M-45-02M.

If you have any questions, please contact me, or your staff may contact Roger Quintero, Tank Farms Programs and Projects Division, (509)373-0421.

Sincerely,

T. Zach Smith

for Roy J. Schepens, Manager
Office of River Protection

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TPD:RAQ

Enclosure

cc: See page 2

cc w/o encl:
M. N. Jaraysi, CH2M HILL
J. A. Voogd, CH2M HILL

cc w/encl:
S. Harris, CTUIR
J. J. Lyon, Ecology
T. Martin, HAB
G. Bohnee, NPT
K. Niles, Oregon Energy
R. Jim, YN
Administrative Record M-45-02M
CH2M HILL Correspondence
Environmental Portal, LMSI

RPP-21216
Revision 2

SINGLE-SHELL TANK RETRIEVAL SELECTION AND SEQUENCE

R. A. Kirkbride
T. W. Crawford
P. G. Haigh
N. W. Kirch
S. L. Orcutt
M. G. Thien
J. A. Voogd

CH2M HILL Hanford Group, Inc.

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CH2MHILL
Hanford Group, Inc.

Post Office Box 1500
Richland, Washington

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LIST OF TERMS

Abbreviations and Acronyms

BBI	Best-Basis Inventory
BDGRE	buoyant displacement gas release event
BVS	Bulk Vitrification System
CH2M HILL	CH2M HILL Hanford Group, Inc.
DBVS	Demonstration Bulk Vitrification System
DOE	U.S. Department of Energy
DST	double-shell tank
Ecology	State of Washington, Department of Ecology
EPA	Environmental Protection Agency
HFFACO	*Hanford Federal Facility Agreement and Consent Order*
HTWOS	Hanford Tank Waste Operations Simulator
MRS	mobile retrieval system
MS	modified sluicing
NEPA	National Environmental Policy Act
ORP	U.S. Department of Energy, Office of River Protection
PFP	Plutonium Finishing Plant
RPP	River Protection Project
RWL	remote water lance
SpG	specific gravity
SST	single-shell tank
TOE	total operating efficiency
TRU	transuranic waste
Vacuum	vacuum retrieval system
WMA	waste management area
WTP	Waste Treatment and Immobilization Plant

Units

Ci/gal	curies per gallon
Kgal	kilogallons (1,000 gallons)
Kgal/year	kilogallons per year
Mgal	million gallons

1.0 INTRODUCTION

This document is provided in accordance with Hanford *Federal Facility Agreement and Consent Order* (HFFACO; Ecology et al. 2003) milestone M-45-02M, "Submit biennial update to SST retrieval sequence document (Agreement Appendix I. Section 2.1.2), Double-Shell Tank space evaluation document and Ecology concurrence of additional tank acquisition." This report satisfies all the requirements of milestone M-45-02M. The full text of milestone M-45-02M can be found in Appendix A.

This revision of the document reflects the start up of the Waste Treatment and Immobilization Plant (WTP) and the use of supplemental low-activity waste treatment. The assumptions used for revision 1-B of this document were updated in March 2006 to include startup dates and capacities for the WTP and supplemental treatment, and the Hanford Tank Waste Operation Simulator (HTWOS) model was run through the completion of the River Protection Project (RPP) mission[1]. The revised document provides a retrieval schedule for all of the single-shell tanks (SSTs), a summary of the 242-A evaporator runs projected to be made to support the RPP mission, additional detail about the assumptions used in the evaluation, and a discussion of the double-shell tank (DST) space needed to support the retrieval schedule.

Where information regarding treatment, management, and disposal of the radioactive source, byproduct material and/or special nuclear components of mixed waste (as defined by the Atomic Energy Act of 1954, as amended) has been incorporated into this document, it is not incorporated for the purpose of regulating the radiation hazards of such components under the authority of chapter 70.105 RCW and its implementing regulations but is provided for information purposes only.

1.1 DOCUMENT OVERVIEW

This document presents a tank retrieval selection and sequencing evaluation developed in accordance with criteria in HFFACO Appendix I. The pool of tanks selected for retrieval, retrieval method(s), estimated duration, and estimated waste volumes to be generated during retrieval and transferred to the double-shell tanks (DSTs) are provided. The following paragraphs provide an overview of the contents of this document, and Table 1-1 provides a crosswalk between the criteria in HFFACO milestone M-45-02M and the parts of this document that satisfy the milestone criteria.

Section 2, Single-Shell Tank Retrieval Pool, discusses the pool of single-shell tanks (SSTs) to be used for selecting and sequencing the next several years of tank waste retrieval activities. The SSTs in the retrieval pool were selected to meet the primary objective of maximizing risk reduction through the retrieval of mobile, long-lived radionuclides or potential airborne contaminants and principal nonradiological hazardous constituents in a manner that is sensitive to waste treatment facility requirements and infrastructure constraints.

[1] The modeling was performed to support development of an Office of River Protection baseline currently with the U. S. Department of Energy, Headquarters, for approval.

Section 3, Single-Shell Tank Retrieval Sequence, discusses a retrieval sequence that selects from tanks in the SST retrieval pool, taking into consideration DST space and waste compatibility plus the closure of waste management areas and resource optimization. The retrieval methodologies to be employed and estimated waste volumes to be generated during retrieval are also provided.

Section 4, Double-Shell Tank Space Evaluation, evaluates DST space availability resulting from the SST retrievals identified in Section 3. The DST space evaluation is based on the results from an HTWOS model run.

Section 5, Double-Shell Tank Space Options, describes DST space-saving options that affect receipt and storage of SST waste. Four DST space-saving options were implemented to complete HFFACO milestone M-46-21 in December 2005, including:

- Increase the DST fill height in AP tank farm,
- Concentrate supernatant waste to a specific gravity (SpG) above 1.41,
- Use "restricted" space in WTP staged feed tanks, and
- Maintain a common 1.2 million gallons of emergency storage space for both Tank Farms and WTP activities.

Further measures that could be used to provide additional space for SST waste retrieval are discussed in Section 5.2.

Table 1-1. Crosswalk Between M-45-02M Milestone Criteria and This Document

Milestone M-45-02M Criteria	Portion of Document Satisfying the Criteria
"...define the tank retrieval sequence..."	Tables 3-1 and 3-2
"...define the..." " ...selection criteria and rationale..." And "...list tank selection rationale..."	Section 2.0
"...define the..." ...reference retrieval method(s) for each tank..." And "...list retrieval methodologies to be employed..."	Table 3-1 and Appendix C
"...define the..." ...estimated retrieval schedules."	Table 3-2
"...list..." "...estimated waste volumes to be generated during retrieval"	Table 3-1 and 3-2
"...discussions covering all assumptions which form the basis of the projection."	Section 1.2 and Appendix C

1.2 EVALUATION METHODOLOGY AND ASSUMPTIONS

This evaluation uses the HTWOS model for the prediction of tank space and depiction of tank farm processing events. The HTWOS model simulates the waste storage, retrieval, and treatment processes planned for implementing the RPP mission. Modeling assumptions start with the mission requirements from major agreements and commitments, such as the HFFACO, along with other key assumptions. The HTWOS uses information about waste properties, tank system configurations, desired end states, target milestones, and other parameters associated with particular waste processing scenarios to produce a variety of outputs. These model outputs are used to evaluate the relationship between SST waste retrieval and DST space demands, and for developing future plans for accomplishing the RPP mission.

The following inputs and assumptions were used to develop this document:

- The WTP Hot Commissioning starts on December 1, 2014 and the ramp-up of the production phase of WTP operations starts on February 1, 2016[2].
- Projected volumes and sequences for the receipt of new waste into the DST system will be consistent with recent field experience regarding SST waste retrievals and non-Tank Farm waste generators (e.g., Plutonium Finishing Plant [PFP]).
- The Demonstration Bulk Vitrification System (DBVS) will be refurbished as the Bulk Vitrification System (BVS) and its operation extended[3] using additional waste retrieved from tank 241-S-109 (S-109) and waste retrieved from tank S-105.
- A supplemental pretreatment plant (SPP) and a supplemental treatment plant (STP) will be built in the 200 West Area. Operation of the SPP will begin on February 28, 2014 to pretreat liquid wastes from tank SY-101 using cesium (Cs) ion exchange. The pretreated low-activity waste (LAW) will be sent to the West Area STP for treatment into glass using bulk vitrification. The West Area STP starts hot testing on July 2, 2014 and full capacity operations start on March 2, 2015. After processing the SY-101 waste, waste from tank SY-103 will be processed through the West Area SPP and STP, followed by wastes retrieved from the West Area SSTs. The high-level waste solids from the 200 West Area SSTs will be transferred across the site for staging as feed to the WTP.
- A supplemental treatment plant will also be built in the 200 East Area. Operation of the East Area STP will begin on June 3, 2016 to treat "excess" pretreated LAW from the WTP. Hot testing of the East Area STP starts on June 3, 2016, and full capacity operations start on February 3, 2017.
- Wastes from the B-200 Series SSTs will be retrieved to a transuranic (TRU) waste drying and packaging facility starting on October 1, 2013. After processing the B-200 Series wastes, the packaging facility will be moved to the 200 West Area to package the TRU wastes from the T-200 Series SSTs, and from tanks T-104, T-110, and T-111.

---

[2] These assumed dates do not reflect current uncertainties about the WTP start date.

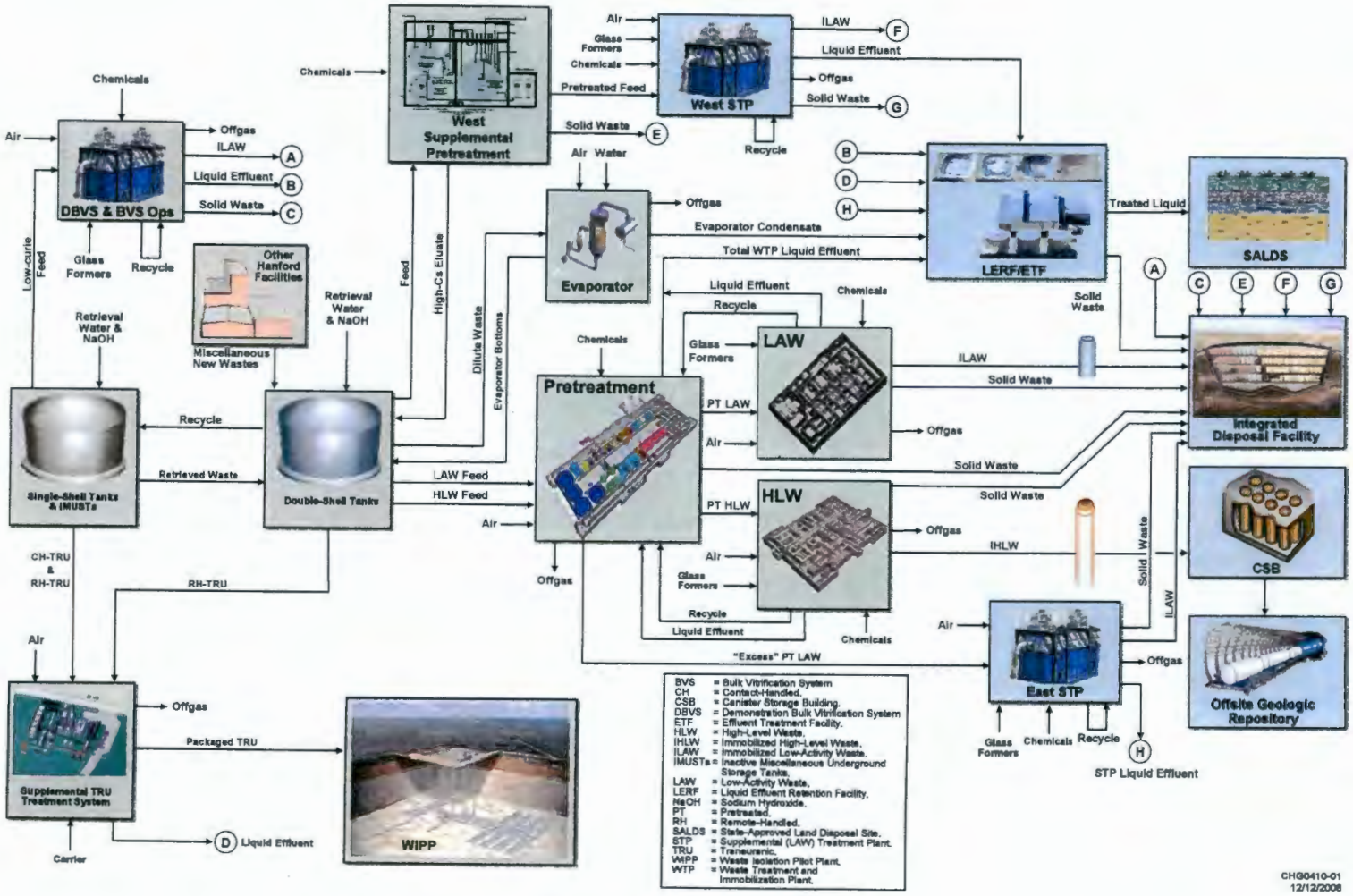
[3] This assumes that all necessary permit updates, National Environmental Policy Act (NEPA) analyses, modifications, and approvals will be obtained to support the refurbishment and extended operations. No decision regarding refurbishment will be made until appropriate NEPA analyses are completed.

- Sludges from tanks AW-103, AW-105, B-107, B-110, B-111, T-105, T-107, T-112, and SY-102 will be washed in the DST system and the washed solids will be transferred to a TRU waste drying and packaging facility. Sludge washing operations start in June 2024 with waste in tank AW-103, and continue with wastes in the other tanks, on a schedule that supports operation of the packaging facility at its capacity.
- Waste inventory data downloaded from the Tank Waste Information Network System (TWINS) in August 2005 were used as input to the modeling. The inventory data accounts for the retrieval of wastes from tanks C-106 and C-203 to the limits of technology, and the ongoing retrieval of wastes from tanks C-103, C-201, S-102, and S-112 (see RPP-27459, *Double- and Single-Shell Tank Inventory Input to the HTWOS Model – 2005a Update* for further information).
- The durations for the retrieval of SST wastes were based on the status of current retrieval projects and on the experience gained from recent retrieval activities for tanks S-102 and S-112, and for the C-Farm tanks.
- The durations for the retrieval of wastes from tanks S-105 and S-109 were based on the processing rates for the DBVS and the BVS.
- The durations for the retrieval of wastes from the remaining SSTs were based on the design capacity of modified sluicing systems[4] and adjusted to account for the following:
    - Ramp-ups and ramp-downs in retrieval system operating efficiency during the start-up of each retrieval effort and near the end of waste retrieval,
    - Total operating efficiencies (TOEs) that can be achieved during the performance of simultaneous retrieval operations,
    - Retrieval operations will be performed on 10 or 15 shifts per week rather than on round-the-clock operation (21 shifts per week),
    - Additional efforts may be required to retrieve hard heels from some of the tanks. Tanks that may require hard heel removal are identified in Appendix B, and
    - Resource leveling will be used to maintain trained staff and retrieval equipment up to the WTP startup.
- A maximum level of 1.235 Mgal for each of the AP-Farm DSTs.
- The emergency DST space allocation is 1.235 Mgal.
- The 242-A evaporator will be operated to maximize the waste volume reduction while still meeting waste transfer and DST waste storage specifications for solids loading and avoiding the creation of buoyant displacement gas release event (BDGRE) conditions.

The assumptions used to make the HTWOS model run that provided the results discussed in this document are summarized in Appendix C. Figure 1-1 provides a simple process flow diagram showing the facilities assumed to be used to treat the Hanford tank wastes.

[4] Estimated retrieval rates for vacuum retrieval systems (Vacuum) or mobile retrieval systems (MRS) are currently slower than desired. Retrieval technology development work is planned to enhance those technologies and increase the retrieval rates to be consistent with those of the modified sluicing systems.

Figure 1-1. River Protection Project Simplified Process Flow Diagram.



2.0 SINGLE-SHELL TANK RETRIEVAL POOL

In order to appropriately select SSTs for retrieval activities, a number of objectives and parameters must be balanced. This section discusses these objectives and parameters as well as the criteria used to identify candidate tanks that make up the tank pool. While the individual tanks in the tank pool did not change for this biennial update, the factors used to select the original tank pool are discussed here to show how the original tank pool was developed. Revision 0-A of this document (RPP-21216, *Single-Shell Tank Retrieval Selection and Sequence*) provides additional discussion of the selection of the pool tanks. Since there has been no significant change to the evaluated tank parameters, the previous evaluation and methodology are presented here simply as a point of reference.

2.1 SELECTION FACTORS

The SSTs in the retrieval pool are selected based upon a set of primary objectives and on the consideration of additional objectives. The primary objectives are to maximize the reduction of short- and long-term risk to human health and the environment and to optimize waste feed so as to maintain efficient WTP operations. The additional objectives (e.g., optimizing use of DST space, resource leveling) include factors that provide for more efficient tank farm operations. Each is discussed in the following sections.

2.1.1 Human Health and Environmental Risk Reduction

Radioactive Concentration – Short-term risk to human health and the environment is measured in terms of radioactivity per gallon of tank waste. Radioactive concentration is expressed in terms of curie content – the higher the curie content, the more risk to human health and the environment. The most effective method to reduce the curie content within the SST system is to retrieve those tanks with the highest curies per gallon ratio. Retrieving tanks with the highest activity per gallon will provide for optimum curie content reduction.

Groundwater Risk – Groundwater risk analysis measures the long-term risk and increased cancer risk based on a groundwater ingestion path (see RPP-8554, *Single-Shell Tank Retrieval Sequence and Double-Shell Tank Space Evaluation*, for further details about the groundwater ingestion path). Certain isotopes if released to the environment pose a greater risk to human health and the environment because of their propensity to migrate through soils and into the groundwater. Contaminants of concern that comprise the significant portion of groundwater risk include ^{14}C, ^{79}Se, ^{99}Tc, ^{129}I, and ^{238}U. Retrieving tanks with the largest inventory of these isotopes will, therefore, provide maximum groundwater risk reduction.

Airborne Risk – Analysis of airborne risk is focused on measuring long-term risk using a post-well driller intruder scenario (see RPP-8554 for further details about this scenario). Twenty-one isotopes generate the most significant portion of airborne risk including: ^{94}Nb, ^{126}Sn, ^{232}Th, ^{238}U, ^{237}Np, ^{236}Pu, ^{238}Pu, ^{239}Pu, ^{240}Pu, ^{241}Pu, ^{242}Pu, ^{244}Pu, ^{241}Am, ^{242}Am, ^{243}Am, ^{243}Cm, ^{244}Cm, ^{245}Cm, ^{246}Cm, ^{247}Cm, and ^{248}Cm. Retrieving tanks with the greatest potential risk to

human health and the environment from these isotopes will therefore provide maximum long-term airborne risk reduction.

2.1.2 Maintain Efficient WTP Operations

Balance WTP Feed – As provided in Appendix I, Section 2.1.2 of the M-45-00 milestone, a primary criterion for selecting SSTs in this sequencing document is to balance waste feed delivery to the WTP and thereby optimize its performance. Balancing waste feeds means providing sufficient low-activity and high-level wastes to avoid outages in any of the WTP processes. Previous life-cycle mission evaluations such as those in ORP-11242, *River Protection Project System Plan*, identified a potential for "starving" the high-level melter operations because of insufficient staged sludge available in the early years of operations. It is, therefore, necessary to identify SSTs containing high-level waste sludges and sequence their retrieval to have balanced feed available in the DSTs for delivery to the WTP.

Shorten WTP Mission – Any SST wastes that could be retrieved, treated, and disposed without requiring WTP processing potentially reduces the volume of feed to the WTP and shortens the WTP mission. Tanks identified as potential TRU packaging or supplemental treatment demonstration candidates fall into this category. Choosing to retrieve these tanks may have the added benefit of requiring little, if any, DST space prior to the start up of the WTP. However, wastes will not be retrieved and packaged as TRU until regulatory uncertainties have been resolved and a suitable packaging facility has been permitted.

Processing West Area DST and SST wastes through the West Area SPP and STP produces about 79,300 MT of immobilized low-activity waste glass (ILAW), which equates to about 6.4 years of WTP operation at the maximum LAW melter rate. Processing pretreated Hanford wastes through the East Area STP produces about 92,900 MT of ILAW, which equates to about 7.5 years of WTP operation at the maximum LAW melter rate. Packaging TRU wastes from 3 DSTs and 17 SSTs reduces the total immobilized high-level waste glass (IHLW) produced by the WTP by about 1,520 canisters (about 710 canisters for the DST wastes and about 810 canisters for the SST wastes), which equates to about 32 months of WTP operation at the maximum HLW melter rate.

2.1.3 Additional Objectives

Waste Management Area (WMA) Closures – Closure of an entire WMA is a concept that has been highlighted during recent HFFACO negotiations. The concept would involve retrieving all of the SSTs within a WMA and allow closure of supporting systems and ancillary equipment leading to closure of an entire WMA. This has the advantage of providing tangible closure progress. Retrieving all tanks within a selected WMA (for example, all of the C-Farm tanks) supports early closure of the WMA-C. In the future, early closure of additional WMAs can be analyzed including impacts on incidental blending, IHLW volume, and mission duration.

Optimize DST Volume – The DST space is limited until the WTP becomes operational and SSTs selected for early retrieval must be chosen to make optimal use of the limited DST space. The

SST retrievals consuming the least amount of DST space used are preferred when the other factors are considered nearly equal.

Resource Leveling and Infrastructure Utilization – Tank retrieval involves unique equipment, infrastructure support and well-trained crews operating in close coordination with overall tank farms operations and upgrade projects. The complexity of moving equipment and retraining crews to new areas suggests that significant efficiencies may be gained by retrieving SSTs in the same area using the same primary and infrastructure equipment that was used for the higher priority tanks. The schedule and resource limitations may suggest that in some cases it makes operational sense to retrieve tanks that may not necessarily rank high in the other factors. The retrieval schedules for the WMA-C tanks were established using resource leveling (i.e., adjusting the retrieval schedule to stay within constrained labor resources) and the HTWOS modeling confirmed that the planned schedule could be achieved. It was assumed that the labor resources needed to support the retrieval of waste from the remaining tanks would be available when needed, and their projected retrieval dates were not constrained by resource leveling.

2.2 METHODOLOGY

This section describes the overall methodology used to determine the SST retrieval pool. First, an evaluation of all SSTs against the primary selection criteria was performed. Best-Basis Inventory data (Tank Waste Information Network System) were collected for all SSTs and then sorted and ranked for each of the three short-term and long-term risk reduction categories (radioactive concentration, groundwater risk, and airborne risk). While the efficient WTP operations criteria (balance WTP feed and shorten WTP mission) cannot be numerically ranked, specific tanks were identified that met the objective of the criteria. Tanks with significant high-level sludge quantities were identified as meeting the balance WTP feed criterion. Tanks that were candidates for direct TRU packaging were identified as meeting the shorten WTP mission criterion. (TRU tanks will not be retrieved and packaged as TRU until regulatory uncertainties have been resolved and a suitable packaging facility has been permitted.)

Then the tanks were evaluated against the additional objectives (WMA closure, optimize DST volume, and resource leveling and infrastructure utilization). The SSTs were numerically ranked by their estimated DST volume needed for storage. Tanks that could be grouped together based on estimates of a common use of resources or equipment were identified as meeting the resource leveling and infrastructure utilization criteria. When all of the tanks in a defined WMA ranked high in most of the other categories they were identified as meeting the WMA closure criteria.

An initial tank screening was completed to identify tanks ranked in the top 50 of each ranked category, and identify tanks that met the criteria for the other non-ranked categories. It should be noted that because the DBVS is only planning on a partial retrieval of tank S-109 and full retrieval or near-term tank closure actions are not planned, it was not included in the tank pool. All SSTs were identified in a matrix with the eight selection factors to develop a visual image of the selected tanks.

Tank selection was then adjusted to provide a balance of tanks ranked high in the environmental risk reduction factors and the qualitative operational factors. HTWOS runs were completed to

validate that the bulk of the retrievals were logistically achievable and effectively used the available DST space (RPP-21216). The tank pool data were then compiled in graphical form to provide a visual tool that helps distinguish between preferred and non-preferred tank groupings. To simplify the presentation, a "star" was used to distinguish a group of tanks where more than half the tanks in that grouping ranked in the top 50 (or met criteria for non-ranked factors) for each factor considered. This "Star Chart," which represents the tank pool, is presented in Figure 2-1. Appendix B of this document contains the complete list of SSTs and their relative ranking against the four quantitative selection factors.

2.3 SUMMARY

A review of the SST retrieval pool reveals a balanced mix of tanks that optimizes early risk reduction, provides for closure of WMA-C, and allows for efficient use of resources and common retrieval systems. Additionally, there are enough "extra" tanks to provide the flexibility to support a robust strategic plan that accommodates differences in actual versus planned DST available space, retrieval technology effectiveness, or unforeseen operational restrictions.

Figure 2-1. Single-Shell Tank Retrieval Pool Selection Criteria

	Risk Reduction			Efficient WTP Operations		DST Space Utilization		
Tank	Curies per Gallon	Short Term Risk (ground water)	Long Term Risk (airborne)	Balance WTP Feed	Shorten WTP Mission	Resource Leveling/ Infrastructure	Optimize DST Volume	WMA Closure
A-102 A-106	☆		☆			☆	A-102	
AX-101 AX-102 AX-103 AX-104	☆	☆	☆			☆	AX-102 AX-104	
C-101 C-102 C-103 C-104 C-105 C-106 C-107 C-108 C-109 C-110 C-111 C-112 C-201 C-202 C-203 C-204	☆		C-101 C-102 C-103 C-104 C-105 C-107	☆		☆	C-106 C-111 C-201 C-202 C-203 C-204	☆
S-102 S-103 S-105 S-107 S-112	S-107	☆	☆					
SX-101 SX-105 SX-106 SX-108 SX-110 SX-115	☆	SX-101 SX-105 SX-106	☆			☆	SX-115	
U-112 U-201 U-202 U-203 U-204	U-112					☆	☆	
B-201 B-202 B-203 B-204					☆		☆	
T-104 T-110 T-111 T-112 T-201 T-202 T-203 T-204					☆		☆	

☆ indicates more than half the tanks in a group are ranked in the top 50 for the selection criteria

Individual tank listing indicates the specified tank is ranked in the top 50 for the selection criteria

✧ B and T Farm tanks are potentially classified as transuranic (TRU) and will not be retrieved and packaged as TRU until all regulatory uncertainties have been resolved and a suitable packaging facility has been permitted.

3.0 SINGLE-SHELL TANK RETRIEVAL SEQUENCE

Eighteen of the SST retrieval pool tanks, listed in Figure 2-1, are identified as the "committed tanks." This term means that there are HFFACO milestones satisfied by completing the retrieval of waste from these tanks. The committed tanks include tanks S-102 and S-112, and all of the C-Farm SSTs.

Table 3-1 provides an example retrieval sequence for SST waste retrievals for the committed tanks. The retrieval sequence provided in Table 3-1 is referred to as an example sequence because it was chosen to demonstrate the viability of retrieving the committed tank pool tanks. In accordance with HFFACO Appendix I, Section 2.1.2, "the pool of tanks selected by this document will be used as the starting point for selecting and scheduling the following two years' tank waste retrieval activities."

This HTWOS model run evaluates the DST space demand needed to support the retrieval of wastes from 18 committed tank pool tanks, the retrieval of a portion of the waste from the DBVS feed tank (tank S-109) and the retrieval of a portion of the waste from another pool tank (tank S-105) before the start of WTP operations. Wastes from the remaining tanks in the SST retrieval pool are projected to be retrieved later in the RPP mission because of transfer or operational constraints or in deference to other mission goals.

Table 3-2 provides the projected sequence and schedule for retrieving wastes from all of the SSTs during the RPP mission. The as-retrieved volumes are an estimate of the volume to be generated during the retrieval of the waste and represent the transient demand on DST space. The as-stored volumes are an estimate of the volume after settling of retrieved solids and concentration of the supernatant layer to a liquid specific gravity of 1.43 in the 242-A Evaporator, and represent the final demand on DST space. The as-retrieved waste volumes for SST wastes retrieved directly to supplemental treatment processes are highlighted with gray in the table because those retrieved wastes do not require DST space for storage.

Table 3-1. Example Single-Shell Tank Retrieval Sequence.

Order	SST	Retrieved To	Modeled Retrieval Duration (Days)[1]	Planned Retrieval Technology	Current Waste Volume[2] (Kgal)	Projected DST Volume Impact (Kgal)	DST Volume Impact Post-Evap (Kgal)
1	C-106	—	Completed	—	—	—	—
2	S-112[1]	SY-102	Ongoing 365	MS RWL	— 31	— 89	— 82
3	C-203	—	Completed	—	—		
4	S-102[1,3]	SY-102	Ongoing 1,271	MS	341	1,497	930
5	C-202[4]	AN-106	43 [Completed]	Vacuum	1	12	2
6	C-201[1]	AN-106	Ongoing 145	Vacuum	1	12	1
7	C-103[1,3]	AN-106	212	MS	75	168	83
8	C-204	AN-106	88	Vacuum	2	24	3
9	C-108[3]	AN-106	203	MS	66	163	86
10	S-109[5]	SY-101 DBVS	4 630	MS	533	314 None	213 —
11	C-109[3]	AN-106	313[6]	MS	63	161	85
12	C-101	AN-101	459	MRS	88	244	153
13	C-102[3]	AZ-101	429[6]	MS	316	415	363
	S-109	BVS	700	MS	N/A	None	None
14	C-104[3]	AN-101	334[6]	MS	259	357	309
15	C-105	AN-101	186	MRS	132	229	147
16	S-105[5]	SY-101 BVS	4 1100	MS	406	260 None	162 None
17	C-110	AN-106	213	MRS	178	394	233
18	C-112[3]	AY-101	207	MS	104	202	131
19	C-107[3]	AY-101	326	MS	247	345	274
20	C-111	AY-101	132	MRS	57	194	82

BVS = Bulk Vitrification System DBVS = Demonstration Bulk Vitrification System Kgal = kilogallon
MRS = Mobile Retrieval System MS = Modified Sluicing RWL = Remote Water Lance

Notes:

1. The retrieval of waste from tanks C-103, C-201, S-102, and S-112 was currently in progress in January 2006, when the assumptions for the modeling were established. The modeled durations for tanks C-103, C-201, and S-112 were established at that time and may not reflect the latest status of retrieval efforts in those tanks. The modeled durations for tanks S-105 and S-109 are based on projections of glass production.
2. Current waste volume data from HNF-EP-0182, *Waste Tank Summary Report for Month Ending June 30, 2005*, Rev. 207.
3. Gray shading indicates which tanks are assumed to be retrieved using modified sluicing with supernate recycle. The use of recycled supernates needs to be approved by the State of Washington, Department of Ecology and the Environmental Protection Agency (EPA) on a tank by tank basis.
4. Tank C-202 is depicted as both modeled and completed because the retrieval of waste from that tank was initiated and completed between the effective date for the inventory used in HTWOS and the issuance of this document. The 43-day duration reported for C-202 is based on the difference between the actual start and finish dates of the retrieval effort.
5. Only part of the waste from tanks S-109 and S-105 will be retrieved for use as feed for supplemental treatment before the start of WTP operations. The remainder will be retrieved later in the mission.
6. The modeled durations for tanks C-102, C-104, C-107, C-109, and C-112 includes additional efforts for the removal of a hard heel.

Table 3-2. Single-Shell Tank Retrieval Sequence. (5 Sheets)

Tank	Retrieval Start Date	Modeled Retrieval Duration (days)	Retrieval End Date	Total Retrieved Volume (Kgal)	DST Volume Impact Post-Evap (Kgal)
C-106	11/18/1998[1]	N/A	12/31/2003[1]	N/A	N/A
S-112	9/28/2003[1] 4/4/2005[2]	365[2]	4/3/2006	89.3[2]	82.0[2]
C-203	6/30/2004[1]	N/A	3/24/2005[1]	N/A	N/A
S-102	12/16/2004[1] 5/31/2005[2]	1,271[2]	11/21/2008	1497.3[2]	930.0[2]
C-202	6/30/2005[1]	43[1]	8/11/2005[1]	12.2	2.0
C-201	10/25/2005	145	3/18/2006	12.1	1.4
C-103	11/6/2005	212	6/5/2006	168.1	92.2
C-204	3/20/2006	88	6/15/2006	24.1	2.9
C-108	4/17/2007	203	11/5/2007	162.8	86.4
C-109	2/15/2008	313	12/23/2008	161.4	84.7
S-109[3]	2/28/2010	2,813	11/10/2017	492.7[3]	334.0[3]
C-101	10/4/2010	459	1/5/2012	244.3	153.5
C-102	1/10/2012	429	3/13/2013	415.4	363.0
C-104	11/26/2012	334	10/25/2013	356.8	309.2
C-105	9/3/2013	186	3/7/2014	229.3	147.4
B-201[4]	10/1/2013	21	10/21/2013	58.0	N/A
B-202[4]	11/1/2013	20	11/20/2013	56.0	N/A
B-203[4]	12/1/2013	35	1/4/2014	100.0	N/A
B-204[4]	1/16/2014	35	2/19/2014	98.0	N/A
C-110	3/10/2014	213	10/8/2014	394.3	232.9
T-201[4]	4/21/2014	21	5/11/2014	60.0	N/A
T-202[4]	5/23/2014	14	6/5/2014	40.0	N/A
T-203[4]	6/17/2014	26	7/12/2014	72.0	N/A
T-204[4]	7/23/2014	26	8/17/2014	72.0	N/A
T-111[4]	8/28/2014	310	7/3/2015	891.0	N/A
C-112	10/10/2014	207	5/4/2015	201.7	130.8
S-105[3]	11/1/2014	1,105	11/9/2017	407.4[3]	254.0[3]
C-107	5/1/2015	325	3/21/2016	345.3	273.8
T-110[4]	7/14/2015	256	3/25/2016	737.0	N/A
B-104	11/1/2015	370	11/4/2016	610.9	517.8
SX-106[5]	11/2/2015	125[5]	3/5/2016	975.0	824.5
C-111	12/22/2015	132	5/1/2016	194.3	81.6

Table 3-2. Single-Shell Tank Retrieval Sequence. (5 Sheets)

Tank	Retrieval Start Date	Modeled Retrieval Duration (days)	Retrieval End Date	Total Retrieved Volume (Kgal)	DST Volume Impact Post-Evap (Kgal)
U-106[5]	3/9/2016	3[5]	3/11/2016	401.9	313.5
S-106[5]	3/10/2016	306[5]	1/9/2017	1,379.0	1,100.8
T-104[4]	4/6/2016	220	11/11/2016	631.3	N/A
BY-101[5]	5/2/2016	289[5]	2/14/2017	1,283.8	1,024.8
S-103[5]	1/8/2017	74[5]	3/22/2017	1,296.9	615.9
BX-107	2/1/2017	571	8/25/2018	1,979.5	519.6
B-105	5/4/2017	1,302	11/25/2020	817.2	602.6
BX-112	5/5/2017	1,323	12/17/2020	729.6	224.2
AX-101	5/6/2017	1,712	1/11/2022	996.3	866.2
B-108	5/7/2017	1,332	12/28/2020	514.1	224.7
A-104	5/8/2017	1,172	7/22/2020	246.7	43.7
BX-104	5/9/2017	1,361	1/28/2021	1,601.2	171.9
BX-110	5/10/2017	1,217	9/7/2020	604.6	455.2
U-103[5]	7/16/2017	118[5]	11/10/2017	1,082.0	869.9
U-201[5]	11/9/2017	1[5]	11/9/2017	40.0	7.9
U-202[5]	11/9/2017	1[5]	11/9/2017	40.0	7.4
U-203[5]	11/14/2017	1[5]	11/14/2017	40.0	6.3
U-204[5]	2/5/2018	1[5]	2/5/2018	30.0	4.6
SX-103[5]	2/10/2018	280[5]	11/16/2018	1,686.4	1,208.7
SX-115[5]	8/27/2018	1[5]	8/27/2018	32.3	8.3
S-107	1/10/2019	356	12/31/2019	5,577.8	717.0
S-108	1/10/2019	465	4/18/2020	1,710.1	997.3
SX-110[5]	6/5/2020	25[5]	6/29/2020	475.3	118.5
SX-108[5]	6/11/2020	26[5]	7/6/2020	175.3	183.6
TX-113	7/23/2020	444	10/9/2021	1,991.6	1,529.6
TX-116	9/8/2020	419	10/31/2021	1,741.5	1,383.7
SX-104	11/26/2020	660	9/16/2022	2,573.9	1,105.9
BY-106	12/29/2020	335	11/26/2021	1,332.4	1,116.4
S-104	12/30/2020	349	12/13/2021	3,300.6	542.5
SX-101	1/31/2021	765	3/6/2023	1,167.4	1,217.8
BY-112	10/10/2021	238	6/4/2022	1,253.4	918.3
SX-111	11/1/2021	272	7/30/2022	1,803.8	256.0
SX-107	12/9/2021	235	7/31/2022	1,808.4	184.0
BY-109	12/14/2021	348	11/26/2022	724.0	600.4
U-108	1/26/2022	655	11/11/2023	1,165.8	982.8

Table 3-2. Single-Shell Tank Retrieval Sequence. (5 Sheets)

Tank	Retrieval Start Date	Modeled Retrieval Duration (days)	Retrieval End Date	Total Retrieved Volume (Kgal)	DST Volume Impact Post-Evap (Kgal)
S-110	6/15/2022	449	9/6/2023	1,646.2	941.3
TX-118	7/31/2022	323	6/18/2023	679.3	524.4
BY-111	8/1/2022	253	4/10/2023	1,328.1	1,016.5
BY-105	9/17/2022	436	11/26/2023	1,473.3	1,235.8
BY-104	11/30/2022	518	4/30/2024	1,240.6	1,025.1
BY-110	3/7/2023	515	8/2/2024	1,012.9	837.7
U-109	4/11/2023	737	4/16/2025	997.8	821.1
SX-105	6/19/2023	721	6/8/2025	981.2	884.8
TX-106	9/7/2023	382	9/22/2024	940.9	755.7
U-105	11/15/2023	542	5/9/2025	946.2	757.9
SX-102	11/27/2023	836	3/11/2026	930.3	776.3
TX-112	5/1/2024	435	7/9/2025	1,684.3	1,373.1
S-111	8/3/2024	790	10/1/2026	981.3	819.9
TY-101	9/23/2024	313	8/1/2025	1,946.5	218.4
SX-114	4/20/2025	435	6/28/2026	2,635.8	303.7
TX-105	5/10/2025	425	7/8/2026	1,516.2	1,233.0
U-110	6/12/2025	456	9/10/2026	2,007.0	252.7
TX-115	7/10/2025	399	8/12/2026	1,453.8	1,185.5
TX-117	8/4/2025	405	9/12/2026	1,267.0	1,028.6
TX-114	3/15/2026	398	4/16/2027	1,422.3	1,095.7
B-107[4, 5]	4/16/2026	2[5]	4/17/2026	197.3	N/A
TY-103	7/2/2026	269	3/27/2027	973.4	275.6
TX-109	7/12/2026	376	7/22/2027	457.9	438.2
SX-109	8/13/2026	440	10/26/2027	2,444.8	571.8
B-110[4, 5]	9/6/2026	2[5]	9/7/2026	197.3	N/A
BY-103	9/13/2026	309	7/18/2027	1,284.0	1,028.8
TX-110	9/16/2026	337	8/18/2027	1,189.7	974.4
TY-105	10/5/2026	365	10/4/2027	1,077.1	377.5
B-111[4, 5]	1/27/2027	2[5]	1/28/2027	197.3	N/A
T-105[4, 5]	3/12/2027	2[5]	3/13/2027	314.9	N/A
S-101	3/31/2027	493	8/4/2028	3,081.3	754.7
TX-111	4/17/2027	390	5/10/2028	910.1	748.1
B-103	7/19/2027	87	10/13/2027	208.7	112.2
BY-102	7/23/2027	227	3/5/2028	913.3	719.2
T-107[4, 5]	8/1/2027	2[5]	8/2/2027	197.3	N/A

Table 3-2. Single-Shell Tank Retrieval Sequence. (5 Sheets)

Tank	Retrieval Start Date	Modeled Retrieval Duration (days)	Retrieval End Date	Total Retrieved Volume (Kgal)	DST Volume Impact Post-Evap (Kgal)
BY-107	8/19/2027	220	3/25/2028	859.8	718.9
BX-111	10/10/2027	224	5/20/2028	522.5	404.2
BX-109	10/14/2027	321	8/29/2028	349.0	288.2
B-106	10/29/2027	273	7/27/2028	316.5	185.6
T-112[4, 5]	12/20/2027	2[5]	12/21/2027	197.3	N/A
U-102	3/6/2028	518	8/5/2029	783.2	719.8
B-101	4/6/2028	117	7/31/2028	402.3	271.6
A-105	5/11/2028	155	10/12/2028	216.7	98.3
SX-112	5/21/2028	177	11/13/2028	1,331.1	157.8
BX-105	7/31/2028	257	4/13/2029	1,432.5	188.3
A-106	8/4/2028	385	8/23/2029	381.3	173.3
BY-108	8/5/2028	191	2/11/2029	527.4	506.4
B-109	9/2/2028	257	5/16/2029	890.5	320.3
TX-102	10/13/2028	190	4/20/2029	556.8	447.7
TX-101	11/14/2028	218	6/19/2029	148.4	220.8
AX-104	2/12/2029	63	4/15/2029	94.3	10.1
B-102	4/17/2029	74	6/29/2029	102.3	60.3
A-103	4/19/2029	527	9/27/2030	892.0	706.9
TY-104	4/23/2029	98	7/29/2029	346.6	76.1
BX-102	5/20/2029	153	10/19/2029	1,128.8	107.1
TX-103	6/20/2029	143	11/9/2029	371.9	298.9
TX-108	6/30/2029	251	3/7/2030	321.8	262.0
U-104	8/2/2029	220	3/9/2030	579.6	307.0
BX-101	8/6/2029	130	12/13/2029	1,137.0	89.6
U-107	8/24/2029	483	12/19/2030	808.6	689.6
T-101	10/20/2029	119	2/15/2030	275.9	168.0
TX-104	11/10/2029	214	6/11/2030	115.7	145.0
U-111	12/14/2029	423	2/9/2031	554.8	481.4
AX-102	2/16/2030	157	7/22/2030	50.3	45.8
SX-113	3/8/2030	105	6/20/2030	469.1	22.2
BX-108	3/10/2030	103	6/20/2030	207.2	67.0
BX-103	6/12/2030	238	2/4/2031	644.1	137.1
B-112	6/24/2030	79	9/10/2030	135.2	64.6
U-112	6/24/2030	141	11/11/2030	552.3	139.8
AX-103	7/26/2030	388	8/17/2031	232.3	198.1

Table 3-2. Single-Shell Tank Retrieval Sequence. (5 Sheets)

Tank	Retrieval Start Date	Modeled Retrieval Duration (days)	Retrieval End Date	Total Retrieved Volume (Kgal)	DST Volume Impact Post-Evap (Kgal)
U-101	9/12/2030	122	1/11/2031	73.3	84.9
A-101	9/29/2030	470	1/11/2032	888.4	727.3
T-108	11/12/2030	42	12/23/2030	17.4	17.9
TX-107	12/20/2030	78	3/7/2031	88.3	72.7
BX-106	12/24/2030	209	7/20/2031	184.3	75.2
TY-102	1/15/2031	117	5/11/2031	195.1	147.2
T-106	2/5/2031	81	4/26/2031	154.9	42.5
TY-106	2/13/2031	54	4/7/2031	251.6	26.2
T-103	3/11/2031	82	5/31/2031	187.0	40.1
T-109	4/8/2031	91	7/7/2031	140.1	124.9
T-102	4/30/2031	194	11/9/2031	187.8	41.9
A-102	8/21/2031	157	1/24/2032	65.3	62.3
Totals (Mgal)				**112.5**[6]	**58.4**

Notes:

1. Dates or durations represent the actual start of waste retrieval, the actual completion of waste retrieval, or the actual duration of a completed waste retrieval effort.
2. Dates, durations, or waste volumes represent the values used in HTWOS to model the portion of an ongoing retrieval effort that occurs after the effective date of the tank waste inventory used as the starting point for modeling. This was done because the starting inventory already accounts for the retrieval of some of the wastes from tanks S-102 and S-112.
3. The Total Retrieved Volume and DST Volume Impact Post-Evap volumes for tanks S-105 and S-109 represent the volumes retrieved into the DST system and ignore the volumes retrieved to outside the DST system.
4. The shaded cells identify tanks whose wastes are assumed to be packaged as contact-handled transuranic waste, or are assumed to be water-washed and packaged as remote-handled transuranic waste.
5. The HTWOS model retrieved wastes from these tanks at a rate faster than can be supported by the retrieval technology to keep processing facilities operating or because of conflicts in the model logic that were found late in the data analysis.
6. The sum of all of the Total Retrieved Volume values includes about 4.1 Mgal of retrieved transuranic wastes that are sent outside of the double-shell tank system. The total double-shell tank space impact is about 108.4 Mgal.

4.0 DOUBLE-SHELL TANK SPACE EVALUATION

Current estimates indicate that approximately 5.1 Mgal of DST storage capacity will be needed for the waste retrieved from 18 of the SST retrieval pool tanks (the committed tanks), and for the portions of waste retrieved from another pool tank (tank S-105) and from a non-pool tank (tank S-109) prior to the startup of the WTP. Wastes will be retrieved from tanks S-105 and S-109 as feed to supplemental treatment facilities and those retrieval efforts will generate some waste that has to be sent to the DST system. Retrieval of all of the wastes from tanks S-105 and S-109 is not anticipated to be completed prior to WTP startup.

Figure 4-1 shows how the total DST space will be used to support SST waste retrievals prior to the startup of the WTP, and the space usage reflects the space optimization efforts discussed in Section 5.1. There is sufficient space in the DST system to support retrieval of waste from the C-Farm SSTs and from tanks S-102, S-105, S-109, and S-112 as can be seen in Figure 4-1. Table 4-1 provides the definition of the different space allocation categories used in Figure 4-1. The text following Table 4-1 explains the basis for each of the categories.

The use of supplemental treatment allows the retrieval of about 2.2 Mgal of waste from twelve SSTs prior to the start of WTP hot operations. About 1.1 Mgal of waste is retrieved from the B-200 and T-200 series tanks and from tanks T-110 and T-111 and sent to the TRU packaging facility. About 670 Kgal of waste is retrieved from tanks S-105 and S-109 by selective dissolution and sent to the DBVS and BVS facilities. The startup and initial operation of the West Area SPP and STP empties tank SY-101 (about 980 Kgal is transferred from SY-101 to the West Area SPP) allowing for the transfer of waste from SY-103 to SY-101 before the start of WTP hot operations. This subsequently opens up tank SY-103 to receive the waste retrieved from tank SX-106 (about 400 Kgal of waste).

Figure 4-1. Total Double-Shell Tank Volume Through Calendar Year 2016.

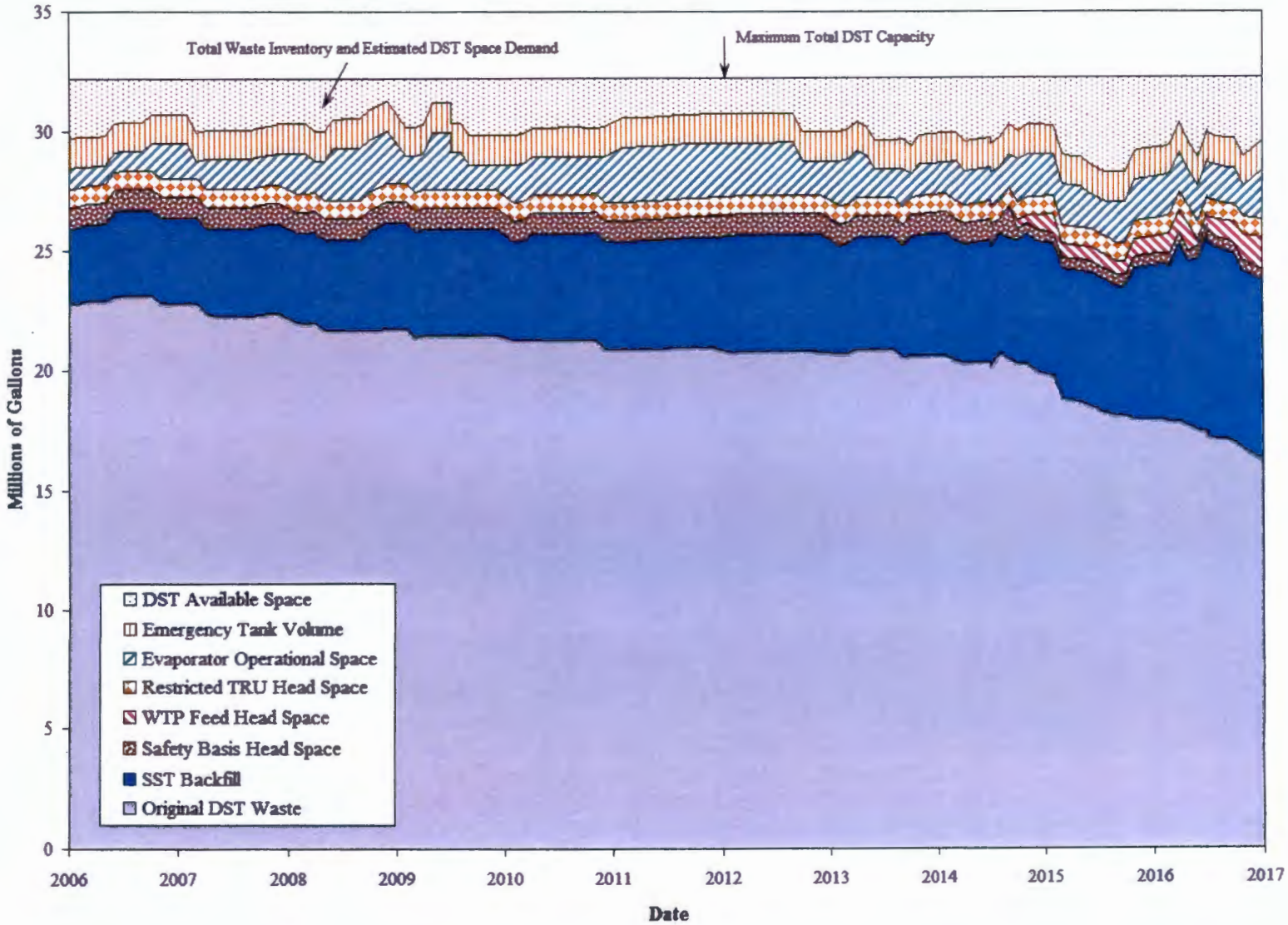


Figure 4-2. Total Double-Shell Tank Volume Through the River Protection Project Mission.

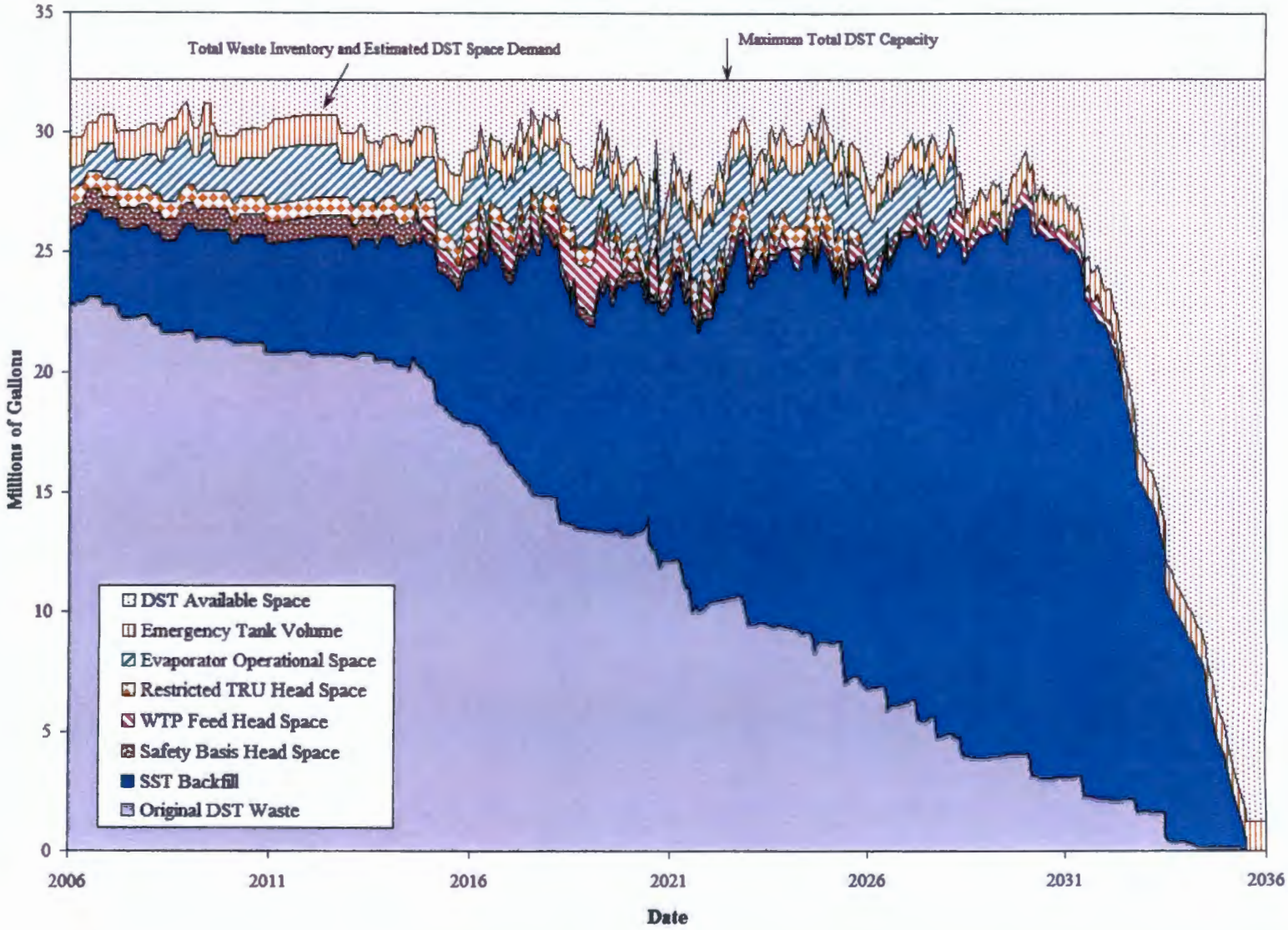


Table 4-1. Double-Shell Tank Space Allocation Criteria.

Category	Criteria
DST Available Space	Unallocated space (i.e., the leftover space).
Evaporator Operational Space	Space above waste in DSTs used to support 242-A Evaporator operation (i.e., dilute waste receivers, the evaporator feed tank, and the evaporator bottoms receiver tank).
Emergency Tank Volume	1.235 million gallons of available space that could be used to receive waste in the event of a leaking DST or emergency returns from the WTP.
Restricted TRU Space	Space above the TRU solids in tanks AW-103 and AW-105.
WTP Feed Head Space	Space above waste specifically identified as an early WTP feed source or in tanks used to deliver feed to the WTP throughout the whole mission.
Safety Basis Headspace	Space in tanks that cannot be used because of a safety issue associated with the waste.
Original DST Waste	Waste in the DST system before July 2003.
SST Backfill	SST waste retrieved into the DST system after June 2003.

Notes:
See the discussion immediately following for further explanation of the categories.

The DST space category identified as Original DST Waste represents the space occupied by waste that was in the DSTs as of June 30, 2003. The DST space category identified as SST Backfill represents the DST space occupied by waste retrieved from the SSTs since June 30, 2003. Between June 30, 2003 and the starting point for this analysis, the volume of waste in the DST system increased by about 2.3 Mgal due to receipt of retrieved SST waste (primarily) and due to receipt of new wastes from non-tank farm sources such as 222S Laboratory and PFP (HNF-EP-0182, Rev. 183 and Rev. 207).

The DST space category identified as Safety Basis Headspace represents unfilled space in a DST containing waste that has an associated safety issue. For example, in Waste Group A tanks (tanks AN-103, AN-104, AN-105, AW-101, and SY-103), the current waste conditions pose the potential for a spontaneous BDGRE involving flammable gas (RPP-13033, *Tank Farms Documented Safety Analysis*) if additional waste were transferred into those tanks.

The DST space category identified as WTP Headspace represents the unfilled space in a DST containing waste specifically identified for delivery to the WTP as waste feed. Currently, those tanks are AN-102, AN-107, and AY-102. Other DSTs will be allocated to this category when wastes are staged for compliance verification sampling or when the tank is filled with waste before delivery as feed to the WTP.

The DST space category identified as Restricted TRU Headspace represents the unfilled space above the TRU waste in tanks AW-103 and AW-105. Double-shell tanks identified as containing TRU waste will not be retrieved and packaged as TRU until regulatory uncertainties have been resolved and a suitable packaging facility has been permitted.

The DST space category identified as Emergency Tank Volume represents 1.235 million gallons of available space that could be used to receive waste from other DSTs in the event of a leaking

DST, or from the WTP in the event of emergency returns from the WTP. The emergency space allocation is not associated with a specific tank but is distributed throughout the DST system. The value for the emergency space allocation is based on the maximum volume of waste that could be stored in an AP-Farm DST (OSD-T-151-00007, *Operating Specifications for the Double-Shell Storage Tanks*).

The DST space category identified as Evaporator Operational Space represents the unfilled space in DSTs used to support the 242-A Evaporator operations, which includes any DSTs used to receive dilute waste or to stage (sample) dilute waste to the evaporator, the DST used to provide a feed stream to the evaporator, and the evaporator bottoms receiver. The DSTs allocated to this category change over time as wastes are transferred around the DST system. The DST space category identified as DST Available Space represents any unfilled space not allocated to a category listed above, and as such represents the space available to support SST retrieval or the receipt of new wastes into the DST system. Because some of the Evaporator Operational Space can be used to receive dilute liquids generated during the retrieval of SST wastes, the Evaporator Operational Space can be considered as Available Space if sufficient DST space is reserved for the concentrated evaporator bottoms stream.

Table 4-2 provides a summary of the evaporator campaigns and cold runs projected to be needed each fiscal year (FY) out through FY 2028 along with the volume of waste feed and the waste volume reduction achieved. At the beginning of this evaluation, the DST system contains about 10.4 Mgal of dilute waste that could be concentrated in the 242-A Evaporator to remove about 4.5 Mgal of water. By the start of WTP hot operations, the 242-A Evaporator is projected to process about 9.6 Mgal of waste and remove about 5 Mgal of water[5], and by the end of FY 2017, the 242-evaporator is projected to process about 10.4 Mgal of waste to remove about 5.6 Mgal of water. About 31 Mgal of wastes are sent to the evaporator, and about 19 Mgal of water are removed yielding about 12 Mgal of concentrated waste to be stored in the DST system during the RPP mission. Each evaporator campaign is assumed to take approximately 10 days to process about 1 Mgal of feed.

A preliminary review of the projected campaign schedule and evaporator feed batches indicates the number of campaigns occurring in FY 2020 and beyond (especially in FY 2021) could be reduced by consolidating wastes from various tanks. Consolidating wastes to reduce the number of evaporator campaigns will be addressed in future modeling.

After FY 2028, the evaporator is not used by the model because the various treatment processes remove waste at a sufficient rate to create space in the DST system to support SST waste retrieval. There may be benefits available in FY 2028 and beyond by concentrating dilute wastes before delivery to the WTP. Further evaluation is needed of the waste compositions to determine the waste volume reductions that can be achieved, and of the evaporator and feed delivery schedules to see if the wastes can be concentrated in time to support the WTP feed demands, to determine if running the evaporator after FY 2028 is beneficial.

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[5] The volumes of waste processed and water removed are based on volumes reported in Table 4-2 through the end of FY 2016. The 242-A campaign reported for FY 2016 is included because it occurs about the start of WTP hot operations.

Table 4-2. 242-A Evaporator Operations Summary by Fiscal Year

Fiscal Year	Number of Waste Evaporator Campaigns	Waste Volume Fed to Evaporator (Kgal)	Waste Volume Reduction (Kgal)
2006	0[1]	0	0
2007	2[1]	1,333	850
2008	2	2,068	745
2009	1	1,073	401
2010	1	835	517
2011	1	887	378
2012	0	0	0
2013	2	1,693	988
2014	1	650	345
2015	1	320	252
2016	1	774	541
2017	1	760	545
2018	1	580	558
2019	0	0	0
2020	5	3,002	2,092
2021	11	8,273	3,852
2022	2	1,901	958
2023	1	1,093	1,060
2024	4	810	331
2025	3	662	611
2026	4	1,789	1,587
2027	3	1,652	1,318
2028	1	1,092	899
Totals	68	31,247	18,828

Notes:

1. One of the campaigns projected for FY 2007 was actually completed late in FY 2006.

5.0 DOUBLE-SHELL TANK SPACE OPTIONS

5.1 IMPLEMENTED DOUBLE-SHELL TANK SPACE OPTIONS

Four DST space optimization efforts from RPP-7702, the *Tank Space Options* report, have been implemented to complete HFFACO milestone M-46-21, "Complete Implementation of Double-Shell Tank Space Optimization Study Recommendations (Tank Space Options Report, Document No. RPP-7702, April 12, 2001)." The four efforts are discussed below.

1. Share DST reserve emergency space.

   Tank Farms now shares emergency space with the WTP. This emergency space is reflected in Interface Control Document 19 (24590-WTP-ICD-MG-01-019). HNF-3484, the *Double-Shell Tank Emergency Pumping Guide,* has been updated and reviewed by the State of Washington, Department of Ecology (Ecology). The Emergency Tank Volume space category shown in Figure 4-1 reflects the allocation of space equivalent to only one DST (1.235 Mgal) as emergency space.

2. Use previously "restricted" space within DSTs containing WTP staged feed.

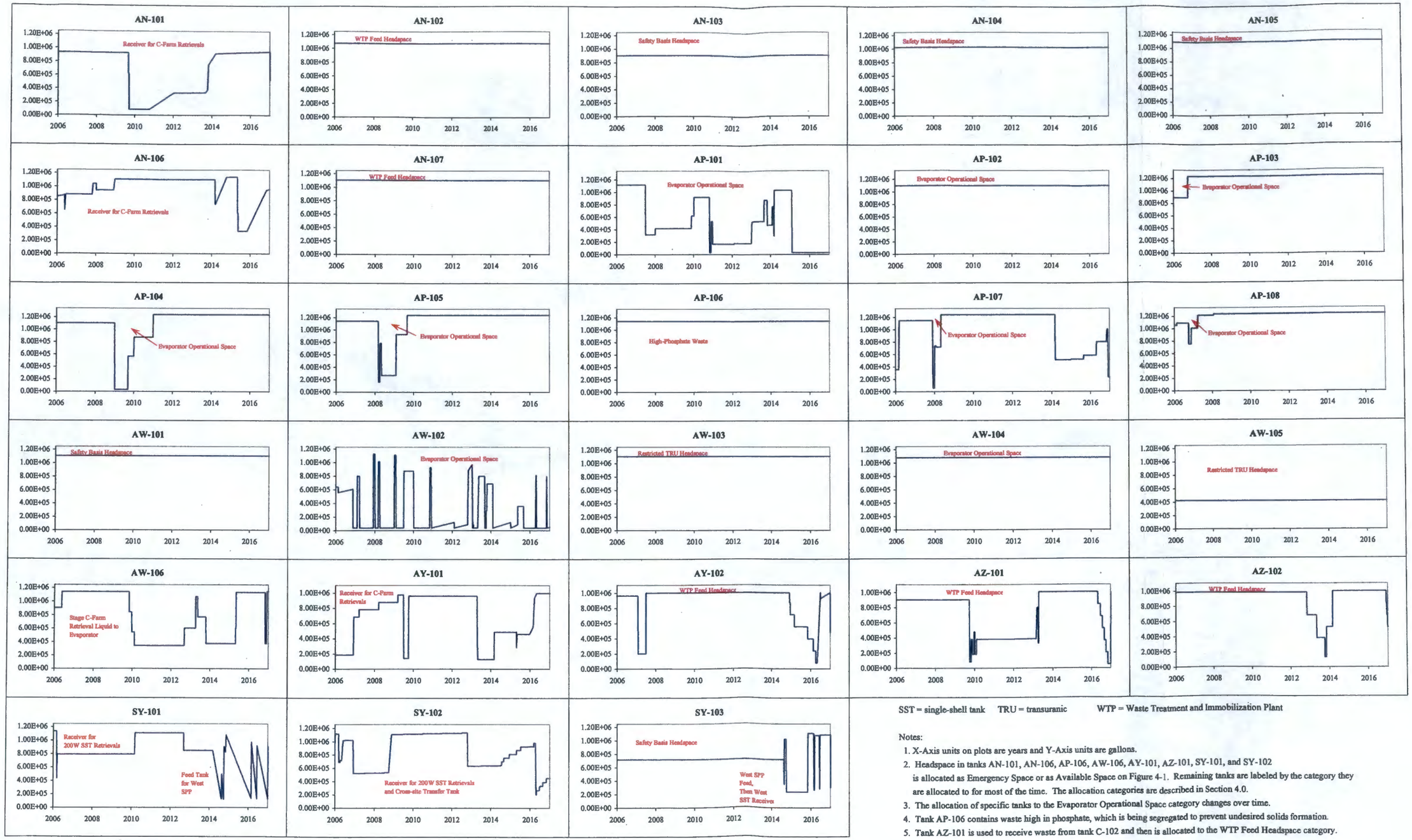
   Restrictions on use of staged feed tank space were rescinded in External letter 04-TPD-024, 'Contract No. DE-AC27-99RL14047 – Response to Request for U. S. Department of Energy (DOE), Office of River Protection (ORP) to Rescind Direction on "Configuration Control of Waste Feed Delivery Tank Contents"' (04-TPD-024 – Letter). CH2M HILL Hanford Group, Inc. (CH2M HILL) has incorporated changes into HNF-SD-WM-OCD-015, the *Tank Farm Waste Compatibility Program*, for approving transfers into formerly restricted WTP feed tanks. The current model reflects the consolidation of waste in tank AP-101 with waste in tank AY-102, the blending of AZ-101 supernate with other supernates to reduce the sulfate concentration, and the retrieval of C-104 waste into AN-101. These transfers can be seen in Figure 5-1.

3. Concentrate evaporator slurries to a higher SpG (greater than 1.41.SpG).

   Past evaporator campaigns 2003-03, 2003-04, 2004-01, 2005-01, and 2006-01[6] have concentrated wastes to SpGs of 1.46, 1.42, 1.43, 1.42, and 1.42, respectively. To make the 5.1 Mgal of space available for retrieving waste from the twenty SSTs discussed in Section 3.0, approximately 9.6 Mgal of waste from twelve DSTs are modeled as being concentrated to a SpG of 1.43. This removes about 5.3 Mgal of water and leaves about 4.3 Mgal of concentrated waste to be stored in the DST system. The changes from moving and concentrating the DST wastes can be seen as a comparison of the initial and final SpGs in Figure 5-2.

[6] One of the evaporator campaigns projected by the HTWOS model to be performed in FY 2007 was actually accomplished at the end of FY 2006.

Figure 5-1. Double-Shell Tank Volumes versus Time Through Calendar Year 2016.



SST = single-shell tank TRU = transuranic WTP = Waste Treatment and Immobilization Plant

Notes:

1. X-Axis units on plots are years and Y-Axis units are gallons.
2. Headspace in tanks AN-101, AN-106, AP-106, AW-106, AY-101, AZ-101, SY-101, and SY-102 is allocated as Emergency Space or as Available Space on Figure 4-1. Remaining tanks are labeled by the category they are allocated to for most of the time. The allocation categories are described in Section 4.0.
3. The allocation of specific tanks to the Evaporator Operational Space category changes over time.
4. Tank AP-106 contains waste high in phosphate, which is being segregated to prevent undesired solids formation.
5. Tank AZ-101 is used to receive waste from tank C-102 and then is allocated to the WTP Feed Headspace category.

Figure 5-2. 200 Area Double-Shell Tank (DST) Waste Contents

DSTs as of 10/1/05

10-1-05_tfcoupr6.csv (12/4/2006)

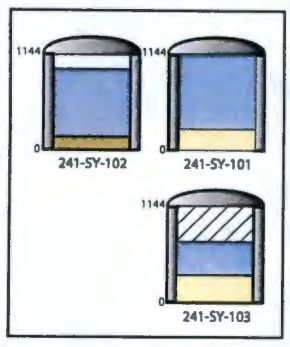
DSTs as of 5/2/2016 (Projected)

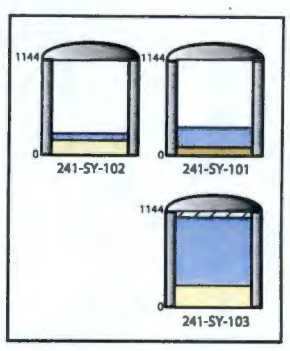
end-of-c-farm_dst-vols_tfcoupr6.xls (1/29/2006)

SY-Tank Farm- 1977

3 @ 1,144 Kgal Operational Capacity, Double-Shell

Tank	Kgal Solids	Kgal Supernatant	SpG (Liquid)
241-SY-101	251	883	1.27
241-SY-102	157	813	1.25
241-SY-103	318	397	1.46





SY-Tank Farm- 1977

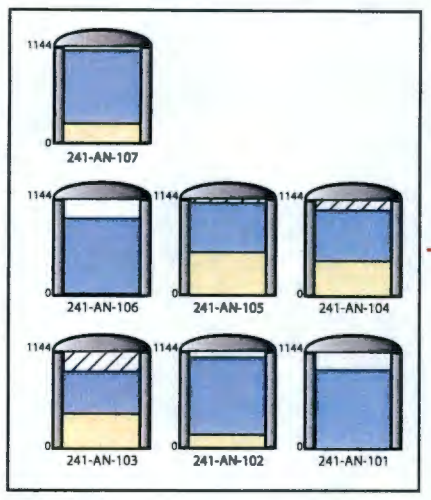
3 @ 1,144 Kgal Operational Capacity, Double-Shell

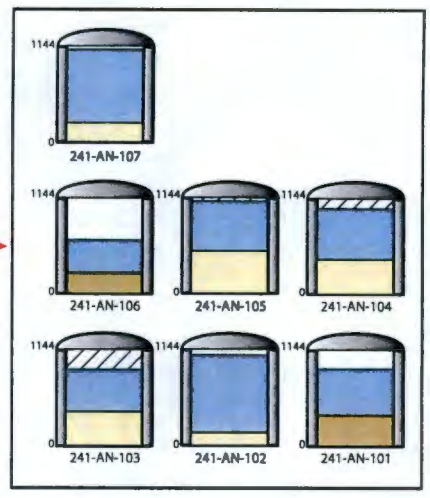
Tank	Kgal Solids	Kgal Supernatant	SpG (Liquid)
241-SY-101	101	237	1.30
241-SY-102	173	89	1.04
241-SY-103	252	817	1.29

AN-Tank Farm- 1981

7 @ 1,144 Kgal Operational Capacity, Double-Shell

Tank	Kgal Solids	Kgal Supernatant	SpG (Liquid)
241-AN-101	0	926	1.42
241-AN-102	154	916	1.44
241-AN-103	404	499	1.46
241-AN-104	414	607	1.52
241-AN-105	509	588	1.49
241-AN-106	18	894	1.09
241-AN-107	230	871	1.43





AN-Tank Farm- 1981

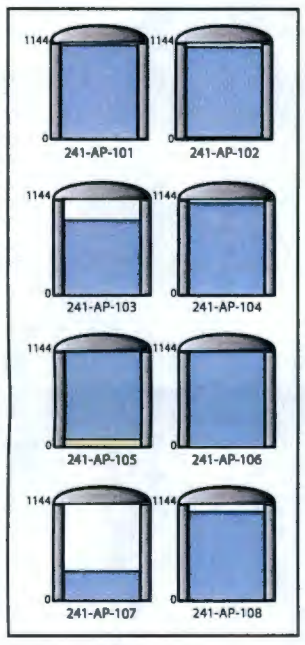
7 @ 1,144 Kgal Operational Capacity, Double-Shell

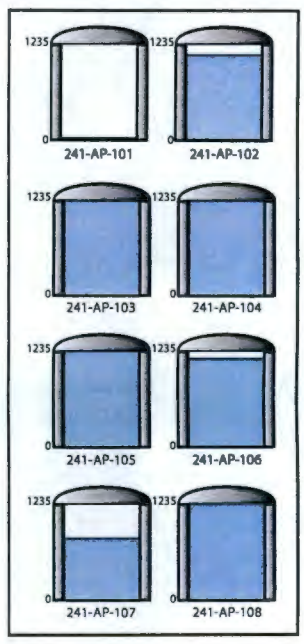
Tank	Kgal Solids	Kgal Supernatant	SpG (Liquid)
241-AN-101	366	549	1.18
241-AN-102	154	916	1.44
241-AN-103	404	499	1.46
241-AN-104	414	607	1.52
241-AN-105	509	588	1.49
241-AN-106	247	391	1.22
241-AN-107	230	871	1.43

AP-Tank Farm-1986

8 @ 1,144 Kgal Operational Capacity, Double-Shell

Tank	Kgal Solids	Kgal Supernatant	SpG (Liquid)
241-AP-101	0	1115	1.31
241-AP-102	23	1071	1.39
241-AP-103	0	894	1.34
241-AP-104	0	1100	1.27
241-AP-105	89	1050	1.27
241-AP-106	0	1136	1.21
241-AP-107	0	351	1.28
241-AP-108	0	1050	1.41





AP-Tank Farm-1986

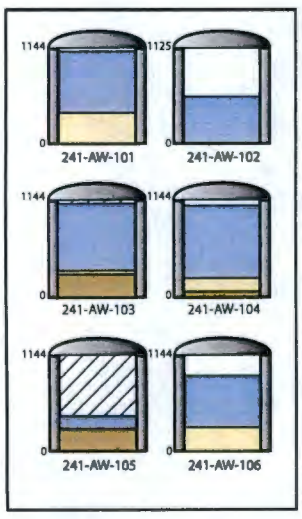
8 @ 1,235 Kgal Operational Capacity, Double-Shell

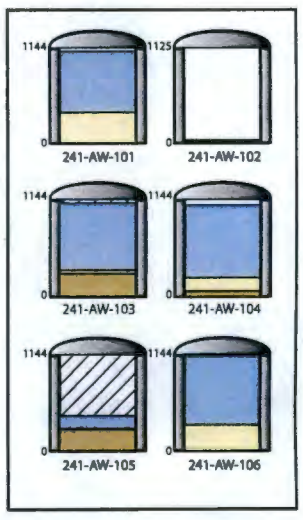
Tank	Kgal Solids	Kgal Supernatant	SpG (Liquid)
241-AP-101	0	28	1.42
241-AP-102	6	1088	1.40
241-AP-103	0	1235	1.36
241-AP-104	0	1235	1.42
241-AP-105	1	1234	1.45
241-AP-106	0	1136	1.21
241-AP-107	0	797	1.42
241-AP-108	0	1235	1.42

AW-Tank Farm-1980

1 @ 1,125 Kgal Operational Capacity, Double-Shell
5 @ 1,144 Kgal Operational Capacity, Double-Shell

Tank	Kgal Solids	Kgal Supernatant	SpG (Liquid)
241-AW-101	371	732	1.54
241-AW-102	7	548	1.24
241-AW-103	313	787	1.28
241-AW-104	223	851	1.31
241-AW-105	264	157	1.05
241-AW-106	283	616	1.30





AW-Tank Farm-1980

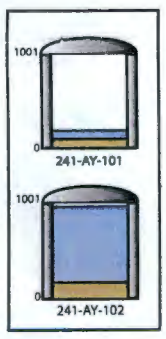
1 @ 1,125 Kgal Operational Capacity, Double-Shell
5 @ 1,144 Kgal Operational Capacity, Double-Shell

Tank	Kgal Solids	Kgal Supernatant	SpG (Liquid)
241-AW-101	371	732	1.54
241-AW-102	8	28	1.12
241-AW-103	313	787	1.28
241-AW-104	223	851	1.31
241-AW-105	264	157	1.05
241-AW-106	314	816	1.11

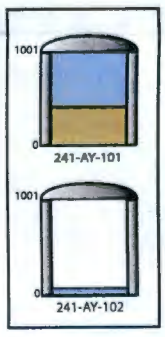
AY-Tank Farm- 1971-76

2 @ 1,001 Kgal Operational Capacity, Double-Shell

Tank	Kgal Solids	Kgal Supernatant	SpG (Liquid)
241-AY-101	96	89	1.22
241-AY-102	170	791	1.12



WTP commissioning tank



AY-Tank Farm- 1971-76

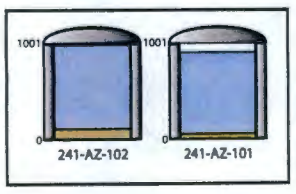
2 @ 1,001 Kgal Operational Capacity, Double-Shell

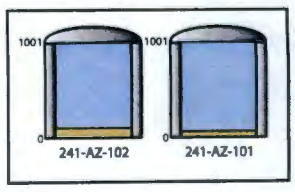
Tank	Kgal Solids	Kgal Supernatant	SpG (Liquid)
241-AY-101	402	593	1.11
241-AY-102	4	71	1.28

AZ-Tank Farm- 1975-76

2 @ 1,001 Kgal Operational Capacity, Double-Shell

Tank	Kgal Solids	Kgal Supernatant	SpG (Liquid)
241-AZ-101	52	849	1.25
241-AZ-102	105	876	1.13





AZ-Tank Farm- 1975-76

2 @ 1,001 Kgal Operational Capacity, Double-Shell

Tank	Kgal Solids	Kgal Supernatant	SpG (Liquid)
241-AZ-101	63	938	1.24
241-AZ-102	99	898	1.42

LEGEND

Sludge | Saltcake | Supernatant | Available Space | Restricted Space

Figure updated 12/19/06

CH2MHILL Hanford Group, Inc.

4. Raise the allowable tank levels.

   Controls needed to increase the fill height in all of AP tank farms have been placed within OSD-T-151-00007 for use during "top-off" transfers into AP tank farm. The increased space made available in five of the AP Farm DSTs (tanks AP-103, AP-104, AP-105, AP-107, and AP-108) will be used to receive concentrated waste from future evaporator runs before the WTP starts up. The increased space made available in tanks AP-101, AP-102, and AP-106 is not used before the WTP start up because of a need for operational flexibility (AP-101), the small volume of space available (about 140 Kgal in AP-102), and waste compatibility concerns (high-phosphate waste in AP-106).

In total, these actions have provided approximately 2.4 Mgal of additional DST storage space for waste retrieval and established the basis for concentrating retrieved waste thereby using less space.

Concurrently, SST retrieval plans have evolved to reduce the required DST space through an increase in the amount of high-curie concentration SST sludge waste retrieved, a reduction of the amount of SST salt waste retrieved, and the use of recycled DST liquids for sluicing. In addition, plans are continuing to demonstrate a supplemental treatment technology to avoid the need for DST space, if successfully deployed.

5.2 FUTURE DOUBLE-SHELL TANK SPACE CONSIDERATIONS

5.2.1 Potential Double-Shell Tank Space Options

As noted in Section 4.0, the DST system has sufficient space to receive and store the waste from WMA C, S-102, S-105, S-109, and S-112. If additional SST waste is to be retrieved into the DST system before the WTP becomes operational, new space savings measures may be required. Out of the eight options identified in Table 4-2 of RPP-7702, the following options remain available for creating DST space or avoiding the need for DST space in the future.

1. Utilize alternate storage for emergency reserves. This includes the restricted space over TRU waste in AW-103 and AW-105.
2. Utilize double-contained surface storage.
3. Construct new double-shell tanks.
4. Avoid using DST space (supplemental treatment).

Previous space evaluations relied on the startup of the WTP and supplemental treatment to provide DST space relief and thereby support continued SST retrievals. The recent uncertainty associated with the WTP start up suggests other DST space relief methods may need to be implemented to avoid temporarily curtailing SST retrievals while waiting for WTP start up. Deployment of supplemental pretreatment capacity along with supplemental treatment can allow SST retrievals to continue. Building additional DSTs would provide additional tank space but would be expensive, take approximately seven years, and be counter productive to the objective

of closing the tank farms and reducing the Hanford footprint. Currently, there are no plans in the RPP baseline to build additional DSTs. Temporary use of an appropriately upgraded and permitted SST for selected storage missions could provide additional tank space that would allow SST retrieval momentum to be maintained. A recent evaluation of SST waste staging (RPP-RPT-25589, *Evaluation of Alternatives to Support Temporary Waste Staging Needs*) provides insight into potential temporary SST storage missions. Further evaluation of additional DST space saving options may be warranted.

5.2.2 Double-Shell Tank Space Required for Continued Retrieval

Ecology has expressed interest in continuing the retrieval of additional high-risk SST waste from the pool of tanks, identified in Section 2.0, after the retrieval of waste from the WMA-C tanks has been completed. Inspection of Figure 2-1 reveals that two A-Farm tanks (A-102 and A-106) and the four AX-Farm tanks would be the next logical candidates when prioritizing the pool tanks for retrieval based on risk reduction. About 1.8 Mgal of DST space was estimated to be needed to support the retrieval of approximately 620 Kgal of waste from tanks A-102 and A-106, and the four AX-Farm tanks.

The retrieval of approximately 24.4 Mgal of waste from all the remaining SSTs (after tanks A-102 and A-106, and the four AX-Farm tanks) would yield approximately 101 Mgal of waste volume that must move through the DST system. The 101 Mgal of waste will be transferred out of the DST system to feed the WTP and supplemental treatment processes. Should this retrieved waste need to be stored in the DST system, the volume could be reduced to approximately 54 Mgal by concentrating the liquid phase.

Approximately 103 Mgal of as-retrieved wastes would be generated from the retrieval of all of the SST wastes after completion of the committed tanks. The 103 Mgal estimate includes the retrieval of the heels from tanks S-109 and S-105 (about 0.3 Mgal of retrieved waste), the retrieval of two A-Farm tanks (A-102 and A-106) and all four of the AX-Farm tanks (about 1.8 Mgal of retrieved waste), and all of the remaining SSTs (about 101 Mgal of retrieved waste). About 84 DSTs would be needed to store these 103 Mgal of retrieved wastes. If those 103 Mgal of retrieved wastes could be concentrated in the 242-A Evaporator, the space demand could be reduced to about 55 Mgal. The concentrated SST wastes would require about 45 DSTs for storage.

About 4.4 Mgal of liquid from retrieved SST wastes are sent to the West Area SPP and STP before the WTP starts hot operations, and about 33 Mgal of liquid from retrieved SST wastes are sent to the West Area SPP and STP during the RPP mission. Use of these facilities reduces the processing load on the WTP and the number of cross-site transfers needed between the West and the East Areas.

6.0 REFERENCES

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APPENDIX A.

HANFORD FEDERAL FACILITY AGREEMENT AND CONSENT ORDER MILESTONE M-45-02M

APPENDIX A

Hanford Federal Facility Agreement and Consent Order Milestone M-45-02M.

The text of Hanford *Federal Facility Agreement and Consent Order* Milestone M-45-02M is provided below for information.

"This provides for a biennial update of a SST retrieval sequence document that will define the tank retrieval sequence, selection criteria and rationale, reference retrieval method(s) for each tank, and the estimated retrieval schedules. The retrieval sequence document will list retrieval methodologies to be employed and estimated waste volumes to be generated during retrieval (to be transferred to the DSTs or other available safe storage). The report will also list tank selection rationale based on the primary objective of maximizing risk reduction through the retrieval of mobile, long-lived radionuclides or potential airborne contaminants and principle nonradiological hazardous constituents in a manner which is sensitive to waste treatment facility requirements and infrastructure constraints. The sequencing will also take in consideration DST space and DST waste compatability [sic] when selecting the SST retrieval sequence. Tank selection for retrieval will take into consideration the closure of waste management areas and resource optimization. The biennial updates will be submitted to Ecology for approval as Agreement primary documents.

This also provides for a bienniel [sic] update of the double shell tank space evaluation document. This new milestone replaced milestone M-31-02 and subsequently M-46-00L, M-46-00L, and M-46-00M, etc. A tank volume projection report shall be submitted on a bienniel [sic] basis to Ecology and EPA. This report shall include discussions covering all assumptions which form the basis of the projection. The report shall include or shall be accompanied by DOE's plans for acquisition of additional tanks based on the tank volume projection. Ecology concurrence of additional tank acquisition within 60 days. Within 60 days of receiving the DST tank space evaluation document, the three parties shall meet to establish new milestones, if required, for acquisition of additional tanks."

APPENDIX B.

SINGLE-SHELL TANK RISK RANKING AND PROJECTED DOUBLE-SHELL TANK SPACE DEMAND

APPENDIX B.

SINGLE-SHELL TANK RISK RANKING AND PROJECTED DOUBLE-SHELL TANK SPACE DEMAND

Table B-1 provides a listing of the risk ranking categories and ranking values for the waste in the single-shell tanks, along with the projected space demand from this analysis and identification whether additional efforts will be needed to remove a hard heel of waste to meet the Tri-Party Agreement goals for waste retrieval. The risk and tank ranking values are the same that were published in the previous revision of this document and are provided for the reader's information.

Table B-1. Tank Ranking by Data Category. (4 Sheets)

Tank	Rank by Ci/gal	Rank by Groundwater Risk	Rank by Airborne Risk	Rank by Estimated DST Space Used (least to greatest)	Projected Double-Shell Tank Space Demand (Kgals)	Hard Heel Removal is Projected to be Needed (Yes or No)
A-101	49	25	46	106	888	No
A-102	24	74	42	35	65	No
A-103	58	49	57	108	892	No
A-104	2	97	16	37	247	No
A-105	4	60	6	41	217	No
A-106	13	62	9	67	381	Yes
AX-101	40	43	55	123	996	Yes
AX-102	10	104	58	34	50	No
AX-103	16	48	20	61	232	Yes
AX-104	1	58	14	25	94	No
B-101	11	102	13	60	402	No
B-102	128	132	143	32	102	No
B-103	127	124	114	45	209	No
B-104	114	84	106	93	611	Yes
B-105	124	110	118	121	817	No
B-106	113	105	127	53	317	Yes
B-107	75	88	68	75	None	No
B-108	129	122	141	62	514	Yes
B-109	27	113	122	82	891	Yes
B-110	109	82	78	3	None	No
B-111	46	55	74	4	None	No
B-112	108	94	144	29	135	No
B-201	143	146	100	5	None	No
B-202	141	130	126	12	None	No
B-203	144	143	120	10	None	No
B-204	145	144	117	9	None	No

Table B-1. Tank Ranking by Data Category. (4 Sheets)

Tank	Rank by Ci/gal	Rank by Groundwater Risk	Rank by Airborne Risk	Rank by Estimated DST Space Used (least to greatest)	Projected Double-Shell Tank Space Demand (Kgals)	Hard Heel Removal is Projected to be Needed (Yes or No)
BX-101	15	133	72	44	1,137	No
BX-102	28	137	33	59	1,129	No
BX-103	22	128	18	43	644	Yes
BX-104	41	75	50	68	1,601	Yes
BX-105	69	89	102	46	1,433	Yes
BX-106	57	98	95	42	184	Yes
BX-107	126	64	96	89	1,980	Yes
BX-108	64	115	133	36	207	No
BX-109	88	107	132	64	349	Yes
BX-110	111	53	108	94	605	No
BX-111	110	51	123	85	523	No
BX-112	118	90	92	54	730	Yes
BY-101	50	18	94	137	1,284	Yes
BY-102	105	37	89	109	913	No
BY-103	83	15	79	134	1,284	No
BY-104	45	20	75	124	1,241	Yes
BY-105	93	54	44	144	1,474	No
BY-106	66	8	105	132	1,332	No
BY-107	62	41	115	97	860	No
BY-108	77	50	110	88	527	No
BY-109	56	45	98	96	724	Yes
BY-110	68	29	90	120	1,013	Yes
BY-111	106	35	82	116	1,328	No
BY-112	100	33	86	118	1,253	No
C-101	20	114	41	84	244	No
C-102	35	111	4	90	415	Yes
C-103	5	83	3	99	168	No
C-104	32	61	2	110	357	Yes
C-105	18	59	7	86	229	No
C-106	8	119	66	26	None	No
C-107	9	66	5	102	345	Yes
C-108	53	108	136	72	163	No
C-109	14	78	101	76	161	Yes
C-110	130	79	104	77	394	No
C-111	7	112	65	49	194	No
C-112	12	63	51	79	202	Yes
C-201	81	135	107	15	12	No
C-202	63	136	119	16	None	No
C-203	119	125	128	20	None	No
C-204	115	127	146	17	24	No
S-101	30	44	32	129	3,081	Yes
S-102	78	36	70	100	1,497	Yes

Table B-1. Tank Ranking by Data Category. (4 Sheets)

Tank	Rank by Ci/gal	Rank by Groundwater Risk	Rank by Airborne Risk	Rank by Estimated DST Space Used (least to greatest)	Projected Double-Shell Tank Space Demand (Kgals)	Hard Heel Removal is Projected to be Needed (Yes or No)
S-103	61	30	64	95	1,297	Yes
S-104	38	68	34	122	3,301	No
S-105	117	5	38	135	407	Yes
S-106	85	16	97	136	1,379	Yes
S-107	42	73	8	104	5,578	Yes
S-108	80	10	22	141	1,710	Yes
S-109	120	12	88	115	493	Yes
S-110	59	23	37	127	1,646	Yes
S-111	43	27	112	111	981	Yes
S-112	104	26	29	148	89	Yes
SX-101	31	42	24	119	1,167	Yes
SX-102	47	22	49	130	930	Yes
SX-103	48	19	27	140	1,686	Yes
SX-104	37	40	12	133	2,574	No
SX-105	52	34	21	107	981	Yes
SX-106	76	7	45	113	975	No
SX-107	21	95	54	70	1,808	No
SX-108	6	106	10	63	175	No
SX-109	33	65	40	114	2,445	No
SX-110	29	99	80	52	475	No
SX-111	26	86	53	73	1,804	No
SX-112	23	100	61	58	1,331	No
SX-113	107	93	134	31	469	No
SX-114	34	72	60	87	2,636	No
SX-115	3	134	31	19	32	No
T-101	102	69	93	56	276	No
T-102	74	92	121	40	188	Yes
T-103	17	117	69	30	187	No
T-104	142	121	76	2	None	Yes
T-105	86	76	83	50	None	Yes
T-106	116	118	129	28	155	No
T-107	87	67	87	80	None	No
T-108	133	126	139	24	17	No
T-109	138	129	140	48	140	No
T-110	132	131	109	7	None	No
T-111	140	87	62	1	None	No
T-112	125	141	113	8	None	Yes
T-201	146	147	103	6	None	No
T-202	147	149	131	14	None	No
T-203	148	148	124	11	None	No
T-204	149	145	130	13	None	No
TX-101	25	85	35	65	148	Yes

Table B-1. Tank Ranking by Data Category. (4 Sheets)

Tank	Rank by Ci/gal	Rank by Groundwater Risk	Rank by Airborne Risk	Rank by Estimated DST Space Used (least to greatest)	Projected Double-Shell Tank Space Demand (Kgals)	Hard Heel Removal is Projected to be Needed (Yes or No)
TX-102	90	46	59	91	557	No
TX-103	92	56	71	81	372	No
TX-104	36	80	99	51	116	Yes
TX-105	95	3	17	145	1,516	No
TX-106	84	24	39	131	941	Yes
TX-107	60	81	52	38	88	No
TX-108	91	57	73	74	322	Yes
TX-109	123	70	77	103	458	Yes
TX-110	98	14	25	138	1,190	No
TX-111	99	28	36	126	910	Yes
TX-112	96	2	15	147	1,684	No
TX-113	131	1	85	149	1,992	No
TX-114	101	11	23	142	1,422	No
TX-115	94	4	19	143	1,454	No
TX-116	122	32	47	146	1,742	No
TX-117	112	38	43	139	1,267	No
TX-118	65	47	1	101	679	Yes
TY-101	134	109	91	69	1,947	No
TY-102	121	103	137	55	195	No
TY-103	97	77	84	66	973	No
TY-104	82	101	116	39	347	No
TY-105	73	71	125	78	1,077	No
TY-106	67	123	142	27	252	No
U-101	19	120	135	33	73	No
U-102	44	31	48	105	783	Yes
U-103	79	21	63	112	1,082	Yes
U-104	51	96	81	57	580	No
U-105	71	6	11	128	946	Yes
U-106	54	52	26	71	402	No
U-107	103	13	28	117	809	Yes
U-108	72	9	30	125	1,166	Yes
U-109	89	17	111	98	998	Yes
U-110	55	91	67	83	2,007	No
U-111	70	39	56	92	555	Yes
U-112	39	116	138	47	552	No
U-201	135	138	148	23	40	No
U-202	139	139	147	21	40	No
U-203	136	140	149	18	40	No
U-204	137	142	145	22	30	No

Ci/gal Curies per gallon

APPENDIX C.

MODELING ASSUMPTIONS

APPENDIX C.
MODELING ASSUMPTIONS

Table C-1 provides a summary of the Hanford Tank Waste Operations Simulator modeling assumptions used in this evaluation.

Table C-1. Assumptions Matrix. (21 Sheets)

A1.1. Brief Description of Case	
Update TFC life-cycle planning basis. A simple schematic of the overall process is shown in Figure 1-1.	
A2.0. Major Facilities	
A2.1. New Waste Generation	
A2.1.1. New Waste Introduced Via Deactivation	
PUREX – Deactivation ~ 2025	15 Kgal
T-Plant – Deactivation ~ 2025 Flush Volume Factor	15 Kgal 22%
A2.1.2. New Waste Introduced Via Operations	
222-S Laboratory – Receipt Rate: • FY 2006 through FY 2014 • FY 2015 through the end of waste processing Flush Volume Factor	 • 5 Kgal/year • 10 Kgal/year 22%
A2.2. Waste Treatment Plant	
Key features for modeling	Key features of the WTP that will be modeled for purposes of mission planning and estimation of secondary waste streams include: • LAW Feed Receipt Tanks (simplified – 1.5 Mgal lumped capacity) • HLW Feed Receipt Tank • Front End Evaporator (simplified – no feed tanks) • Ultrafilter System (with modified [OH^-] endpoint and oxidative leach) • Pretreated HLW Lag Storage and Blend Tanks (simplified – 81 Kgal lumped capacity) • Cesium Ion-Exchange (as a black-box) • Back End Evaporator / Pretreated LAW Storage (simplified and product routing modified to interface with STP) • HLW Melter Feed Preparation (simplified) • HLW Melter (model total capacity, not individual melters) • LAW Melter Feed Preparation (simplified) • LAW Melter (model total capacity, not individual melters) • Off-gas treatment systems (added NH_4^+ for proper stoichiometry). • Recycle of LAW SBS and WESP Condensate to back-end evaporator feed tank. • Recycle of HLW SBS and WESP to front-end evaporator feed tank. • Transfer of LAW Caustic Scrubber solution to LERF via WTP PT facility.

Table C-1. Assumptions Matrix. (21 Sheets)

Technical Basis for Modeling	The basis for modeled chemical reactions, extents, and split factors for estimating primary and secondary waste streams will be the 24590-WTP-MDD-PR-01-002, Rev 6, with flowsheet and operating mode modifications as needed to implement other assumptions.
A2.2.1. Low-Activity Waste Processing Schedule	
LAW feed delivery dates	Start delivery of the first LAW feed batch on 12/1/2014 and deliver remaining LAW feed as needed to keep the WTP operating within model constraints. The first LAW feed batch will be provided by a decant transfer of about 131 Kgal of supernate from AY-102 to the LAW feed receipt tanks.
LAW Pretreatment Ramp Up	Support the down-stream demand for pretreated LAW up to a maximum UF permeate rate of 17.7 gpm.
LAW Vitrification Ramp Up	From - To MTG/d (net rate) 3/1/2015 – 1/31/2016 3.3 2/1/2016 – 12/31/2016 18.0 1/1/2017 – 12/31/2017 24.0 1/1/2018 – 12/31/2019 28.8 1/1/2020 – end of mission 34.0
Complete Waste Processing	Goal is to complete waste processing as soon as possible.
A2.2.2. LAW Feed Receipt Tanks	
LAW Feed Receipt Tank Use	1.5 Mgal Total Capacity; be capable of receiving 1 Mgal without interruption while feeding out of the remaining 0.5 Mgal
A2.2.3. LAW Pre-Treatment Process	
LAW WTP Process Model	• The LAW (liquid) fraction of Envelope C waste from tanks AN-102 and AN-107 does not need to be segregated from other waste within the pretreatment facility since it will be pretreated in tank farms prior to delivery to WTP. • There will be approximately 300 gallons (2005 lb_m air-dried) of spent cesium ion exchange resin generated for every 300,000 gallons of supernate treated through the cesium ion exchange system. • Spent cesium ion exchange resin will contain the following constituents after being prepared for disposal: o Cr – 670 µg/g o K – 220 µg/g o Na – 83,800 µg/g o ^{99}Tc – 6.74 µg/g o ^{238}U – 14.8 µg/g o ^{60}Co – 1.31 µCi/g o ^{137}Cs – 60 µCi/g
A2.2.4. LAW Melter Design and Operation	
LAW melter glass capacity	6900 gallons
LAW melter operation	• One LAW melter is replaced every 2.5 years. • At the time of replacement, the contents of the melter are sent to a "Spent" melter stream. • The glass remaining in the LAW melter at the end of the mission will be sent to the spent melter stream.
A2.2.5. LAW Melter Off Gas Treatment	
	The partitioning factors used for the scrubbers and filters were taken from 24590-WTP-MDD-PR-01-002.
A2.2.6. ILAW Formulation and Packaging	
ILAW Process	• During hot commissioning, the total sodium loading, sulfate volatilization and formulation of the LAW glass will be estimated

Table C-1. Assumptions Matrix. (21 Sheets)

	using the Gimpel Model as described in 24590-WTP-MDD-PR-01-002. • During hot operations, the total sodium loading of LAW glass from pretreated feed will be determined using the DOE Model (D-03-DESIGN-004), which maximizes the sodium oxide loading in the LAW glass subject to the following constraints: $[Na_2O] \leq 20wt\%$ $[SO_3] \leq 0.8wt\%$ • During hot operations, the composition of the LAW glass will be estimated using a glass recipe model similar to that described in 24590-WTP-MRQ-PO-04-0065 (DRAFT). Sulfate volatilization will be estimated using Equation 3.1-5f of 24590-WTP-RPT-PT-02-005. • Melter split factor for ^{129}I: 20% of the ^{129}I entering the melter will be retained in the LAW glass product and the remaining 80% will report to the melter off-gas system. • No loss of production is incurred by the replacement of a new melter.
ILAW Glass Density	2.6 MT/m^3
ILAW Package Net Mass	5.92 MT
A2.2.7. ILAW Interim Storage Capacity	
ILAW Interim Storage Capacity	No lag storage of ILAW in WTP.
A2.2.8. High-Level Waste Processing Schedule	
HLW feed delivery dates	Start delivery of the first batch group of HLW feed on 12/15/2014 and deliver remaining HLW feed as needed to keep the WTP operating within model constraints. The first batch group of HLW feed will be provided from AY-102 using existing supernate or by adding sufficient water to the decanted solids to obtain a slurry solids loading between 10 and 200 grams solids per liter of slurry (150 g/liter nominal).
HLW Vitrification Ramp-up	From - To HLW MTG/d (net rate) 5/17/2015 – 1/31/2016 0.69 2/1/2016 – 12/31/2016 3.0 1/1/2017 – 12/31/2017 4.0 1/1/2018 – end of mission 5.0
A2.2.9. HLW Feed Receipt Tanks	
HLW Feed Receipt Tank Usage	• Sufficient space to receive 160,000 gallons (600 m^3) without interruption. • HLW feed deliveries do not need to be suspended when the LAW feed receipt tanks contain waste from either AN-102 or AN-107. • All HLW batches must be at least 130,000 gallons total volume and contain at least 2 wt% solids.
A2.2.10. HLW Pre-Treatment Process	
HLW WTP Process Model	• The water wash factors in the TWINS on 12/19/2005 will be used for partitioning waste into solid and liquid phases during retrieval and staging. • The caustic leach factors in the TWINS on 12/19/2005 will be used as the basis for computing the caustic leach factors associated with each delivered batch of HLW solids and for the entrained solids.

Table C-1. Assumptions Matrix. (21 Sheets)

	• All solids delivered with the HLW feed and entrained solids delivered with the LAW feed will undergo caustic leaching, and caustic-leached solids containing more than 5,000 μg Cr / g dried solids will undergo oxidative leaching. The insoluble fraction remaining will be incorporated into HLW glass. • An oxidative leach process that removes Cr from the HLW sludge without impact on cycle time or other species will be implemented in the ultrafilters. Reaction stoichiometry and endpoint (5,000 μg Cr / g dried solids) are described in RPP-15552.
A2.2.11. HLW Melter Design and Operation	
HLW melter glass capacity	1800 gallons
HLW melter design	• One HLW melter is replaced every 2.5 years. • At the time of replacement, the contents of the melter are sent to a "Spent" melter stream. • The glass remaining in the HLW melter at the end of the mission will be sent to the spent melter stream.
A2.2.12. HLW Melter Off Gas Treatment	
• Primary off gas treatment • Secondary off gas treatment	• All liquid effluent will be recycled back to the pre-treatment facility. • Partitioning factors used for the scrubbers and filters were taken from 24590-WTP-MDD-PR-01-002.
A2.2.13. IHLW Formulation and Packaging	
Method for Estimating HLW Waste Oxide Loading	Glass Properties Model modified as follows. • Increase the maximum spinel liquidus temperature constraint from 1050 °C to 1100 °C. • Increase the maximum viscosity constraint from 5.5 Pa•s to 10 Pa•s. • Increase the maximum Cr_2O_3 constraint from 0.5 wt% to 1.0 wt%. • Use a maximum zircon liquidus temperature limit of 1050 °C. • Use a Product Consistency Test (PCT) upper limit of 2 g/m^2.
Melter split factor for ^{129}I	20% of the ^{129}I entering the melter is retained in the HLW glass product and the remaining 80% will report to the melter off-gas system.
IHLW Glass Density	2.7 MT/m^3
IHLW Canister Net Mass	3.2 MT (thin-walled canister)
A2.2.14. IHLW Interim Storage	
IHLW Interim Storage Capacity	22 canisters of IHLW can be stored in the WTP before having to ship canisters to an interim storage site on the Hanford Site.
A2.2.15. Effluent Collections	
	• Two streams are recycled from the LAW melter off-gas (MOG) system and one stream is recycled from the HLW MOG system. • One stream from each MOG system is recycled to the pretreatment facility. • One stream from the LAW MOG system is transferred through the pretreatment facility to the LERF/ETF.
A2.3. Supplemental Treatment	
A2.3.1. TRU Sludge Packaging	
Contact-Handled Sludge Packaging Feed Delivery	• The contact-handled Supplemental TRU Treatment and Packaging process will be available on 10/1/2013 to process waste from the 200-Series SSTs listed below. • The system will first be located near B-Farm and then moved to T-Farm. There will be a 10-day outage between tanks and 60-day outage to move equipment between farms.

Table C-1. Assumptions Matrix. (21 Sheets)

	• Tanks [B-201, B-202, B-203, B-204], [T-201, T-202, T-203, T-204], T-111, T-110, and T-104 will be retrieved and sent for packaging as CH-TRU. The tanks will be retrieved and packaged in the stated order except that the tank order within the [brackets] can be changed. • The waste from the B-200 and T-200 series SSTS, T-104, T-110, and T-111 will be retrieved using equal volumes of retrieval water, without impact to DST space (i.e., no liquids are returned to the DST system). • It is assumed that this waste can be treated and packaged as contact-handled TRU and disposed of at WIPP. • There will be no water or waste sent to the DST system.
Remote-Handled Sludge Packaging Feed Delivery	• The remote-handled Supplemental TRU Treatment and Packaging process will be available on 5/9/2025. The process will be mobile and located near the tank farm where the RH-TRU waste is located, i.e., AW-Farm, B-Farm, and T-Farm. • All remote-handled sludge will be water-washed prior to treatment to remove soluble waste constituents. • The solids in tank SY-102 will be moved across the site as soon as the waste currently in tank AN-104 has been moved out and will be combined with the solids in tank AW-105 or AW-103 as space allows. • Supernatant liquid will be decanted from tank AW-103 in June 2024. The waste solids in tank AW-103 will be washed four times over a nine-month period starting 7/9/2024 using one gallon of 0.01 M NaOH solution for each gallon of the initial bulk settled solids for each wash. After each wash, the solids are settled to 40 wt% before decanting the wash solution for feed to the evaporator. The first wash of the waste solids in AW-103 is assumed to dissolve the saltcake portion. Existing water wash factors and the Sr solubility model will be applied to estimate the overall wash effectiveness. • Add enough 0.01 M NaOH to deliver a 10 wt% solids slurry for packaging. • Supernatant liquid will be decanted from tank AW-105 in July 2025. The waste solids in tank AW-105 will be washed four times over a nine-month period starting 8/9/2025 using one gallon of 0.01 M NaOH solution for each gallon of the initial bulk settled solids for each wash. After each wash, the solids are settled to 40 wt% before decanting the wash solution for feed to the evaporator. The first wash of waste solids in AW-105 is assumed to dissolve the saltcake portion. Existing water wash factors and the Sr solubility model will be applied to estimate the overall wash effectiveness. • Add enough 0.01 M NaOH to deliver a 10 wt% solids slurry for packaging. • After packaging the RH-TRU waste from the DSTs, the packaging facility will be located near B-Farm to wash and package the waste from tanks B-107, B-110, and B-111. The retrieved SST waste will be washed four times over a nine-month period in the B-Complex WRF using one gallon of 0.01 M NaOH solution for each gallon of the initial bulk settled solids for each wash. After each wash, the solids are settled to 40 wt% before decanting the wash solution for feed to the evaporator. The first wash of the

Table C-1. Assumptions Matrix. (21 Sheets)

	waste solids will dissolve the saltcake portion. Existing water wash factors and the Sr solubility model will be applied to estimate the overall wash effectiveness. • Add enough 0.01 M NaOH to deliver a 10 wt% solids slurry for packaging. • After packaging the RH-TRU waste from the B-Farm SSTs, the packaging facility will be located near T-Farm to wash and package the waste from tanks T-105, T-107, and T-112. The retrieved SST waste will be washed four times over a nine-month period in the T-Complex WRF using one gallon of 0.01 M NaOH solution for each gallon of the initial bulk settled solids for each wash. After each wash, the solids are settled to 40 wt% before decanting the wash solution for feed to the evaporator. The first wash of the waste solids will dissolve the saltcake portion. Existing water wash factors and the Sr solubility model will be applied to estimate the overall wash effectiveness. • Add enough 0.01 M NaOH to deliver a 10 wt% solids slurry for packaging.
Sludge Packaging Process	The overall process for both contact-handled and remote-handled TRU sludge treatment is assumed to use the "dry batch mode" as described in the System Design Description (RPP-20499) and summarized as follows: • The slurry will be transferred to the Feed Receipt Process System modeled as a single tank with a working volume of 28,800 gallons. • The slurry, carrier and heat are continuously added to the dryer, while dried product is withdrawn to maintain a product with 20 wt% water and 80 wt% waste loading (both relative to waste, water and carrier). • The carrier is added at a ratio of 76 gallons of additive per 14,400 gallons of feed to the packaging facility. • Secondary waste will be estimated using the dryer retention factors as stated in 20843.PCAL.001, Assumption 8 and by applying the DFs for the 242-A Evaporator condenser. Liquid effluent will either be transferred to the LERF via Tank Truck or recycled to the Retrieval project. For planning purposes, it will be assumed that the liquid effluent is transferred only to LERF (no recycle) and modeled as a continuous transfer. • The CH-TRU dried waste product is packaged in standard waste boxes (SWB), each SWB holding approximately 2,760 lb_m waste. • The RH-TRU dried waste product is packaged in 55-gallon drums containing 700 lb_m of product per drum, which are loaded three drums to a RH-72B canister. • The washed solids will require remote handling for packaging, can be treated and packaged as remote-handled TRU for disposal at WIPP.

Table C-1. Assumptions Matrix. (21 Sheets)

A2.3.2. Supplemental LAW Processing	
Supplemental Treatment Demonstration	• A Demonstration Bulk Vitrification System (DBVS) will be located in the 200 West Area (west of S-Farm) and be operated at a net rate of 3.66 MTG/d starting on 3/3/2010 to process 260 MT Na from the low-curie waste from tank S-109. The demonstration will be completed by 10/31/2012. • The DBVS will be fed directly from S-109 with no solids entrained out of S-109. The feed will be delivered at 5 M Na. The S-109 waste retrieval will be controlled to limit the total activity in the retrieved waste to 0.0062 Ci per liter (at the 5 M Na feed concentration) for the demonstration. • The DBVS process assumptions (other than process rate) will be the same as that used for the full-scale Supplemental Treatment Process.
Supplemental Treatment Demonstration Extension	• The Bulk Vitrification System (BVS) facility will be refurbished and re-permitted for extended operation after an outage. • The refurbished facility starts operating on 8/3/2013 at a net rate of 3.66 MTG/day and operates as long as low-curie feed from tanks S-109 and S-105 is available. • The feed to the BVS process for extended operation includes: o Low-curie feed from the continued selective dissolution of tank S-109 waste. It is expected that continued selective dissolution of waste in S-109 will continue until the cumulative removal of waste reaches 90%. About 80% of the Na, and 20% of the Cs currently in the tank (circa January 2006) will be sent to the DBVS or the BVS. The remaining waste will be retrieved later. o Low-curie feed from the selective dissolution of tank S-105 waste. It is anticipated that selective dissolution will continue until the cumulative removal of waste reaches 90%. About 80% of the Na, and 20% of the Cs currently in the tank (circa January 2006) will be sent to the DBVS or the BVS. An additional 9% will be retrieved later to the West Area Supplemental Pretreatment System, leaving approximately 1% of the waste as a residual.
East Area Supplemental Treatment Process	• A production process facility will be located in the 200 East Area. • The production facility, consisting of four melter lines, starts hot testing on 6/3/2016 and operates at 25% of full capacity (about 3.66 MTG/d) for eight months. • Full capacity operation starts on 2/3/2017 at a rate of 14.65 MTG/d. • "Excess" pretreated LAW from the WTP will be used to feed the East Area Supplemental Treatment process.
West Area Supplemental Pretreatment	• A supplemental pretreatment system will be installed in two new vaults located near SY-Farm. • Solid/liquid separation will be performed in tank SY-101 by the installation of two rotary microfiltration units. • Waste pretreatment will be performed using a regenerable Cs ion exchange (IX) resin contained in one of two new vaults. In one vault, two IX resin columns will be used to remove Cs; one as a lead column and as a one polishing column. Cs removal will proceed until breakthrough of Cs is observed, at which time the system will be shut down and the resin regenerated using an acid

Table C-1. Assumptions Matrix. (21 Sheets)

	eluent. The acid eluent is collected in an eluate tank within the Cs IX vault, sampled and analyzed, neutralized with caustic, and transferred to tank SY-102 for subsequent transfer to an East Area DST. • Pretreated waste is sent to one of two new double-contained receiver tanks (DCRTs) located in the second of the two new vaults. Each new DCRT has a working volume of 41,400 gallons. Pretreated waste from the Cs IX system will be sent to one DCRT while the pretreated waste in the other DCRT is sampled and analyzed before being sent to the West Area Supplemental Treatment Plant. • Since the pretreatment system is being started before the West Area STP, pretreatment operations will start on 2/28/2014 and continue until the DCRTs are full. Pretreatment operations will resume when the West Area STP starts up and removes pretreated waste from the DCRTs. • Waste in tank SY-101 will be used as the first feed to the pretreatment system. Then the supernatant liquid in tank SY-103 will be transferred to SY-101 for solid/liquid separation and delivery to Cs IX. The salt solids in tank SY-103 will be dissolved, sampled and analyzed, and transferred to tank SY-101. After SY-103 has been emptied, it will be used to receive and sample wastes for staging into SY-101 and processing through Cs IX.
West Area Supplemental Treatment Process	• A production process facility will be located in the 200 West Area near the SY Farm and the West Area Supplemental Pretreatment Facility. • The production facility, consisting of four melter lines, starts hot testing on 7/2/2014 and operates at 25% of full capacity (about 3.66 MTG/d) for eight months. • Full capacity operation starts on 3/2/2015 at a rate of 14.65 MTG/day. • The West Area STP operates to process as much liquid waste from the West Area SSTs as possible.
WTP Process Considerations	The WTP pretreatment facility will be configured so that a portion of concentrated pretreated LAW from the Treated LAW Concentrate Tank can be transferred to the East Area Supplemental Treatment Plant (STP) as feed. This is downstream of the point to which LAW SBS and WESP condensate is recycled, so the STP feed will include a proportional fraction of the SBS and WESP condensate.
STP Process Basis (including DBVS)	The process will be modeled using a simple flowsheet that implements the overall mass balances (elemental, NO_x, and activity) as shown in Section 3.2 of the process flowsheet (RPP-20528) using the process design criteria provided in 145579-A-DC-002, with the following exceptions: • The Tri-mer scrubber (provides backup off-gas treatment) is assumed to not be operated. • The splits for the dryer will be set equal to the splits used for the WTP evaporators. • 20 wt% total Na_2O loading (about 17.6 wt% waste Na_2O loading). These mass balances cover both primary and major secondary waste streams from the process which will be modeled as a single lumped process train comprising the following unit operations:

Table C-1. Assumptions Matrix. (21 Sheets)

	• Feed Tank • Dryer • Condenser for Dryer Off Gas • Melter • Sintered Metal Filter with recycle to dryer (modeled as to dryer feed tank) • Hydrosonic Scrubber • HEPA Filter • Carbon Filter • NO_x Removal
Product and Packaging	Bulk vitrification is used as the supplemental treatment process to immobilize LAW. The following will be used to estimate bulk vitrification product volume and package count. • Glass density is 2.65 MT/m^3. • Packaged in 35 m^3 roll-off boxes, each filled with 42.6 MT glass.
In-Tank Sr/TRU Precipitation	
In-tank Demonstration	• On 3/1/2020, clean out AP-102 by decanting supernate down to 10 inches above any existing solids layer. • Sometime in April 2020, transfer 50 Kgal of supernate from AN-107 into AP-102, mixing it with the 10 inch liquid heel, and adding enough water to dilute the Na concentration to 5.5 M. • Add the necessary reagents [5.308 gallons of 3.83 M $NaMnO_4$ and 6.723 gallons of 3 M $Sr(NO3)_2$ each per 1000 gallons of diluted waste] and simulate the Sr/TRU precipitation. • Simulate the reaction time and solids settling time by waiting 30 days. (Note that this may be considered conservatively long as the reaction requires a minimum of 4 hours [per RPP-24809] and the settling of C-Farm solids is assumed to occur within 3 to 5 days. Also, some time may be needed for sampling and analysis of the pretreated waste and evaluation of the results before declaring the demonstration was successful.)
In-tank Precipitation	After successful completion of the demonstration, the wastes in AN-102 and AN-107 will be transferred to AP-102 in four batches to precipitate Sr and TRU as outlined below. The pretreated supernate will be delivered to WTP as Envelope A feed. The Sr/TRU precipitate will be blended with other tank solids and delivered to WTP as HLW Envelope D feed. **For pretreatment of the AN-107 waste:** • Add 372 Kgal of waste from AN-107 to AP-102, mixing with the waste from the demonstration, and adding enough water to dilute the Na concentration to 5.5 M. • Add the necessary reagents (in the same ratio as used in the demonstration) and simulate the Sr/TRU precipitation by applying the reactions and removal factors. • Simulate the reaction time and solids settling time by waiting 30 days. • Decant the pretreated supernate to another DST for sampling before delivery to the WTP. • Add 422 Kgal of waste from AN-107 to AP-102, mixing with the 10-inch liquid heel. • Add about 100 Kgal of flush water to tank AN-107 to dilute remaining supernate heel and transfer to AP-102 for treatment

Table C-1. Assumptions Matrix. (21 Sheets)

	with the second AN-107 Batch, adding enough water to dilute the Na concentration to 5.5 M. (Note that none of the solids in AN-107 are removed by the flush water.) • Add the necessary reagents (in the same ratio as used in the demonstration) and simulate the Sr/TRU precipitation by applying the reactions and removal factors. • Simulate the reaction time and solids settling time by waiting 30 days. • Decant the pretreated supernate to another DST for sampling before delivery to the WTP. **For pretreatment of the AN-102 waste:** • Add 456 Kgal of waste from AN-102 to AP-102, mixing with the 10-inch liquid heel, and adding enough water to dilute the Na concentration to 5.5 M. • Add the necessary reagents (in the same ratio as used in the demonstration) and simulate the Sr/TRU precipitation by applying the reactions and removal factors. • Simulate the reaction time and solids settling time by waiting 30 days. • Decant the pretreated supernate to another DST for sampling before delivery to the WTP. • Add 482 Kgal of waste from AN-102 to AP-102, mixing with the 10-inch liquid heel. • Add about 100 Kgal of flush water to tank AN-102 to dilute remaining supernate heel and transfer to AP-102 for treatment with the second AN-102 Batch, adding enough water to dilute the Na concentration to 5.5 M. (Note that none of the solids in AN-102 are removed by the flush water.) • Add the necessary reagents (in the same ratio as used in the demonstration) and simulate the Sr/TRU precipitation by applying the reactions and removal factors. • Simulate the reaction time and solids settling time by waiting 30 days. • Decant the pretreated supernate to another DST for sampling before delivery to the WTP, or deliver from AP-102 (by decanting the supernate) depending on the availability of DST space.
A2.4. Waste Disposal Sites	
ILAW Facility Need Dates (Integrated Disposal Facility; IDF)	The IDF will be operational at the beginning of FY 2011 (10/1/2010). The ILAW produced by the Supplemental Treatment demonstration can be safely stored until the IDF is available.
IHLW Facility Need Dates (Project W-464)	The need date for IHLW interim storage facility (the Canister Storage Building) will be the date on which the first IHLW is produced (estimated to be 9/1/2015). The demand for interim storage space will be established assuming that 22 canisters of WTP-provided IHLW is used. The shipping date of IHLW to Yucca will be the date on which the Canister Storage Building is full (880 canisters + 22 canisters in WTP-provided lag storage), but no earlier than 10/3/2017. Canisters will be shipped to Yucca at a rate of 2 canisters per day, first priority given to shipping the newly created IHLW from the WTP – any excess shipping capacity will be used to empty the IHLW stored in the CSB.

Table C-1. Assumptions Matrix. (21 Sheets)

A2.5. Cesium and Strontium Capsule Processing	
Cesium and Strontium Capsules	Cesium and strontium capsules are disposed separately by RL and not incorporated into HLW glass in the WTP.
A3.0. Retrieval and Closure	
A3.1. SST Interim Stabilization	
Saltwell liquid pumping	None; saltwell pumping was completed in March 2004.
A3.3. SST Retrieval Progress	
SST retrieval history and status	Retrieval actions have been completed or are in progress (IP) for the following tanks: Tank / Start Date / End Date/Status C-103 / 11/06/2005 / IP C-106 / 11/18/1998 / 12/31/2003 C-201 / 10/25/2005 / IP C-202 / 6/30/2005 / 8/11/2005 C-203 / 6/30/2004 / 3/24/2005 S-102 / 12/16/2004 / IP S-112 / 9/28/2003 / IP
A3.4 SST Retrieval Sequencing	
Near-term retrieval sequence (into FY 2016)	Retrieve SST wastes from the C-Farm, S-102, S-105, S-109, and S-112 tanks as scheduled below and as the available DST space and model logic allows: Source Tank / Receiver Tank / Time Frame C-200 SSTs / / FY 2006 C-103 / / FY 2006 S-112 / / FY 2006 C-108 / AN-106 / 4/17/2007 C-109 / AN-106 / 2/15/2008 S-102 / / 10/1/2008 S-109 (partial) / SY-101 / FYs 2009 -2010 S-109 (partial) / DBVS / FYs 2010 -2012 C-101 / AN-101 / 10/4/2010 C-102 / AZ-101 / 1/10/2012 C-104 / AN-101 / 11/26/2012 C-105 / AN-101 / 9/3/2013 S-109 (partial) / BVS / FYs 2013 -2015 S-105 (partial) / BVS / FYs 2015 -2017 S-105 (partial) / SY-102 / FYs 2015 -2017 S-105 (heel) / SY-102 / FY 2018 C-110 / AN-106 / 3/10/2014 C-112 / AY-101 / 10/10/2014 C-107 / AY-101 / 3/27/2015 C-111 / AY-101 / 12/22/2015
Long-term retrieval sequence (FY 2016 and beyond)	• Continue by retrieving wastes from B-104, BX-107, and BY-101, and blending them with the HLW solids in tanks AN-106, AY-101, and AN-101, respectively, pairing each SST with a DST. • Continue by retrieving waste from the remaining SSTs, prioritizing the sequence based on considerations of retrieval logistics and tank space to provide feed to the various processes, and using targeted blends to reduce HLW glass quantities.
A3.7. Waste Retrieval Facilities	
Waste Retrieval Facility (WRF) Availability Dates	B-Complex WRF: 6/21/2018 T-Complex WRF: 6/21/2019

Table C-1. Assumptions Matrix. (21 Sheets)

	Wastes retrieved from tanks in the B or T complexes before the WRFs are available will be at lower insoluble solids loadings. Compliant transfer lines will be constructed to support retrievals from B and T complex before the WRFs are made available; one line for each complex.
A3.8. SST Farm Upgrades	
Availability Dates for Tank Farms Upgrades	Any SST farm upgrades needed to support the retrieval of SST waste will be completed and operational before the retrieval dates projected by the HTWOS model.
A3.9. Constraints on Simultaneous Retrievals	

Simultaneous retrieval	The most limiting condition(s) resulting from application of the following constraints:
	• Retrieval and transfer systems in the NE and NW quadrants can support a maximum of 6 simultaneous retrievals in each tank farm and a total of six simultaneous retrievals in each quadrant (after the WRFs are constructed).
	• Retrieval and transfer systems in the SE and SW quadrants can support a maximum of 2 simultaneous retrievals in each tank farm and a total of two simultaneous retrievals in that quadrant.
	  o SE - A, AX, and C farms
	  o NE - B, BX, and BY farms
	  o SW - S, SX, and U farms
	  o NW - T, TX, and TY farms
	• A maximum of 7 total simultaneous retrievals can be performed at one time. (This assumes that labor resources are available.)
	• The waste from up to two SSTs may be retrieved to one DST at one time.
	• The waste from one only SST may be retrieved into one WRF tank at a time.
	• These constraints also apply to retrievals going directly from SSTs to supplemental treatment processes.

A3.10. Retrieval Rates	
SST Waste Retrieval Rates	Minimum retrieval durations are given in Table C-2.
A3.11. Retrieved Waste Volume & Composition	
Retrieval Solution Requirements	• The amount of retrieval solution needed to retrieve the waste from the committed tanks will be determined as the amount need to achieve the total retrieved volume given in Table 3-1 after the application of water wash factors. • The amount of retrieval solution needed to retrieve wastes from the S, SX, and U farm SSTs, except for tanks S-102, S-105, S-109, and S-112, will be determined as the amount needed to result in a Na concentration ≤ 5 M and an insoluble solids concentration ≤ 5 wt% (3.5 volume %) after the application of wash factors. • The amount of retrieval solution needed to retrieve wastes from SSTs in the B or T farm complex before the WRFs are available will be determined as the amount needed to result in a Na concentration ≤ 5 M and an insoluble solids concentration ≤ 5 wt% after the application of wash factors. • The amount of retrieval solution needed to retrieve wastes from SSTs in the B or T farm complex after the WRFs are available will be determined as the amount needed to result in a Na

Table C-1. Assumptions Matrix. (21 Sheets)

	concentration ≤ 5 M and an insoluble solids concentration ≤ 10 wt% after the application of wash factors. • The amount of retrieval solution needed to retrieve wastes from all other SSTs will be determined as the amount needed to result in a Na concentration ≤ 5 M and an insoluble solids concentration ≤ 10 wt% after the application of wash factors.
A3.12. Retrieval Systems	
Retrieval System Availability	• A sufficient number of retrieval systems are available. • Retrieval systems will be reused when cost effective.
A3.13. Single Shell Tank Waste Residuals	
SST Waste Residuals	• 200 Series SSTs: Best Basis Inventory (BBI) data for tanks where retrieval actions have been completed, when available, or 30 ft^3 of "selected phase" as defined in DOE/ORP-2003-02, Inventory and Source Term Data Package - Environmental Impact Statement for Retrieval, Treatment and Disposal of Tank Waste, and Closure of Single-Shell Tank Waste at the Hanford Site Richland WA, Rev. 0; calculated for the BBI used as model input. Table C-3 provides the residual waste fraction values used in the HTWOS Model run. • 100 Series SSTs: BBI data for tanks where retrieval actions have been completed, when available, or 360 ft^3 of 35 wt% water-washed solids with liquids at ½ the concentration of bulk as-retrieved supernate. Detemination of the as-retrieved supernate composition is described in Assumption A3.11.
A3.15. SST Waste Leaks	
SST Waste Leaks During Retrieval	No waste is assumed to leak from the SSTs during retrieval.
A4.0. Waste Feed Operations	
A4.1. Initial Waste Inventory	
Date that BBI quarterly update was issued	Starting tank inventories represents the contents of the tanks as of April 1, 2005 (documented in RPP-27459). This is identified as the "FY 2005a" inventory and is based on BBI data downloaded from TWINS on 8/10/2005 and 8/29/2005. Adjustments were made in the HTWOS model for historical transfers through 6/30/2005.
IMUST waste total volume (retrieved in FYs 2020-2030)	500 Kgal total
A4.2. DST Operations	
A4.2.1. Sodium Hydroxide Additions	
Caustic addition for SST Retrievals	Liquids associated with sludge retrievals need to have at least 0.05 M free OH.
A4.2.2. Flush Volumes	
	Table C-4 provides the flush volumes used in the HTWOS model.

Table C-1. Assumptions Matrix. (21 Sheets)

A4.2.3. Minimum DST Level	
	• Liquids or slurries can be removed down to within 12 inches above the bottom of a DST. • Wastes can be removed down to the bottom of a DST during final cleanout. • Supernatants can be pumped down to within 10 inches of a settled solids layer. • SY-101 can only be pumped down to 100 inches (275 Kgal) between now and 1/29/2012. After that date, the transfer pump will be replaced and the waste can be pumped down to 12 inches. • SY-102 can only be pumped down to 200 inches (550 Kgal) until the solids are transferred across the site to AN-104. After the solids are transferred, the waste can be pumped down to within 12 inches. • The AZ/AY farm tanks can be pumped down below 64 inches if the annulus ventilation is shut down. The annulus ventilation will be shut down when necessary to deliver feed to the WTP allowing the waste to be pumped down within 12 inches of the bottom.
A4.2.4. Maximum DST Level	
Maximum DST Levels	The approval to raise the maximum fill levels in AP farm DSTs was obtained on 10/31/2005.
A4.2.5. Tank Solids Level	
Solids Settling Endpoint	• Insoluble solids retrieved from C-Farm SSTs can be settled to a solids loading comparable to that in the source SSTs within 2 days of transferring to a DST. This is accomplished in the model by settling to the same bulk solids volume observed in the SSTs or to an adjusted bulk volume based on mass dissolved during retrieval. • Insoluble solids retrieved from other SSTs and currently in the DST system can be settled to 40 wt% solids within 30 days.
Solids Management Strategy	• DSTs supporting C-Farm retrieval will be operated with a minimal supernate layer so that they do not become Group A tanks even though they will be filled with significant quantities of solids. • DSTs not supporting C-Farm retrieval are assumed to hold up to 10 wt% bulk solids based on the maximum operating level of each DST.

Table C-1. Assumptions Matrix. (21 Sheets)

A4.2.6. Tank Space Allocation	
DST Usage	**WTP Feed Staging tanks:** AN-101, AN-102, AN-103, AN-104, AN-105, AN-107, AP-101, AP-102, AP-103, AP-104, AP-105, AP-106, AP-107, AP-108, AW-101, AY-101, AY-102, AZ-101, and AZ-102 **WTP Alternative (Back-up) HLW Feed Staging tanks:** AN-103, AN-104 (cross-site receiver), and AN-105. At the modelers' discretion, other DSTs equipped with dual mixer pumps can be used to store and stage HLW feed. **Slurry Transfer Limitations:** Use AZ, AY, and AN farms, primarily for staging HLW solids. Try to avoid staging solids through AP or AW farms after retrieving the solids currently in those farms. **Supplemental Sludge Treatment Process Feed Staging Tanks:** AW-103, AW-105, and SY-102 **Supplemental LAW Treatment DST Usage:** **Provide feed directly from S-105 and S-109 to the DBVS and BVS operations.** Provide feed from SY-101 and SY-103 for the West Area Supplement Pretreatment and Supplemental Pretreatment. Then use SY-101 and SY-103 to stage feed to those systems. **Sludge Transfer for Waste Feed Staging:** C Farm solids will be retrieved to tanks AN-101, AN-106, AY-101, and AZ-101. Some of these tanks may require additional equipment for mobilizing and transferring HLW solids into other DSTs for staging to the WTP. **In-tank Sr/TRU precipitation** Tank AP-102 will be used to perform in-tank precipitation of Sr and TRU from wastes in tanks An-102 and AN-107.
Emergency Space and LAW or HLW Waste Return Space • TFC Emergency Space and Emergency Returns from WTP • LAW or HLW Non-Emergency Process Returns from WTP • Contingency space	Emergency Space and Emergency Returns was raised from 1.14 Mgal to 1.235 Mgal on 10/31/2005, and will be allocated as shown below: • 1.235 Mgal total • None • None
WTP Returns (to the DST system)	No waste streams or wastewaters are returned to DST system from the WTP.
DST Space Allocation Categories • Evaporator Operational Space • Restricted TRU Headspace • Restricted WTP Feed Tank Space • Safety Basis Headspace	• Supports 242-A operation (AW-102, bottoms receiver, and dilute waste receivers, when used) • TRU solids (AW-103 and AW-105) • Early WTP feed sources or DSTs used to stage WTP feed • Waste has an associated safety issue

Table C-1. Assumptions Matrix. (21 Sheets)

A4.2.7. Feed Segregation and Blending	
Feed Control List	Blend or segregate wastes in specific tanks as summarized below:
• Blend off high-sulfate supernate (FCL Issue # 1, HNF-SD-WM-OCD-015, Rev. 16-D, Table A-1)	• Decant and blend the AZ-102 supernate with supernates containing lower sulfate (SO_4) concentrations so that the final [SO_4]:[Na] ratio in AZ-102 and in any other tank receiving significant quantities of the high [SO_4] supernate will be less than a target level of 0.048 mole SO_4/mole Na after blending and any evaporator campaigns are completed. Constrain the blending of AZ-102 supernate to start after 9/30/2012.
• Blend off high ^{233U} solids (Revised from FCL Issue # 2, HNF-SD-WM-OCD-015, Rev. 16-D, Table A-1)	• Blend the solids from C-104 with the solids from C-101 and C-105 in AN-101 so that the resulting ($[U_{fissile}]/[U_{total}]$) ratio is less than a target level of 9.4. Segregate the two source tanks and the resulting blend from other sources of solids.
• Prepare and protect hot commissioning feed (FCL Issue # 3, HNF-SD-WM-OCD-015, Rev. 16-D, Table A-1)	• Transfer the existing dilute supernate from AY-102 leaving behind about 18 inches of heel. Transfer about 770 Kgal of AP-101 supernate into AY-102, without concentrating the AP-101 supernate in the 242-A Evaporator and being careful to remain within the maximum level of AY-102. Do not add any other waste to or remove any other waste from AY-102 prior to waste feed delivery to the WTP.
• Segregate Envelope C (Revised from FCL Issue # 4, HNF-SD-WM-OCD-015, Rev. 16-D, Table A-1)	• Segregate the waste in AN-102 and AN-107 from all other wastes until it has been pretreated in DSTs.
• Segregate TRU sludge from complexed waste (FCL Issue # 5, HNF-SD-WM-OCD-015, Rev. 16-D, Table A-1)	• Do not store Envelope C waste or other waste capable of complexing TRU with the insoluble solids currently in AW-103, AW-105, or SY-102. Waste will be considered to be Envelope C for this purpose if the [TRU]:[Na] ratio exceeds 13 μCi/mole or the [^{90}Sr]:[Na] ratio exceeds 1.19E+03 μCi/mole in the liquid phase.
• Reduce WTP hydrogen generation rate by blending (FCL Issue #6, HNF-SD-WM-OCD-015, Rev. 16-D, Table A-1)	• Blend the HLW solids in C-102 with the solids in AZ-101 to reduce the H_2 generation rate.
• Segregate waste destined for TRU or LLW packaging (FCL Issue # 7, HNF-SD-WM-OCD-015, Rev. 16-D, Table A-1)	• Do not add to or store additional waste with the insoluble solids currently in AW-103 and AW-105, with the exception that the addition of remote-handled TRU from SY-102 to either tank is permitted. Control the addition of wastes to SY-102 to avoid mixing the TRU solids in SY-102 with additional solids. Additional solids may be settled on top of the TRU solids in SY-102 as long as they are not mixed with the SY-102 solids and the transfer of wastes through SY-102 is controlled to avoid disturbing the TRU sludge layer. Do not transfer contact-handled TRU waste into the DST system. Segregate the remote-handled TRU waste from insoluble non-TRU solids.

Table C-1. Assumptions Matrix. (21 Sheets)

• Segregate low-cesium SST waste for supplemental treatment (Revised from FCL Issue # 8, HNF-SD-WM-OCD-015, Rev. 16-D, Table A-1)	• Manage the low-curie waste (less than 0.05 Ci/liter ^{137}Cs when normalized to 7 M Na) retrieved from tanks S-109 and S-105 to maximize the amount of low-cesium feed that can be made available to non-WTP supplemental treatment. Keep the low-cesium fraction designated for feed separate from any high-cesium waste.
Waste Blending	• There is no deliberate blending of waste to optimize WTP feeds other than the specific blending described in the feed controls, or identified immediately below. • Blend wastes from tanks B-104, BX-107, and BY-101 with the HLW solids in tanks AN-106, AY-101, and AN-101 respectively, pairing each SST with a DST. • Blend the HLW solid heels from various wastes as they are moved into and through the WRFs and the DST system. (Note: Incidental blending that occurs as waste is moved through the system is relied on to provide benefits such as a significant reduction in HLW glass quantities).
A4.2.8. Availability of DST Space	
DST Integrity	No DST failures or replacements are assumed.
A4.2.9. Aging Waste Farm Condensates	
	About 96 Kgal of waste is added to tank AY-101 to account for the DST space needed to receive ventilation system condensates collected in vessel AZ-301.
A4.2.10. Common Use of Transfer Lines	
	There are no restrictions on the subsequent use of transfer lines based on waste types (HLW, LAW, TRU, and LLW) and chemistries.
A4.2.11. Waste Transfer Routes	
Essential Drawings for DST Waste Transfer System	Transfer system constraints are imposed through the near-term SST retrieval plans.
A4.2.12. Waste Transfer Rates and Timing	
Cross-site Transfer Rate	• Wastes transferred cross-site through the supernatant line can be transferred at rates between 50 and 60 gallons per minute. • Wastes transferred cross-site through the slurry line can be transferred at rates between 100 and 120 gallons per minute.
SST Retrievals	Wastes retrieved from the SSTs will be retrieved at the capacity of the retrieval system as defined by the minimum durations when DST space is available.
DST Transfer Rate	Wastes can be transferred between DSTs or to the WTP at a rate of 140 gallons per minute (excluding cross-site transfers).
Transfer Durations	Waste transfer durations will be calculated by dividing the total volume being transferred by the transfer rate.
Transfer System Set-up Time	There is a 5-day delay between subsequent uses of transfer routes having common components starting after C-Farm retrievals are complete to account for the closeout of one transfer route and the establishment of another route.
DST Waste Residuals	100 gallons having the composition of the last waste contained in the tank.

Table C-1. Assumptions Matrix. (21 Sheets)

A4.3. 242-A Evaporator	
A4.3.1. Evaporator Availability	
242-A Evaporator Shutdown & New Evaporator Availability	242-A Evaporator is available through the end of SST retrieval. The Evaporator is not available for operation during outages for the upgrades listed below: 3/5/2008 – 10/27/2008 MCS Upgrades 3/31/2008 – 11/20/2008 HVAC Supply 1/23/2009 – 12/18/2009 HVAC Exhaust 5/19/2010 – 11/5/2010 Leak Detection (Trace Tek) 2/4/2011 – 2/2/2012 Repair Sanitary Drain, Replace EC-1 Condensor, Install Reboiler-Condensate System, Install Manual Flush Valves-Dip Tubes, Upgrade PB-2 Relief Valves, Replace-Upgrade Flow Indicators, Install Process Concensate Sampling Station and Install Control Valves.
A4.3.2. Evaporator Operation	
• Training Volume	• 82 Kgal of water is evaporated to train personnel if the evaporator has not been operated for 11 months. Each training run adds 50 Kgal of water to AW-102.
• Average Evaporation Rate	• 500 Kgal/month
• Maximum Evaporation Rate	• The lesser of 50 gpm boil-off or 140 gpm feed
• Bottoms Set Point (g/mL)	• 1.43
• Feed Staging Duration	• 3 months minimum
• Yearly Evaporation of Waste	• Yes
• SST wastes evaporated	• Evaporate retrieved waste as needed to manage DST space until the WTP starts. • Evaporate retrieved waste as needed to concentrate dilute waste to meet the WTP LAW feed specification after the WTP starts.
A4.3.3. Evaporator Process Chemistry	
Waste Volume Reduction	• Water is removed until the specific gravity set point is reached (as calculated by algorithms within the model). Recent issues with solids formation in the evaporator are handled as part of the historical transfer data. • The waste volume reduction factor can be calculated using the following equation: $WVR = \frac{(\rho_B - \rho_F)}{(\rho_B - 1)}$ Where: ρ_B = Evaporator set point (bottoms SpG) ρ_F = Specific gravity of evaporator feed
Process Condensate Composition	• The volume of process condensate will be 1.15 times the waste volume boiled off the feed to account for seal water and the vacuum system steam jets. • The composition of process condensate from the 242-A Evaporator will be estimated using the split factors calculated using the following equation: $SF_i = \frac{1}{\left[1 + \frac{Kp_i}{21{,}579}\left(\frac{(1 - WVR)}{WVR}\right)\right]}$

Table C-1. Assumptions Matrix. (21 Sheets)

	Where: SF_i = split factor for component i; the split factor is the mass or activity of component i in the process condensate to the mass or activity of i in the feed WVR = waste volume reduction factor Kp_i = 242-A evaporator partition coefficients from HNF-14755 and RPP-17239; in the case of tritium and water the Kp_i values are equal to the WVR because they partition equally with water. 21,579 = a numerical factor accounting for the 15% volume increase and for the ratio of the volume of condensate as a vapor to the volume of condensate as a liquid, at the operating conditions in the evaporator.
Gaseous Effluent	The contributions of the waste to the gaseous effluent stream will be estimated by applying split factors (the reciprocal of decontamination factors) to the process condensate stream. The split factors are derived from decontamination factors that come from a condenser in the WTP evaporator model, which is based on the 242-A Evaporator.
A4.3.4. ETF and LERF	
Effluent Treatment Facility	ETF (nor the downstream facilities TEDF/SALDS) capacity does not constrain Tank Farm, supplemental treatment, or WTP operations. The processing rate may be varied at the discretion of the modeler.
LERF Capacity	• The ETF will be modeled as a black box. Overall partitioning of feed into solid waste and treated effluent will be approximated using overall removal efficiencies for the reverse osmosis and ion exchange units (the polisher outlet). • The LERF will be modeled as two basins, each with a 7.8 Mgal volume, used to provide lag storage of liquid effluents from the 242-A Evaporator and the various treatment processes. One will be used to accumulate effluent while the other is used to feed ETF.
A4.4. Waste Feed Delivery	
A4.4.1 Hot Commissioning Feed Delivery Plan	
LAW Feed Delivery	Deliver the supernate in tank AY-102 as the first LAW batch for hot commissioning of the WTP.
HLW Feed Delivery	Deliver 90% of the insoluble solids in AY-102 as HLW feed for hot commissioning of the WTP, adding water as needed to mobilize the solids and dilute the feed to meet WTP contract feed specifications.
A4.4.2. Feed Delivery Plans	
LAW Feed Delivery Sequence	Provide available feed from the DST system as needed to keep the LAW processes in the WTP operating. Try to deliver the waste in tank AN-104 early in the sequence to free up AN-104 for use as the cross-site slurry receiver.
HLW Feed Delivery	Provide available feed from the DST system as needed to keep the HLW processes in the WTP operating.
A4.4.3. LAW Feed Specifications	
	BNI contract Specification 7 will be used to assess envelope compliance.
A4.4.4. LAW Entrained Solids	
Entrained Solids Quantity	• 0.5 wt% solids are entrained in decanted supernatants. • Supernatant liquids from dissolving salts will entrain the same solids concentration as exists in the tank after dissolution up to a maximum of 2 wt%.
Entrained Solids Composition	Entrained solids have the same composition as the average composition of solids in the tank.

Table C-1. Assumptions Matrix. (21 Sheets)

A4.4.5. HLW Feed Specifications	
	BNI contract Specification 8 will be used to assess envelope compliance.
A4.4.6. Feed Compliance Verification	
Compliance Verification Sampling	Staged feed must remain in a DST for 210 days after filling the tank before delivering to the WTP to provide time to complete feed specification compliance sampling and analysis.
A5.0. Project Delivery	
A5.1. Project Impacts on DST System Availability	
N/A	N/A
A5.2. Feed Staging Tank Upgrades	
	• The necessary equipment will be available in time to support all planned waste transfers. • The DSTs will need a mixer pump, and, a decant/transfer pump (if solids entrainment is a concern) or a fixed intake transfer pump (if solids entrainment is not a problem). Solids retrieval equipment will be installed in AN-101 and AN-106 to move C-Farm solids into WTP waste feed staging tanks. • The following DSTs have been identified as requiring project work before use as feed staging tanks; AN-101, AN-102, AN-103, AN-104, AN-105, AN-107, AP-101, AP-102, AP-104, AW-101, AY-101, AY-102, AZ-101, and AZ-102
A6.0. HTWOS Model or Data Analysis Assumptions	
A6.1. Estimating Waste Compositions	
	Wastes are homogenized when mixed.
A6.2. Water Content of Initial Inventory	
	The water content of initial inventory is determined by calculating a stream density and total stream mass (including water), the total stream mass excluding water, and then obtaining water content by difference.
A6.3. Volume of In-Process Streams	
	Volumes of waste streams are calculated from mass using density correlations for liquids and a solid density of 3 g/mL.
A6.4. Transuranic Content Accounting	
	TRU quantities for LAW and ILAW are based on Specification 2 and 7 definitions.
A6.5. Radionuclide Decay	
	• The BBI reference decay date of 1/1/2004 is used as the reference decay date in the model. • Radionuclides are decayed to January 1 of the year of delivery for feed specification compliance assessment. • Half-life values for decay calculations are taken from the Chart of Nuclides, 15th Edition.
A6.6. Waste Chemistry and Mass Balances	
	• Dissolution of solids is predicted by the application of water-wash factors downloaded from the from TWINS on 12/19/2005 and by use of the Sr solubility model documented in RPP-21807. • Chemical charges are balanced when washing solids by the adjustment of bound OH- and then by adjustment of CO32-. • TOC (less oxalate) shall be treated as C. • HTWOS does not account for solids formation.

Table C-1. Assumptions Matrix. (21 Sheets)

A6.7. ILAW Package Production		
	ILAW package production rates are based on the glass production rates, glass density, and package fill assumptions.	
A6.8. IHLW Canister Production		
	IHLW canister production rates are based on the glass production rates, glass density, and canister fill assumptions.	

Terms:

BBI = Best Basis Inventory
BNI = Bechtel National, Inc.
CERCLA = Comprehensive Environmental Response, Compensation and Liability Act of 1980
CH-TRU = Contact-handled TRU
DST = Double-Shell Tank
ETF = Effluent Treatment Facility
FCL = Feed Control Limit
FY = fiscal year
HEPA = high-efficiency particulate air
HLW = high-level waste
IDF = Integrated Disposal Facility
IHLW = immobilized high-level waste
ILAW = immobilized low-activity waste
IMUST = inactive miscellaneous underground storage tanks
LAW = low-activity waste
LERF = Liquid Effluent Retention Facility
LLW = low-level waste
ORP = U.S. Department of Energy, Office of River Protection
PFP = Plutonium Finishing Plant
PT = Pretreated
PUREX = Plutonium-Uranium Extraction Plant
RCRA = Resource Conservation and Recovery Act of 1976
RH-TRU = remote-handled TRU
RL = U.S. Department of Energy, Richland Operations Office
SALDS = State-Approved Land Disposal Site
SBS = Submerged Bed Scrubber
SST = Single-Shell Tank
STP = Supplemental Treatment Plant
SWB = Standard Waste Box
TEDF = Treated Effluent Disposal Facility
TFC = Tank Farm Contractor
TOC = total organic carbon
TOE = total operating efficiency
TPA = Tri-Party Agreement (Hanford Federal Facility Agreement and Consent Order) (Ecology et al. 1996)
TRU = transuranic
TWINS = Tank Waste Information Network System
WSCF = Waste Sampling and Characterization Facility
WESF = Waste Encapsulation and Storage Facility
WESP = wet electrostatic precipitator
WIPP = Waste Isolation Pilot Plant (Carlsbad, New Mexico)
WRF = Waste Retrieval Facility
WTP = Waste Treatment and Immobilization Plant
WVRF = waste volume reduction factor

Table C-2. Estimated Minimum SST Retrieval Durations Based on Proposed Technologies. (2 Sheets)

Tank	Retrieval Technology	Minimum Duration, Days	Tank	Retrieval Technology	Minimum Duration, Days	Tank	Retrieval Technology	Minimum Duration, Days	Tank	Retrieval Technology	Minimum Duration, Days
A-101	MS	454	BY-101	MS	368	S-111	MS	388	TX-106	MS	358
A-102	MS	162	BY-102	MS	203	S-112	RWL	263	TX-107	MRS	79
A-103	MRS	502	BY-103	MRS	276	SX-101	MS	532	TX-108	MS	244
A-104	MRS	154	BY-104	MS	363	SX-102	MS	471	TX-109	MS	365
A-105	MRS	156	BY-105	MRS	313	SX-103	MS	605	TX-110	MRS	303
A-106	MS	348	BY-106	MRS	300	SX-104	MRS	440	TX-111	MS	365
AX-101	MS	643	BY-107	MRS	200	SX-105	MS	501	TX-112	MS	391
AX-102	MRS	151	BY-108	MRS	174	SX-106	MS	399	TX-113	MRS	392
AX-103	MS	378	BY-109	MS	328	SX-107	MRS	161	TX-114	MRS	338
AX-104	MRS	64	BY-110	MS	356	SX-108	MRS	146	TX-115	MRS	349
B-101	MRS	116	BY-111	MS	218	SX-109	MRS	280	TX-116	MRS	374
B-102	MS	74	BY-112	MS	205	SX-110	MRS	133	TX-117	MRS	313
B-103	MRS	87	C-101	MRS	462	SX-111	MRS	185	TX-118	MS	303
B-104	MS	371	C-102	MSwR	428	SX-112	MRS	147	TY-101	MRS	145
B-105	MRS	209	C-103	MSwR	211	SX-113	MRS	105	TY-102	MS	118
B-106	MS	237	C-104	MSwR	333	SX-114	MRS	215	TY-103	MRS	170
B-107	MRS	ST-FR	C-105	MRS	185	SX-115	MRS	44	TY-104	MRS	98
B-108	MS	224	C-106	RC	N/A	T-101	MRS	111	TY-105	MRS	218
B-109	MS	243	C-107	MSwR	325	T-102	MS	187	TY-106	MRS	53
B-110	MRS	ST-FR	C-108	MSwR	202	T-103	MRS	78	U-101	MRS	111
B-111	MRS	ST-FR	C-109	MSwR	312	T-104	MS	ST-FR	U-102	MS	461
B-112	MRS	80	C-110	MRS	213	T-105	MS	ST-FR	U-103	MS	534
B-201	VRS	ST-FR	C-111	MRS	129	T-106	MRS	73	U-104	MRS	186
B-202	VRS	ST-FR	C-112	MSwR	233	T-107	MRS	ST-FR	U-105	MS	335
B-203	VRS	ST-FR	C-201	VRS	145	T-108	MRS	47	U-106	MS	224
B-204	VRS	ST-FR	C-202	VRS	42	T-109	MRS	92	U-107	MS	434
BX-101	MRS	102	C-203	VRS	N/A	T-110	MRS	ST-FR	U-108	MS	543

Table C-2. Estimated Minimum SST Retrieval Durations Based on Proposed Technologies. (2 Sheets)

Tank	Retrieval Technology	Minimum Duration, Days	Tank	Retrieval Technology	Minimum Duration, Days	Tank	Retrieval Technology	Minimum Duration, Days	Tank	Retrieval Technology	Minimum Duration, Days
BX-102	MRS	125	C-204	VRS	87	T-111	MRS	ST-FR	U-109	MS	521
BX-103	MS	225	S-101	MS	359	T-112	MS	ST-FR	U-110	MRS	229
BX-104	MS	250	S-102	MS	638	T-201	VRS	ST-FR	U-111	MS	379
BX-105	MS	231	S-103	MS	301	T-202	VRS	ST-FR	U-112	MRS	125
BX-106	MS	211	S-104	MRS	213	T-203	VRS	ST-FR	U-201	VRS	84
BX-107	MS	406	S-105	SD/MS	ST-FR	T-204	VRS	ST-FR	U-202	VRS	88
BX-108	MRS	90	S-106	MS	412	TX-101	MS	221	U-203	VRS	85
BX-109	MS	309	S-107	MS	359	TX-102	MS	174	U-204	VRS	91
BX-110	MRS	197	S-108	MS	462	TX-103	MS	135	-	-	-
BX-111	MRS	188	S-109	SD/MS	ST-FR	TX-104	MS	218	-	-	-
BX-112	MS	290	S-110	MS	378	TX-105	MRS	362	-	-	-

Key

MS	Modified Sluicing
MSwR	Modified Sluicing with Recycle
MRS	Mobile Retrieval System
RC	Retrieval Complete
RWL	Remote Water Lance
SD	Selective Dissolution
ST-FR	Supplemental Treatment Feed Rate
VRS	Vacuum Retrieval System

	Tanks designated for Supplemental TRU Treatment
	Additional efforts are anticipated to be needed to remove a hard heel from the tank
	Waste retrieval operations are complete

Table C-3. Residual Waste Fractions for the 200-Series Single-Shell Tanks.

Tank	Residual Waste Fraction
241-B-201	0.00765320
241-B-202	0.00786579
241-B-203	0.00451865
241-B-204	0.00461688
241-C-201	0.38613886
241-C-202	0.16888777
241-C-203	1.00000000
241-C-204	0.13273523
241-T-201	0.00793930
241-T-202	0.01103254
241-T-203	0.00624636
241-T-204	0.00624636
241-U-201	0.07722777
241-U-202	0.08495055
241-U-203	0.09438950
241-U-204	0.12135793

Table C-4. Waste Transfer Flush Volumes.

Transfer Type	**Flush Volume per Transfer (gallons)**
Cross-site	24,000
Northwest quadrant WRF to West Area cross-site transfer tank	6,000
Northeast quadrant WRF to receiving tank	7,500
East Area DST to DST or DST to LAW feed staging tank transfer	500
Feed Staging Tanks to WTP Feed Receipt Tanks	0[1]
Flush Volume from Miscellaneous Tank Farm Operations	120 Kgal/year[2]

Note:

1. No flush volumes are modeled for the feed delivery transfers.
2. Value based on estimated maximum limit set by RPP-8554 Rev. 2.

DST double-shell tank
LAW low-activity waste
SST single-shell tank
WRF Waste Retrieval Facility
WTP Waste Treatment Plant

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