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		Design Agent				1	1	R. R. Thompson	R R Thompson	4/11/01	T4-58
1	1	Cog. Eng. V. C. Boyles	V C Boyles	4/11/01							
1	1	Cog. Mgr. N. W. Kirch	N W Kirch	4-11-01	R3-73						
1	1	QA J. F. Bores	J F Bores	4/12/01	R2-87						
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Tank Space Options Report

V. C. Boyles et al
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V. C. Boyles
C. B. Bryan
J. M. Conner
T. W. Crawford
C. DeFigh-Price
N. W. Kirch
M. A. Knight
T. H. May
D. A. Reynolds
J. N. Strode
R. R. Thompson
CH2M HILL Hanford Group, Inc.

P. A. Meyer
Pacific Northwest National Laboratory

Date Published
April 2001

CH2MHILL
Hanford Group, Inc.

Prepared for the U.S. Department of Energy
Office of River Protection

EXECUTIVE SUMMARY

A risk-based priority for the retrieval of Hanford Site waste from the 149 single-shell tanks (SSTs) has been adopted as a result of changes to the *Hanford Federal Facility Agreement and Consent Order* (HFFACO) (Ecology et al. 1997) negotiated in 2000. Retrieval of the first three tanks in the retrieval sequence fills available capacity in the double-shell tanks (DSTs) by 2007. As a result, the HFFACO change established a milestone (M-45-12-T01) requiring the determination of options that could increase waste storage capacity for single-shell tank waste retrieval. The information will be considered in future negotiations. This document fulfills the milestone requirement.

This study presents options that were reviewed for the purpose of increasing waste storage capacity. Eight options are identified that have the potential for increasing capacity from 5 to 10 million gallons, thus allowing uninterrupted single-shell tank retrieval until the planned Waste Treatment Plant begins processing substantial volumes of waste from the double-shell tanks in 2009. The cost of implementing these options is estimated to range from less than $1 per gallon to more than $14 per gallon. Construction of new double-shell tanks is estimated to cost about $63 per gallon.

Providing 5 to 10 million gallons of available double-shell tank space could enable early retrieval of 5 to 9 high-risk single-shell tanks beyond those identified for retrieval by 2007. These tanks are A-101, AX-101, AX-103, BY-102, C-107, S-105, S-106, S-108, and S-109 (Garfield et al. 2000). This represents a potential to retrieve approximately 14 million total curies, including 3,200 curies of long-lived mobile radionuclides.

The results of the study reflect qualitative analyses conducted to identify promising options. The estimated costs are rough-order-of magnitude and, therefore, subject to change. Implementing some of the options would represent a departure from the current baseline and may adversely impact the schedule for the Waste Treatment Plant. Some of the options would diminish the operational flexibility inherent in the current baseline and increase the risk of inability to accommodate significant Waste Treatment Plant startup problems, the potential loss of use of a double-shell tank, and other unforeseen events that could require additional tank space beyond that currently assumed necessary. The most promising options require more study to establish feasibility, enhance cost estimates, and understand operations impact of abnormal tank space utilization and need scenarios.

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LIST OF TERMS

CHG	CH2M HILL Hanford Group, Inc.
Ci/L	Curies per liter
DCRT	double-contained receiver tank
DOE	U.S. Department of Energy
DOE-RL	U.S. Department of Energy, Richland Operations Office
DST	double-shell tank
Ecology	Washington State Department of Ecology
ft	feet
g/mL	grams per milliliter
gpm	gallons per minute
HFFACO	*Hanford Federal Facility Agreement and Consent Order*
IMUST	inactive miscellaneous underground storage tank
kgal	kilogallons
m	meters
m^3	cubic meters
M	molar
Mgal	million gallons
NEPA	*National Environmental Policy Act* 1969
ORP	U.S. Department of Energy, Office of River Protection
OSD	Operational Specification Document
PFP	Plutonium Finishing Plant
RCRA	*Resource Conservation and Recovery Act*
PUREX	Plutonium-Uranium Extraction
SST	single-shell tank
WTP	Waste Treatment Plant

1.0 INTRODUCTION

The *Hanford Federal Facility Agreement and Consent Order* (HFFACO) (Ecology et al. 1997) established a timetable for the environmental restoration of the Hanford Site. Major milestones include the retrieval of waste from the single-shell tanks (SSTs) by 2018 and subsequent closure of the SSTs. Waste retrieved from the SSTs will be stored in the double-shell tank (DST) system prior to treatment in the planned Waste Treatment Plant (WTP). Projections of waste volumes resulting from the retrieval of SSTs by 2018 show a need for additional operational storage capacity by 2007 (Allen 2001).

Changes to the HFFACO, negotiated in August 2000 and signed on January 23, 2001, accelerate the retrieval of high-risk waste containing large quantities of mobile long-lived radionuclides from SSTs. One consequence of the changes is that available DST space will be utilized by the end of 2007 after three SSTs are retrieved. The changes in the HFFACO were made with full knowledge of this situation. This tank capacity limitation is a significant concern to the negotiators. As a result, the HFFACO change established a new milestone (M-45-12) that includes a target milestone (T01) requiring the assessment of options to increase available storage space for SST retrieval. This document presents the options.

A brief description of the Hanford Site tank farm facilities and the delineation of the tank capacity issue is presented in Section 2.0. The methodology of this study, including a description of the facilitated workshops conducted to identify options and select those for further evaluation, is presented in Section 3.0. The options that appear to have the highest potential to alleviate the projected 2007 - 2011 tank capacity limitations and their further definition and evaluation are presented in Section 4.0.

The workshops identified options less likely to alleviate the near-term tank capacity shortage, but with promise as longer-term solutions. These could reduce the amount of new DST space necessary for retrieval of waste from the SSTs. These options are reviewed and described in Section 5.0. Approximately 130 options were suggested in the early phases of the workshops. Some options were eliminated based on the consensus of workshop participants; however, these options are presented in Section 6.0 for completeness.

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2.0 BACKGROUND

Waste volume projections (Garfield et al. 2000; Strode and Boyles 2000; Allen 2001) are based upon the expected WTP commissioning in 2007 and planned processing rates. After start-up and initial operations, significant volumes of DST waste will be processed by the WTP, beginning in 2009.

Recent modeling projections (Allen 2001) indicate that the available DST space will be utilized after the retrieval of the three tanks identified in the recent M-45 negotiations (S-112, S-102, and C-104). As part of the planning basis, the WTP will provide six low-activity waste feed receipt tanks with a total capacity of 1500 kgal in 2007. These tanks have a combined capacity of 1500 kgal and are to be available in 2007. When these tanks are available, an additional 1500 kgal of combined processing/receipt storage capacity becomes available, which would then be consumed by the next several SST retrievals.

This section includes a brief description of the Hanford Site tank farm facilities and describes the tank space issue.

2.1 EXISTING TANK FARM FACILITIES

Underground tanks comprised of steel and concrete are used for storage of hazardous radioactive waste. The waste is a byproduct of nearly 50 years of nuclear weapon material production from irradiated reactor fuel at the Hanford Site. Storage is provided by 28 double-contained DSTs with a nominal capacity of 1 million gallons each. Twenty-five of these tanks are located in the 200 East Area and three are located in the 200 West Area.

Waste is also stored in older SSTs, tanks with a single steel liner in concrete. There are 149 SSTs located in six tank farms in the 200 East Area and six tank farms in the 200 West Area. Of these tanks, 67 are known or suspected to have leaked.

Tanks deemed subject to potential uncontrolled increases in temperature or pressure because of the nature of their waste content are designated as "Watch List Tanks," as established by the "Wyden Amendment," Public Law 101-510, Section 3137 (1990). These tanks are restricted from receiving additional waste without the written approval of the Secretary of the U.S. Department of Energy (Public Law 101-510, 1990). There are presently 5 DSTs and 19 SSTs in this category. However, this concern is expected to be closed by September 2001.

Fifteen tanks have waste addition restrictions applied (Boston 2000). Significant resources have been expended to characterize these tanks including several that have been subjected to treatabilty studies at the Savannah River Site and Pacific Northwest National Laboratory in preparation for processing by the WTP. These tanks are referred to as "WTP feed source tanks" throughout this report.

2.2 THE TANK CAPACITY ISSUE

The total operating capacity of the 28 DSTs is 31.3 million gallons (Mgal). Figure 2-1 presents the DST space allocations. Current restrictions reduce the amount of waste that can be stored in these tanks by 3.3 Mgal, resulting in an available capacity of 27.4 Mgal. These restrictions include 2280 kilogallons (kgal) of emergency reserve space; 700 kgal of unused space in the remaining Flammable Gas Watch List tanks; and 900 kgal of unused space in WTP feed source tanks.

The DST system currently stores 21 Mgal of waste (Hanlon 2001). Planned interim stabilization of SSTs, retrieval of three SSTs (C-104, S-102, and S-112), and routine operational needs are projected to utilize the remaining available capacity of the DST system. This condition limits further SST retrieval until additional space is made available by WTP operations.

This lack of capacity was recognized during the negotiation of near-term SST retrieval milestones in August 2000. Therefore, the negotiators developed HFFACO milestone M-45-12-T01 due February 28, 2002. This milestone reads as follows:

> "Submit an options report documenting DOE assessment of actions that could be taken to increase available tank space for SST waste retrieval.
>
> This report will evaluate and document options for acquiring additional storage space for SST retrieval in addition to that required under this M-45-00-01A Change Request. Principle (*sic*) actions required to implement each option within a reasonable time will be identified. The principle (*sic*) options will have detailed cost and schedules for implementation."

This report is in response to this milestone. The major driver for making additional DST space available is to reduce the risk of additional leakage to the environment from the SSTs. Figure 2-2 illustrates how the risk from the tanks will be reduced when retrieved in the order planned (Garfield et al. 2000) for optimal risk reduction considering infrastructure availability. The fraction of total constituents of concern inventory in the SSTs and soil is presented as a function of the cumulative number of SSTs retrieved in the retrieval sequence.

Figure 2-1. Double-Shell Tank Present Space Allocation

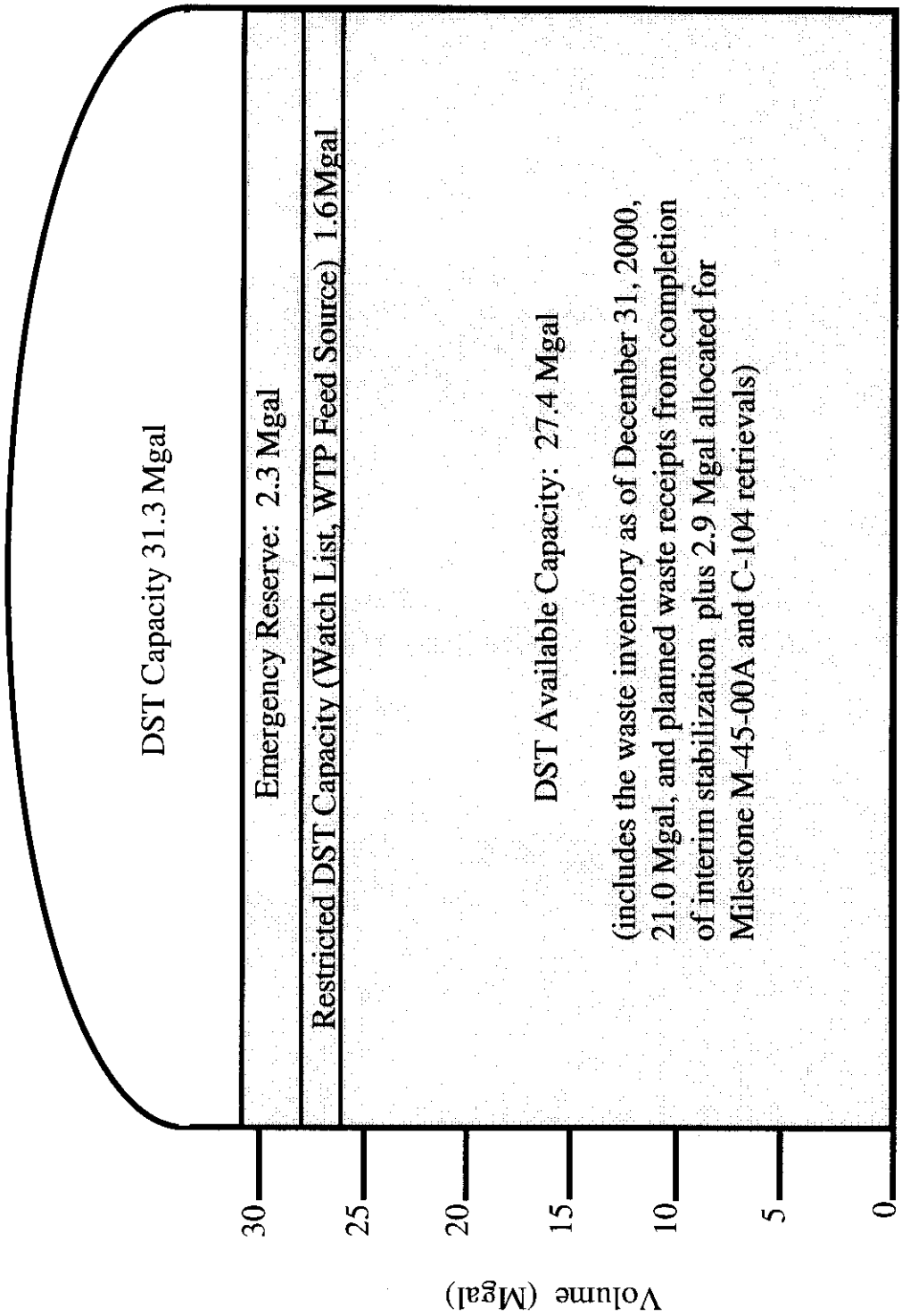
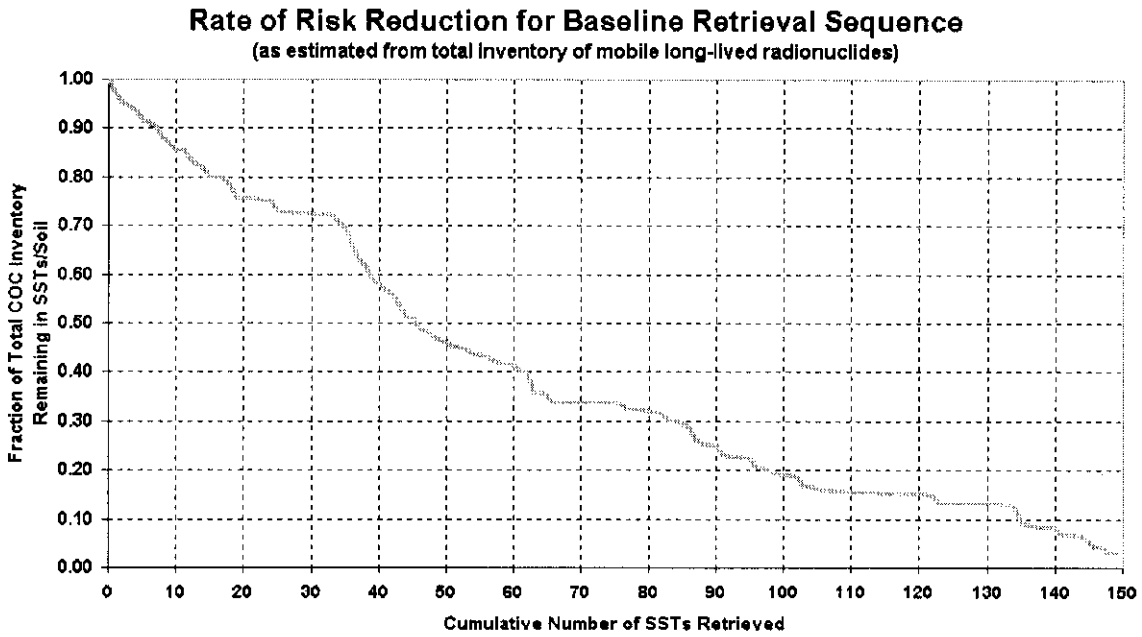


Figure 2-2. Rate of Risk Reduction for Baseline Retrieval Sequence



3.0 METHODOLOGY

The options evaluation and assessment was initiated with a two-day workshop on November 29 - 30, 2000. The participants in the workshop included a cross-section of individuals representing the U.S. Department of Energy, operating contractor, and national laboratory staff. Participants were selected in an effort to provide a cross-section of operations, research, nuclear safety, environmental, programs, and oversight functions. Special emphasis was placed on selecting subject matter experts who would bring a wide experience base for evaluation and assessment of a wide range of options. This workshop focused on identification, development, and categorization of comprehensive lists of options that could increase available tank space.

The workshop began with discussions and presentations to develop a common understanding of the problem, and to ensure that the problem statement was broad enough to not unnecessarily exclude concepts. The workshop participants concluded that the critical time for additional tank space is between 2007 and 2011, when the existing space is fully utilized and the WTP is not fully operational. A half-day brainstorming session was held to identify any potential option that could possibly allow further retrieval of SST wastes after 2007. There was recognition of the longer-term tank space required to support the retrieval of all SSTs by 2018. Additionally, opportunities that require research and development, but are not mature enough to support cost estimate and schedule development were captured for evaluation.

The participants established basic criteria and attributes for option evaluation. These included, but were not limited to, cost effectiveness, technical feasibility, maintainability, operability, risk reduction, and implementation schedule. The participants also grouped and combined options as well as eliminated options after further discussion. The team provided an initial down-selection of the options with the potential of providing additional tank space in the 2007 - 2011 period. Appendix A contains the meeting minutes, charts, list of options and ranking criteria that were developed.

A second workshop was held on January 12, 2001, to present the results of the first workshop to representatives of the Washington State Department of Ecology (Ecology) and the Hanford Advisory Board; to elicit any additional options to be considered; and to propose a format for the report. The specific requirements of the milestone M-45-12-T01 were considered. An annotated report outline was developed addressing content and level of detail. Appendix B contains the meeting minutes, charts, and annotated report outline developed at this meeting. Through the issues development process, and via the workshop outcome efforts, the Hanford Advisory Board subcommittee was apprised of the progress of this task.

Proposed options with the potential of providing additional tank space in the 2007 - 2011 period were evaluated to meet the milestone requirements. Cost estimates and schedules were developed for comparison of the options, in accordance with the level of detail agreed to in the January 12, 2001 workshop. These are initial cost estimates and schedules with the level of detail considered to be necessary by workshop participants. The preliminary schedules of expenditures for each of the multiyear options are not budget grade and require additional review before they can be adopted as a basis for out-year planning. Results are presented in Section 4.0. Long-term solutions identified in the workshops are presented in Section 5.0. Some options were discounted as nonviable. These options are described in Section 6.0.

A diagram of the relationship between the physical options available to increase waste storage space is presented in Figure 3-1.

The results of the study reflect qualitative analyses conducted to identify promising options. The estimated costs are rough-order-of magnitude and, therefore, subject to change. Implementing some of the options would represent a departure from the current baseline and may adversely impact the schedule for the Waste Treatment Plant. Some of the options would diminish the operational flexibility inherent in the current baseline and increase the risk of inability to accommodate significant Waste Treatment Plant startup problems, the potential loss of use of a double-shell tank, and other unforeseen events that could require additional tank space beyond that currently assumed necessary. The most promising options require more study to establish feasibility, enhance cost estimates, and understand operations impact of abnormal tank space utilization and need scenarios.

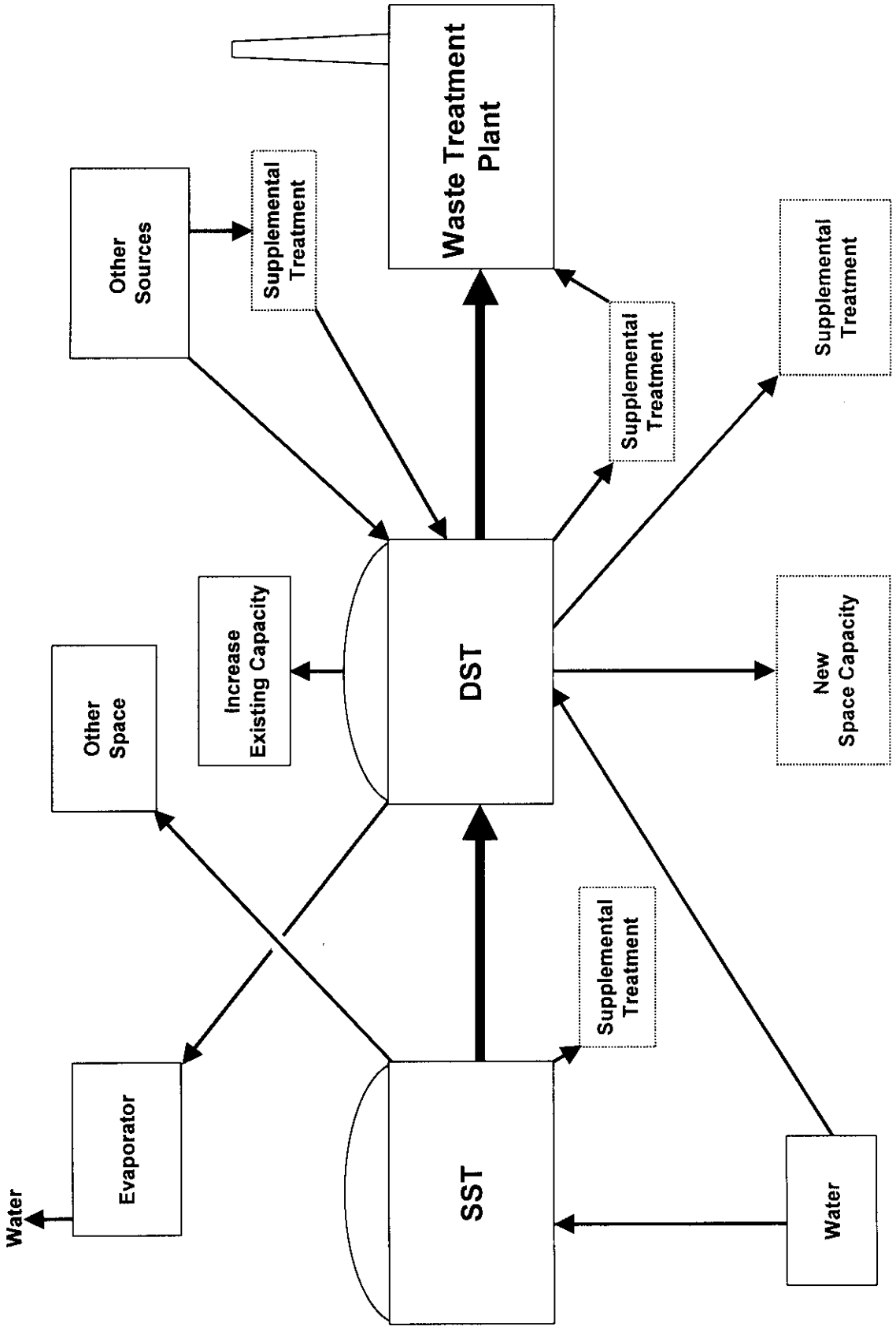


Figure 3-1. Relationship of Physical Tank Space Options Available

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4.0 OPTIONS EVALUATED WITH HIGHEST POTENTIAL TO ALLEVIATE 2007 - 2011 TANK SPACE SHORTAGE

Eight options that encompass the construction of new capacity, modification of current storage practices, and waste treatment alternatives are identified and described in this section. These options were selected for evaluation because they exhibited the potential to provide additional storage space for retrieval of high-risk SST waste during the years 2007 - 2011.

In order to permit future evaluation and comparison, information was developed for each option, including storage capacity provided and the approximate cost estimate and schedule to implement. The cost represents an estimate of the activities necessary to incorporate the capacity into the programmatic planning basis and not life-cycle costs. Most are one-time activities which, when implemented, become part of the baseline. Closure costs were specifically excluded for this comparison because of the uncertainty in closure criteria. Closure costs apply across all options, and as such, should not be a key discriminator between options.

The construction of new double-shell tanks ("new tank" option) is the benchmark for comparison of options. The design has been through extensive review. A detailed cost estimate and schedule were developed in the early 1990s and serve as the basis of the estimate for this report.

A qualitative discussion of other considerations is summarized for each option. Technical feasibility, environmental risk, health and safety risk, maintainability and operability, environmental regulatory impacts, and authorization basis impacts were evaluated. Table 4-1 contains criteria used for the qualitative evaluation.

Table 4-1. Performance Evaluation Feasibility Criteria

Criteria	High Feasibility	Medium Feasibility	Low Feasibility
Technical Feasibility	Work performed previously. Minimal physical change to systems/facilities. Little change to process documents.	Performed previously. Moderate physical change to facilities or systems. Process documents and procedures require change.	Never performed before. Many unknowns. Major physical changes. Research and development required.
Environmental Risk	No new environmental risk identified. Should be bounded by existing permits.	Increased environmental risk. Minor modifications to existing permits.	Requires significant evaluation. New permits required.

Table 4-1. Performance Evaluation Feasibility Criteria

Criteria	High Feasibility	Medium Feasibility	Low Feasibility
Health and Safety Risk	No new or minimal exposure to workers. Should be bounded by current activities.	Possibility of new hazards that require additional precautions.	High industrial, radiation, and construction risk exposure. Risk within industry allowable limits, but requiring special precautions.
Maintainability and Operability	Limited change to existing operations. Simple processes.	New operation similar to existing operation or a major change to an existing operation.	New type facility with complex processes.
Environmental Regulatory Impacts	Changes to existing permits are minor. No impact to HFFACO milestones or consent decree milestones.	Major modifications to existing permits or new permits. Changes or additions expected to be straightforward.	New permits or major modifications to existing permits. Significant public interest and comment expected. Request for variance to regulations required.
Authorization Basis Impacts	Unreviewed Safety Question (USQ) evaluation indicates no changes or minor changes via annual update. No changes to the Technical Safety Requirements.	Updates to the Authorization Basis or controls required. No significant development of new safety analyses.	Significant safety analyses must be prepared to support an Authorization Basis Amendment.

Table 4-2 is a summary of the eight options with the estimated additional capacity, cost, and schedule to implement each option. For this study, the eight options have been considered independently. For example, Option 4.1 is the only option that considers tank space above the 414-inch level. Because of the potential overlap between some options, the tank capacities identified in Table 4-2 cannot be considered additive.

Table 4-2. Summary of Options Most Likely to Provide Additional Capacity in 2007 - 2011 Time Period

Option Title	Additional Capacity (kgal)	Time to Implement (yrs)	Cost per Gallon	Total Cost ($K)
Raise Allowable Waste Levels	1,400	1	$ 0.57	$800
Decrease Dedicated Operational Space	850	0.3	$ 0.22	$190
Use Restricted Tank Capacity	1,300	2	$7.23	$9,900
Combine Aging Waste	980	8	$3.12	$3,060
Utilize Alternate Storage for Emergency Reserves	2,280	4	$2.19 to $4.65	$5,000 to $10,600
Concentrate Waste	2,200	6	$3.98	$8,750
Utilize Double-Contained Surface Storage	1,000	7	$5.75 to $8.80	$5,750 to $8,800
Construct New Double-Shell Tanks	1,200 per tank	7	$62.50	$75,000 per tank

4.1 RAISE ALLOWABLE WASTE LEVELS

4.1.1 Description

This option provides additional storage capacity by increasing the allowable waste levels of the DSTs in AP, AN, AW, and SY-Farms. The current operating capacity for these DSTs used for planning purposes is 1140 kgal (Strode and Boyles 2000), which corresponds to an operating level of 414 inches. This option assumes that the DSTs in these farms are filled to an operating level of 436 inches (1200 kgal).

Tanks in AY and AZ-Farms are excluded from this option based upon the design of the tanks. These tanks are filled from the side and are operated at a maximum level of 356 inches (979 kgal).

4.1.2 Background

The current operating capacity of DSTs is based on filling the tanks to a level of 414 inches, which provides a margin below the historic safety limit of 422 inches. The 422-inch limit was based on seismic calculations performed in the 1980s, and 422 inches was the maximum waste level used in the calculations. The results did not show a "failure or yield" condition. Subsequent analyses (Giller and Weiner 1991) suggest that the fill limit might be raised. The current safety basis for DSTs indicates that tank structural integrity is not challenged due to increased waste levels; therefore, structurally-based level limits are not required in the Authorization Basis (CHG 2000a, CHG 2000b).

In 1998, because of the waste surface level rise in tank SY-101, the maximum waste level in DSTs was readdressed. An evaluation specific to SY-101, *Evaluation of Waste Level Limits in Tank 241-SY-101* (Kirch et al. 1998) identified that a physical constraint on increasing the DST fill limit is the loss of double containment. The loss of double containment occurs where the annulus tank and the primary tank walls meet at approximately 454 inches. The tanks were hydrostatically tested to the 454-inch level prior to use.

For evaluation of this option, a maximum operating level of 436 inches is assumed. The 436-inch level was chosen because, at this level, waste starts to come into contact with in-tank equipment (Kirch et al. 1998) and an 18-inch margin to the level where double-containment ends is maintained.

Technical studies will be required to verify the feasibility of increasing the level, including an updated seismic/structural analysis, a review of the tank wall thickness, and a tank-by-tank review of equipment. The effects of changes in flammable gas concentrations caused by a reduction of headspace volume will require evaluation. The final operating level adopted could be higher or lower as a result of these studies.

The *Resource Conservation and Recovery Act* (RCRA) Part B permit may also need to be revised. Several operating and engineering documents would require revision. No capital equipment is required, but some modification to existing instrumentation would be required; i.e., instrumentation may need to be raised.

4.1.3 Evaluation of Option

4.1.3.1 Additional Capacity (Gallons)

The current waste volume projections use a tank capacity of 1140 kgal (414 inches) for each of the 24 tanks located in AN, AP, AW, and SY-Farms. This option assumes that 23 tanks can be filled to 1200 kgal (436 inches), thereby allowing an additional 60 kgal of waste storage per tank. Because of the need to potentially receive emergency returns from the 242-A Evaporator, the capacity in evaporator feed tank, AW-102, is raised to 1170 kgal. Raising the fill limit for the 24 DSTs will create an additional 1400 kgal of storage space within the existing DSTs.

4.1.3.2 Cost

The cost estimate for this option is presented in Table 4-3 and is based on interviews with subject matter experts.

Table 4-3. Cost Estimate for Raise Allowable Waste Levels Option

Activity Description	Cost ($K)
Conduct Flammable Gas Evaluation	100
Update Structural/Seismic Evaluation	500
Evaluate Minor Equipment Needs	20
Revise RCRA Part B Permit	60
Revise Operating Documents	120
OPTION TOTAL	**$800**

The cost estimate is based on the following assumptions:

- a total of 24 DST tanks will be included in the Flammable Gas Evaluation,
- any required unreviewed safety questions are screened in the flammable gas and structural seismic evaluations (this is for verification of envelope only and not for final certification),
- no further unreviewed safety question resolutions are necessary,
- no additional flammable gas monitors are required,
- no major equipment modifications are required, and
- existing structural and seismic calculations form the basis for new analysis.

The following potential costs are excluded from the estimate:

- waste transfers required to fill the tanks to 436 inches (24 transfers x $130K per transfer = $3,120K);
- re-characterization of 9 WTP feed source tanks (9 tanks x $500K per grab sample per tank = $4,500K);
- compatibility assessments $20K; and
- the DST tank integrity program is using ultrasonic testing to evaluate tank conditions, and it is assumed these tests will be satisfactory for any additional required inspections.

Waste transfer costs are a routine cost, because the tanks can be filled as needed. Re-characterization of the nine feed storage tanks is addressed in Option 4.3.

It is determined that the entire estimated cost would be incurred in one year from start of the activity.

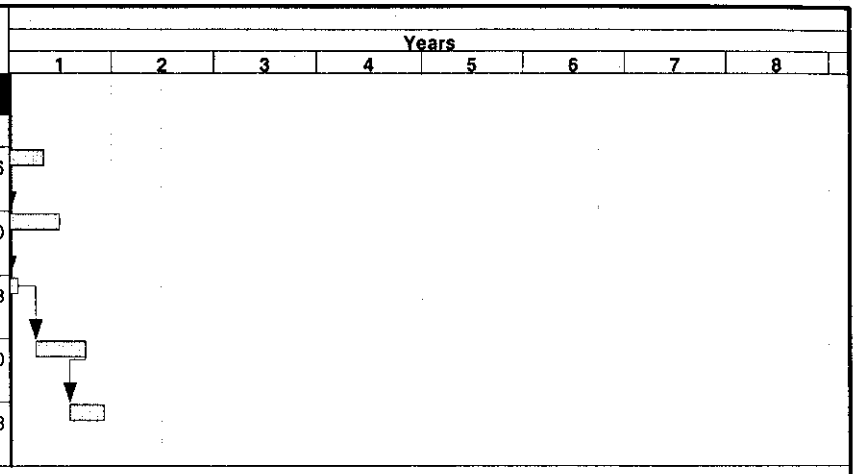
4.1.3.3 Schedule

The schedule for this option is presented in Figure 4-1.

The evaluation of this option and implementation of changes needed to revise engineering and operations documents would take approximately one year to complete. Completion could be accomplished before the 2007 - 2011 need dates. This option can also be implemented on a tank-by-tank or farm-by-farm basis.

Figure 4-1. Schedule for Raise Allowable Waste Levels Option

Activity ID	Activity Description	Orig Dur
OPTION 4.1		
O900100	CONDUCT FLAMMABLE GAS EVALUATION	86
O900200	CONDUCT STRUCTURAL/SEISMIC EVALUATION	130
O900300	EVALUATE MINOR EQUIPMENT NEEDS	23
O900400	REVISE RCRA PART B PERMIT	130
O900500	REVISE OPERATING DOCUMENTS	88



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4.1.3.4 Feasibility Considerations

Additional considerations for the feasibility of raising the allowable waste levels in DSTs are discussed below. Table 4-4 provides the summary assessment of these considerations.

Table 4-4. Feasibility Considerations for Raise Allowable Waste Levels

Criteria	High Feasibility	Medium Feasibility	Low Feasibility
Technical Feasibility	X		
Environmental Risk	X		
Health and Safety Risk	X		
Maintainability and Operability	X		
Environmental Regulatory Impacts	X		
Authorization Basis Impacts		X	

- **Technical Feasibility**

  The currently assumed operating capacity of DSTs has a margin to the maximum capacity. The existing tank structural evaluations indicate that it is probable that tank waste level limits may be raised. The technical uncertainty associated with this option is that existing structural analyses for DSTs may not support a higher waste level or may not meet current standards. If this documentation must be updated extensively, a significant cost and schedule delay would be incurred. The allowable waste level can be increased provided the structural evaluation and the flammable gas review are favorable.

- **Environmental Risk**

  The DSTs meet the requirement of Washington Administrative Code 173-303-640 (4)(e)(iii) that double walled tanks be designed as an integral structure (i.e., an inner tank completely enveloped within an outer shell) and be provided with a built-in continuous leak detection system. Minimal incremental environmental risk is incurred by operating the DSTs at a higher waste level, but below the level of the secondary containment.

- **Health and Safety Risk**

  No additional health and safety risk to the workers or the public are expected from raising the allowable waste level in DSTs.

- **Maintainability/Operability**

  No additional maintenance or operational expense is required to implement this option other than the one-time costs to raise some instrumentation. Actual costs of waste transfers or characterization are not included in this analysis.

- **Environmental Regulatory Impacts**

  A minor change to the RCRA Part B permit may be required because the DST headspace has been reduced.

- **Authorization Basis Impacts**

  Raising the allowable waste levels would require new flammable gas generation rate and ventilation rate studies. These could possibly result in changes to the Limiting Condition for Operation 3.2.1, "DST and AWF Tank Ventilation," (CHG 2000b) surveillance frequency and action statement completion times. The existing waste temperature limits would still apply, and the addition of waste is anticipated to have an insignificant effect on the waste temperature.

4.2 DECREASE DEDICATED OPERATIONAL SPACE

4.2.1 Description

This option provides additional storage capacity by decreasing dedicated operational space requirements within the DSTs. Dedicated operational space is that capacity reserved for specific purposes that support routine tank farm operations.

4.2.2 Background

Current dedicated operational space requirements are presented in Table 4-5.

Table 4-5. Current Dedicated Operational Space

Operation	Tank	Dedicated Volume (kgal)
200 East Area Interim Stabilization Liquid and Dilute Receiver Tanks	Tanks AN-101, AP-108, and AW-105	3,000
200 West Area Interim Stabilization Liquid and Dilute Receiver Tank	Tank SY-102	500
242-A Evaporator Feed Tank	Tank AW-102	1,000
242-A Evaporator Receiver Tank	Tank AW-106	900
Intermediate Feed Staging Tanks	Tanks AN-101, AN-102, AN-105, AP-101, and AP-104	4,900
Dilute Waste Feed Staging Tanks	Tanks AP-106, AP-107, and AN-106	3,300

Not all of the current dedicated operational space will be needed through the time period of 2007 to 2011 and may be made available for other waste storage. A discussion of each operation is included below.

4.2.2.1 Dedicated Operational Space Descriptions

<u>200 East Area Interim Stabilization Liquid and Dilute Receiver Tanks (AN-101, AP-108, and AW-105)</u>

Three tanks have been reserved for receipt of dilute waste in the 200 East Area, tanks AN-101, AP-108, and AW-105. This dilute waste is principally from the interim stabilization of SSTs. Operation of the tanks is described below:

- Tank AN-101 will receive interim stabilization liquid from SSTs A-101 and AX-101 through 2004. After 2004, tank AN-101 will be used as an intermediate feed staging tank. A discussion of feed staging tanks is provided below.
- Tank AP-108 will receive interim stabilization liquid from the BY Tank Farm, waste from tank SY-102, and miscellaneous facility wastes not destined for tank AW-105. After completion of interim stabilization, AP-108 will receive cross-site transfers of SST retrieval waste. As DST capacity is made available for SST retrieval waste, AP-108 is operated as an interim storage tank for transfer of waste from 200 West Area to storage and processing in 200 East Area.
- Tank AW-105 was originally selected to receive 100 Area cleanout waste because the wastes might contain transuranic solids. This tank already contains transuranic solids and will receive approximately 40 kgal of waste from 105-F Basin in 2001. Waste from 105-H Basin will be transferred to tank AW-105 in 2006. Space in tank AW-105 can be made available for SST waste retrieval by using tank AP-108 for receipt of 105-F and 105-H Basin waste. The small volume of waste from 100 Area cleanout can be stored in tank AP-108 without impacting the operation as a cross-site transfer receiver tank.

Elimination of tank AW-105 as a 200 East Area dilute receiver tank would make available approximately 850 kgal for retrieval of high-risk SST waste.

This approach is operationally feasible; however, decreasing the total dilute receiver capacity reduces operational flexibility. By 2005, dilute waste staging tanks will be used for storing concentrated wastes. Only the dilute receiver tanks (AP-108 and AW-105) and the evaporator feed staging tank (AW-102) will be available for receiving, staging, and feeding dilute waste to the evaporator. Once filled, a dilute receiver tank is unavailable for waste receipts for four months while waste characterization is conducted. Without a second dilute waste receiver tank, either the operational strategy will change from a continuous to a batch process or the waste would have to be transferred to tank AW-102 prior to characterization.

200 West Area Interim Stabilization Liquid and Dilute Receiver Tank (SY-102)

At least one DST will be needed in 200 West Area to receive interim stabilization liquid, and waste from the 222-S Laboratory, the Plutonium Finishing Plant (PFP), and SST retrieval. Interim stabilization of 200 West Area tanks will be completed in 2004. Single-shell tank retrieval wastes from tanks S-102 and S-112 are to be stored in tank SY-102 pending transfer to 200 East Area. Tank SY-102 is needed for receipt of SST retrieval waste for subsequent transfer to storage in 200 East Area. Since the bulk of the SST waste and only 3 DSTs are in 200 West Area, SST waste retrieval requires this tank be available.

242-A Evaporator Feed Tank (AW-102)

Prior to evaporation, dilute wastes are transferred into a dilute receiver tank. The waste is staged for four months pending characterization required prior to evaporation. Once it has been determined that the waste is suitable for evaporation, the waste is transferred to the evaporator feed tank, AW-102. Elimination of a dedicated evaporator feed tank would require feeding waste from multiple DSTs, which complicates necessary characterization of dilute waste going to the evaporator and increases cost and operational complexity of running the evaporator. As long as the evaporation of dilute waste is required to reduce waste volume, elimination of the dedicated evaporator feed tank is not considered a viable option.

242-A Evaporator Receiver Tank (AW-106)

After evaporation of approximately 50 percent of the dilute waste volume, the concentrated waste is transferred to the evaporator receiver tank (AW-106). If additional evaporation is required, the waste is transferred back to the evaporator feed tank (AW-102) for re-evaporation.

Elimination of a dedicated evaporator receiver tank would mean that partially evaporated waste would have to be transferred from the evaporator back to the evaporator feed tank (AW-102). This would increase throughput and the length of time required to evaporate dilute waste.

Elimination of a dedicated evaporator receiver tank is not a viable option as long as significant volumes of waste need to be evaporated.

Intermediate Feed Staging Tanks (AN-101, AN-102, AN-105, AP-101, and AP-104)

Projections completed for the last *Operational Waste Volume Projection* (Strode and Boyles 2000) and the *Tank Farm Contractor Operation and Utilization Plan* (Kirkbride et al. 2000) assume that five tanks (AN-101, AN-102, AN-105, AP-101, and AP-104) would be employed as intermediate feed staging tanks for low-activity waste. The tanks are used to stage, dilute, and transfer wastes to the WTP feed tanks. The number of dedicated tanks is determined directly by the WTP feed processing rate. With the exception of tank AN-101, these tanks are currently full and are planned for processing among the initial feeds to the WTP. Once emptied, these tanks are planned to be filled with other waste feed for the WTP.

Dilute Waste Feed Staging Tanks (AN-106, AP-106, and AP-107)

Dilute waste feed staging tanks are used for storage prior to transfer to the evaporator feed tank, AW-102. These tanks are only used when large volumes of dilute interim stabilization wastes are to be evaporated. In the last *Operational Waste Volume Projection* (Strode and Boyles 2000), three tanks, AN-106, AP-106, and AP-107, are identified as dilute waste feed staging tanks. All three are later used to store concentrated waste from interim stabilization of SSTs. In the years 2007 - 2011, these tanks will be full.

4.2.3 Evaluation of Option

4.2.3.1 Additional Capacity (Gallons)

Release of tank AW-105 for other uses would add 850 kgal of capacity.

4.2.3.2 Cost

The cost estimate for this option is presented in Table 4-6 and is based on interviews with subject matter experts.

Table 4-6. Cost Estimate to Decrease Dedicated Operational Space Option

Activity Description	Cost ($K)
Revise Plant Operating Procedures	$40
Perform Compatibility Assessment	$20
Transfer 150 kgal of waste from tank AW-105	$130
OPTION TOTAL	**$ 190**

The cost estimate is based on the following assumption:

- the waste in tank AW-105 (approximately 150 kgal) will be transferred earlier than planned.

The entire estimated cost would be spent within six months of the decision to proceed.

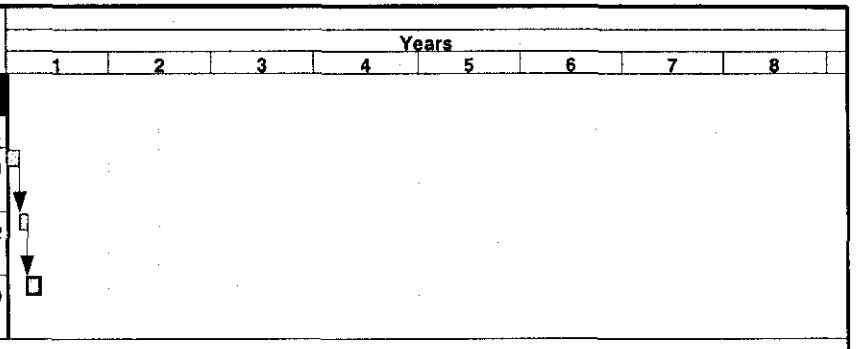
4.2.3.3 Schedule

The schedule for this option is presented in Figure 4-2.

The review and implementation of this option would take approximately six months.

Figure 4-2. Schedule for Decrease Dedicated Operational Space Option

Activity ID	Activity Description	Orig Dur
OPTION 4.2		
O500100	REVISE PLANT OPERATING PROCEDURES	30
O500200	PERFORM COMPATABILITY ASSESSMENT	22
O500300	TRANSFER 150kgal OF WASTE	30



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4.2.3.4 Feasibility Considerations

Additional considerations for the feasibility of decreasing dedicated operational space in DSTs are discussed below. Table 4-7 provides the summary assessment of these considerations.

Table 4-7. Feasibility Considerations for Decrease Dedicated Operational Space Option

Criteria	High Feasibility	Medium Feasibility	Low Feasibility
Technical Feasibility	X		
Environmental Risk	X		
Health and Safety Risk	X		
Maintainability and Operability	X		
Environmental Regulatory Impacts	X		
Authorization Basis Impacts	X		

- **Technical Feasibility**

  No significant technical issues are identified for this option. This option reduces operational flexibility; however, satisfactory changes to current operational strategy are identified.

- **Environmental Risk**

  No incremental environmental risk is incurred by using tank AW-105 for storage of retrieved SST waste.

- **Health and Safety Risk**

  No additional health and safety risk to the workers or the public are expected from using tank AW-105 for storage of retrieved SST waste.

- **Maintainability/Operability**

  This option reduces operational flexibility; however, satisfactory changes to current operational strategy been identified.

- **Environmental Regulatory Impacts**

  No environmental regulatory issues are incurred by using tank AW-105 for storage of retrieved SST waste.

- **Authorization Basis Impacts**

  There is no impact to the Authorization Basis incurred by using tank AW-105 for storage of retrieved SST waste.

4.3 USE RESTRICTED TANK CAPACITY

4.3.1 Description

Currently, not all DSTs are allowed to be filled to the maximum allowable level. Tanks on the Flammable Gas Watch List are restricted from receiving additional waste transfers without the approval of the Secretary of the U.S. Department of Energy (Public Law 101-510, 1990). Fourteen DSTs, including the DSTs on the Watch List, have been characterized for WTP feed and cannot receive additional waste without Office of River Protection approval (Boston 2000). This option increases the allowable stored waste volume in restricted DSTs to the 436-inch current operating level discussed in Section 4.1.

The potential additional storage capacity of each of the restricted tanks is shown in Table 4-8. *Waste Tank Summary Report for Month Ending December 31, 2000* (Hanlon 2001) was used as the basis of the current volume, modified to account for planned operational activities such as caustic addition and waste transfers through 2001. The available volume in AY-101 has been reduced to account for retrieval of tank C-104.

Table 4-8. Watch List and Waste Treatment Plant Feed Source Tanks

Tank	Current Volume (kgal)	Available Volume (kgal)	Watch List	WTP Feed Source
AN-102	1052	~30		X
AN-103	956	184	X	X
AN-104	1052	88	X	X
AN-105	1128	12	X	X
AN-107	1041	~40		X
AP-101	1114	26		X
AP-104	1109	31		X
AY-101	199	~400		X
AY-102	646	334		X
AZ-101	917	63		X
AZ-102	997	0		X
AW-101	1127	13	X	X
SY-103	742	398	X	X
AW-103	509	0		X

These tanks contain approximately 1600 kgal of unutilized capacity. With the exceptions of the AY and AZ tanks, each of these has a potential additional 60-kgal capacity by raising the operating level as detailed in Section 4.1. Tank AY-101 is currently undergoing a tank integrity evaluation. The results of the evaluation may impact its capacity.

4.3.2 Background

Currently, no waste can be added to Watch List tanks without the written approval of the Secretary of the U.S. Department of Energy (Public Law 101-510, 1990). The flammable gas issue is expected to be resolved in 2001. Removal of the tanks from the Watch List should occur by the end of 2001.

Tanks with a high concentration of settled solids have exhibited a tendency for flammable gas retention and release behavior. The tank with the most hazardous gas releases, SY-101, was remediated by dilution with water to dissolve solids and subsequently, was removed from the Watch List. Similar action for the remaining five Flammable Gas Watch List DSTs is not required for resolution of the Flammable Gas Safety Issue. Removal of the remaining tanks from the Watch List is planned for 2001. Addition of water to dilute these DSTs would consume approximately 1000 kgal of existing waste storage capacity.

The WTP waste feed source tanks have been characterized, and waste treatability studies are ongoing. The characterization and treatability studies represent a sunk cost for the River Protection Project. All waste fed to the WTP must be re-characterized within one year of transfer to the WTP. Permission from the U.S. Department of Energy, Office of River Protection (ORP) (Boston 2000) is required to add waste to these tanks. Combination of the wastes without re-characterization would require an evaluation of the effect on the waste treatment process and approval from ORP.

4.3.3 Evaluation of Option

4.3.3.1 Additional Capacity (Gallons)

The maximum capacity that could be realized with this option is 1400 to 1600 kgal. Several significant technical issues require resolution for implementation of the option. Four tanks, AN-103, AY-101, AY-102, and SY-103, have a combined additional capacity of 1300 kgal and were considered for cost and schedule analysis.

4.3.3.2 Cost

The cost estimate for this option is presented in Table 4-9 and is based on interviews with subject matter experts. Costs would be a small fraction of this estimate if characterization or treatability studies specific to the addition of waste are unnecessary.

Table 4-9. Cost Estimate for Use Restricted Tank Capacity Option

Activity Description	Cost ($K)
Sampling and Analysis	4,400
WTP Treatability Studies	5,000
OPTION TOTAL	**9,900**

The cost estimate for this option is based on the following assumptions:

- tanks under evaluation are contained in Table 4-8;
- tanks AN-103, AY-101, AY-102, and SY-103 contain usable available capacity;
- the cost of sampling and analysis for tanks AY-101 and SY-103 are considered elsewhere or beyond the timeline of this study;
- tanks AN-103 and AY-102 may require re-evaluation for WTP waste acceptance and treatability, and are costed;
- Full sampling, analysis, and treatability costs are assumed and may not be required;
- tanks AZ-102 and AW-103 are considered full and are not costed;
- tanks AN-102, AN-104, AN-105, AN-107, AP-101, AP-104, AW-101, and AZ-101 provide minimal additional capacity at less than 100 kgal per tank and are not costed;
- sampling and analysis costs are $2.2M per tank;
- WTP treatability studies are $2.5M per tank; and
- no equipment including pumps, pits, and transfer lines required upgrade to support utilization of tank space.

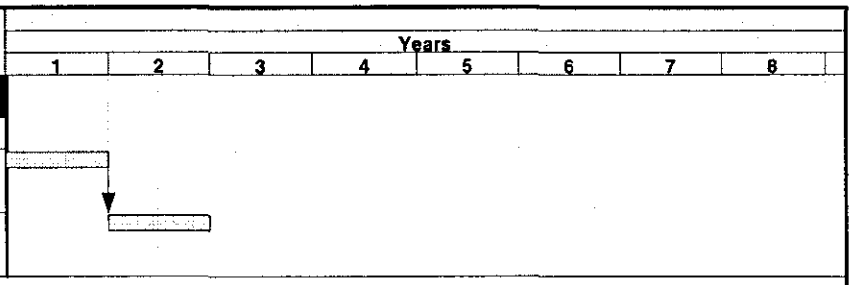
The preliminary expenditure schedule is based on one year to sample and analyze the waste in <u>each</u> tank ($2,200K) followed by one year to perform treatability studies ($2,500K).

4.3.3.3 Schedule

The schedule for this option is presented in Figure 4-3. This schedule represents the timeline for one tank.

Figure 4-3. Schedule for Use Restricted Tank Capacity Option

Activity ID	Activity Description	Orig Dur
OPTION 4.3		
O400100	SAMPLE & ANALYSIS	261
O400200	PERFORM WTP TREATABILITY STUDIES	261



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4.3.3.4 Feasibility Considerations

Additional considerations for the feasibility of using restricted tank capacity in DSTs are discussed below. Table 4-10 provides the summary assessment of these considerations.

Table 4-10. Feasibility Considerations for Use Restricted Tank Capacity Option

Criteria	High Feasibility	Medium Feasibility	Low Feasibility
Technical Feasibility	X		
Environmental Risk	X		
Health and Safety Risk	X		
Maintainability and Operability	X		
Environmental Regulatory Impacts	X		
Authorization Basis Impacts		X	

- **Technical Feasibility**

  No significant technical issues are identified for the use of restricted capacity in DSTs. The use of capacity in Flammable Gas Watch List tanks requires removal of these tanks from the Watch List, planned for 2001 and flammable gas evaluations in accordance with existing Authorization Basis controls(CHG 2000a, CHG 2000b). The use of capacity in WTP feed source tanks require approval of Office of River Protection and an evaluation that the new waste added to the tank is compatible with the existing waste.

  Technical issues associated with decreasing the restricted capacity of the tanks include compatibility of wastes with the WTP feed source tanks and the evaluation of transfers relative to Authorization Basis requirements (CHG 2000a, CHG 2000b).

  The use of currently restricted capacity in DST presents no technical issues. The currently assumed operating capacity of DSTs has a margin to the maximum capacity. The tank structural evaluations indicate that it is likely that individual tank level limits may be raised. The technical uncertainty associated with this option is that existing structural analyses for DSTs may not show a higher waste level is acceptable or may not meet current standards. If this documentation must be updated extensively, a significant cost and schedule delay would be incurred. The allowable waste level can be increased provided the structural evaluation and the flammable gas review are favorable.

- **Environmental Risk**

  No incremental environmental risk is incurred by the use of restricted capacity in DSTs.

- **Health and Safety Risk**

  No additional health and safety risk to the workers or the public are expected by the use of restricted capacity in DSTs.

- **Maintainability/Operability**

  No maintainability or operability issues are expected by the use of restricted capacity in DSTs.

- **Environmental Regulatory Impacts**

  No environmental regulatory issues are incurred by the use of restricted capacity in DSTs.

- **Authorization Basis Impacts**

  Assuming the subject tanks are taken off of the Watch List, transfers can be made given compliance with Administrative Control 5.9, "Flammability Controls," and Administrative Control 5.12, "Transfer Controls." Transfer of additional waste into the DST would require new flammable gas generation rate/ventilation rate studies. These could possibly result in changes to the Limiting Condition for Operation 3.2.1, "DST and AWF Tank Ventilation," (CHG 2000b) surveillance frequency and action statement completion times.

4.4 COMBINE AGING WASTE

4.4.1 Description

Currently, two tanks in the AZ Tank Farm store waste from the Plutonium-Uranium Extraction (PUREX) Plant that is referred to as "aging waste." This option increases tank capacity by combining, concentrating, or moving these wastes. This consolidation will release aging waste capacity for storage of SST retrieval waste. Depending on the process chosen for storing the existing aging waste, the additional tank capacity made available ranges from 700 kgal to 1,000 kgal.

4.4.2 Background

Waste that came directly from the PUREX Plant and had high concentrations of radionuclides is known as aging waste. The radionuclides generated heat that the ventilation systems in AY and AZ Tank Farms were designed to control. All aging waste is currently stored in AZ Tank Farm.

During peak production, it was considered adequate to "age" the waste for five years before it could be transferred out of the aging waste facility to other DSTs. The currently stored waste has aged for more than 15 years. The radioactivity and heat load are much less than when the waste was generated. The primary heat sources are cesium-137 and strontium-90, each of which has a half-life of about 30 years.

The volume of aging waste is not static. Water evaporates from the waste due to the heat load, condenses, and returns to the tanks. Because the condensate return is a batch process, the volume tends to rapidly increase and then gradually decrease. As a result, the sodium concentration varies in these tanks. To prevent solids from forming in the tank, the concentration of the aging waste is limited to a maximum sodium concentration of 5 to 5.5 gram-moles per liter (M).

4.4.3 Evaluation of Option

4.4.3.1 Additional Capacity (Gallons)

Adding low radioactive concentration waste to the AZ tanks and allowing the waste to evaporate until the sodium concentration reaches the current *Operating Specifications for Aging Waste Operations in 241-AY-and 241-AZ* (OSD) (CHG 2000c) limits of 5 M sodium for tank AZ-102 and 5.5 M sodium for tank AZ-101 is one option. The most viable concept involves combining waste from both AZ tanks into one single aging waste tank and allowing the sodium concentration to exceed 5 M. A third concept involves removing the liquid waste from the aging waste tanks and blending it throughout the DST system. The liquid waste would then be concentrated up to a density of 1.41 g/mL in the other tanks.

Table 4-11 shows the liquid volumes requiring storage for the various process alternatives. The waste volume decreases with increasing waste concentration measured as sodium molarity. A description of each process alternative is provided.

Table 4-11. Summary of Liquid Volumes under Various Process Alternatives

Tank	PROCESS ALTERNATIVES							
	Current Conditions		Self-Concentrate and Add Other Waste		Combine Aging Waste and Concentrate		Remove Liquid Waste	
	Current Liquid Volume (kgal)	Current Sodium (M)	At OSD[1] Limits (kgal)	OSD Limit Sodium (M)	Storage Volume (kgal)	Sodium (M)	Storage Volume (kgal)	Sodium (M)
AZ-101	873	4.8	701	5.5	551	7	453	8.5
AZ-102	908	2.4	413	5	295	7	243	8.5

Notes: [1]CHG (2000c)

- **Self-Concentrate and Add Other Waste**

The two AZ tanks have an operating capacity of 980 kgal each or 1960 kgal total and a variable inventory as water evaporates and is replaced. Table 4-11 shows that tanks currently store 1781 kgal of liquid waste at a concentration below that permitted by the OSD (CHG 2000c). Allowing the waste to self-concentrate to the OSD limits would reduce the stored volume by 550 kgal thereby allowing an additional 712 kgal to be added to the two tanks to reach the current operating capacity of 1960 kgal.

- **Combine Aging Waste and Concentrate**

Raising the current concentration limits to 7 M sodium would allow all of the aging waste, including solids to be stored in a single tank. This would produce 980 kgal in available capacity. This could be accomplished using the existing mixer pump in tank AZ-101 to slurry the solids. The process would allow self-concentration in tank AZ-102 by sending the condensate to other tanks then mixing tank AZ-101 to suspend solids. The waste in tank AZ-101 would be transferred to tank AZ-102. Several repetitions of self-concentration and transfer would be required.

One concern with transferring all of the aging waste to one tank is an increase in the radionuclide concentration. Increasing to 7 M sodium could produce cesium-137 concentrations as high as 2.4 Ci/L. One alternative would be to leave the waste in the tanks and add other waste, with low activity, to these tanks prior to self-concentration of the waste to 7 M sodium. The cesium-137 concentrations would remain relatively constant in this approach.

- **Remove Liquid Waste**

Removal of the liquid fraction from aging waste tanks and concentration in the 242-A Evaporator would free the AZ-Farm tanks for additional waste storage. To increase the concentration of the waste, the aging waste would need to be blended with waste from several other tanks. If the waste were subsequently concentrated to a density of 1.41 g/mL, additional capacity could be realized. This step would require a number of transfers from the AZ-Farm to other farms. This would leave the sludge in AZ-Farm. The total volume saved would be 1133 kgal when other waste is brought back in to completely back fill the aging waste tanks.

4.4.3.2 Cost

The cost estimate for this option is presented in Table 4-12 and is based on the combine waste tanks and concentrate option. This option transfers slurried waste from tank AZ-101 to tank AZ-102. Four (4) transfers will be required.

Table 4-12. Cost Estimate for Combining Aging Waste Option

Activity Description	Cost ($K)
Conduct Thermal Studies	200
Prepare Procedures	60
Perform Compatibility Assessments	80
Perform Waste Transfers (4 each)	520
Sample and Analyses	2,200
OPTION TOTAL	**$ 3,060**

The cost estimate is based on the following assumptions:

- all equipment including pumps, pits and transfer lines do not require additional upgrade,
- tank Farm Models or databases do not need to be changed,
- costs reflect that the thermal studies will verify that the Authorization Basis waste temperature limits are not exceeded (CHG 2000a, CHG 2000b),
- condensate (boil-off) and subsequent transfer to the evaporator for processing is not part of this scope,
- four transfers are performed, including jumper changes, at a cost of $130K per transfer, and
- characterization of the combined waste for WTP feed is required at a cost of $2,200K.

The preliminary expenditure schedule includes thermal studies and procedure preparation in the first year at a cost of $260K followed by compatibility assessment and waste transfer during the first year for $150K. Three additional transfers in the fourth, sixth, and eighth years are estimated at $150K each.

The following potential costs are excluded from the estimate:

- if the alternative to continuously add more waste to both AZ tanks and concentrate the waste in-tank is implemented, 9 additional transfers are needed. An incremental cost of $1,200K would be incurred;
- if the alternative to remove the liquid waste and distribute to other tanks is implemented, additional transfers and evaporator operations are required. The total cost of this alternative would be $6,800K; and
- if the thermal studies show that the waste temperature limits are exceeded, then a change to the Authorization Basis (CHG 2000a, CHG 2000b) will be required.

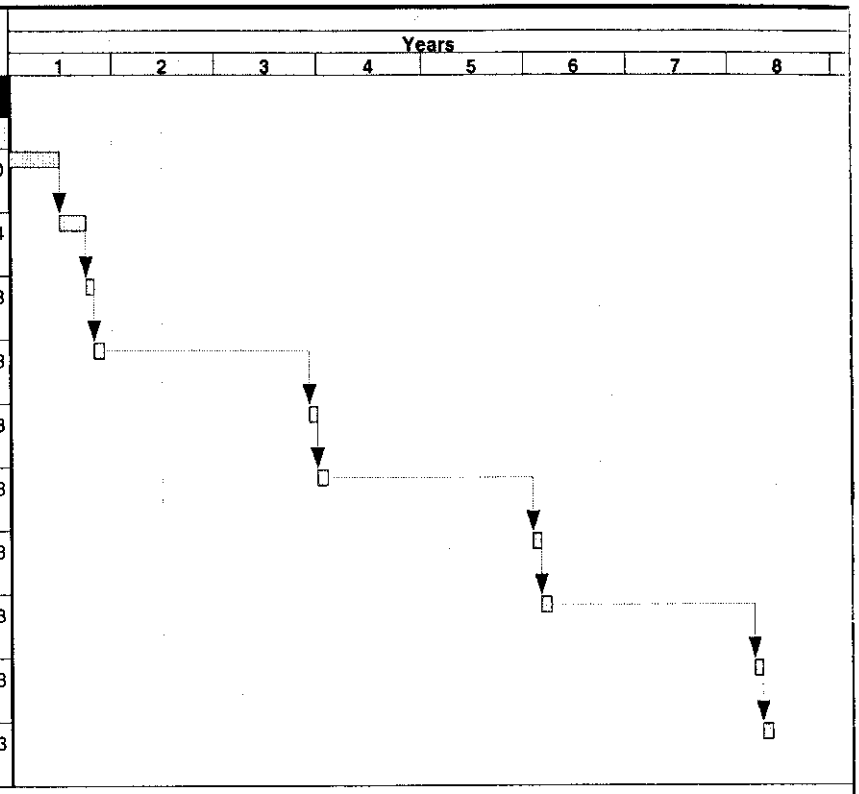
4.4.3.3 Schedule

The schedule for this option is presented in Figure 4-4.

This option relies on the combining aging waste and concentration option. The rate of evaporation from each of these tanks is less than 100 kgal per year. At that rate of evaporation, it would take eight years to complete this option. Acceleration opportunities exist. For example, ventilation rates could be increased, which will increase evaporation rates. Review of the potential to emit radionuclides at accelerated evaporation rates would be required.

Figure 4-4. Schedule for Combine Aging Waste Option

Activity ID	Activity Description	Orig Dur
OPTION 4.4		
O300100	CONDUCT THERMAL STUDIES	130
O300200	INITIATE PROCEDURE PREPERATIONS	64
O300300	PERFORM COMPATABILITY ASSESSMENT	23
O300400	PERFORM WASTE TRANSFERS	23
O300500	PERFORM COMPATABILITY ASSESSMENT	23
O300600	PERFORM WASTE TRANSFER	23
O300700	PERFORM COMPATABILITY ASSESSMENT	23
O300800	PERFORM WASTE TRANSFER	23
O300900	PERFORM COMPATABILITY ASSESSMENT	23
O301000	PERFORM WASTE TRANSFER	23



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4.4.3.4 Feasibility Considerations

Additional considerations for the feasibility of combining aging waste are discussed below. Table 4-13 provides the summary assessment of these considerations.

Table 4-13. Feasibility Considerations for Combine Aging Waste Option

Criteria	High Feasibility	Medium Feasibility	Low Feasibility
Technical Feasibility		X	
Environmental Risk	X		
Health and Safety Risk	X		
Maintainability and Operability		X	
Environmental Regulatory Impacts	X		
Authorization Basis Impacts		X	

- **Technical Feasibility**

  Combination of the waste from the two aging waste tanks into one tank or the storage of additional waste in these tanks is technically feasible. Technical issues that require resolution include evaluation of the resulting waste temperatures and waste source term. The waste temperature must be controlled per Limiting Condition for Operation 3.3.2, "DST and AWF Tank WASTE Temperature Controls" (CHG 2000b). Additional annulus ventilation flow may be required if the thermal evaluation predicts waste temperatures outside the control limits. The resulting waste radionuclide concentration will require evaluation per Administrative Control 5.8, "Source Term Controls," (CHG 2000b).

  The combination of the two aging waste tanks in one tank would require evaluation against Administrative Control 5.15, "Chemistry Control Program." It is anticipated that a higher hydroxide concentration would exist in the resulting waste; therefore, no significant issues are anticipated with this control.

  There may be an added benefit to the WTP resulting from blending of aging waste with other wastes. The radionuclide concentration would be diluted, which may positively affect pretreatment operations. The aging waste also contains high levels of sulfate and fluoride, which are detrimental to the vitrification process and could be reduced by waste blending.

- **Environmental Risk**

  No incremental environmental risk is incurred by the combination of aging waste.

- **Health and Safety Risk**

  Minimal additional health and safety risk to the workers or the public are expected by the combination of aging waste. An increase in the radionuclide concentration of the waste would require appropriate radiological controls during operations associated with the tank.

- **Maintainability/Operability**

  The combination of aging waste requires the use of transfer equipment that has not been operated in several years. Additional maintenance on aging waste tank transfer systems is probable. The ventilation system for the AZ tank farm was replaced in the 1990s, and no new maintenance or operations issues are expected from this option.

- **Environmental Regulatory Impacts**

  The effect of combining aging waste will require evaluation against the radioactive air emissions notice of construction for aging waste tank ventilation system. A minor change to this regulatory document may be required.

- **Authorization Basis Impacts**

  Combining or blending aging waste may require revisions to Limiting Condition for Operation 3.3.2, "DST and AWF Tank WASTE Temperature Controls" and Administrative Control 5.8, "Source Term Controls," (CHG 2000b).

4.5 UTILIZE ALTERNATE STORAGE FOR EMERGENCY RESERVES

4.5.1 Description

Currently, a total of 2280 kgal of capacity is reserved in the DST system. A volume equivalent to one DST is reserved for emergency storage in the event of failure of a DST; a second tank volume is reserved for emergency return of off-specification waste from the WTP. This study considers other emergency storage capacity outside of the DST system. Five options are considered:

- combine DST emergency reserve with WTP emergency return reserve;
- utilize two of the four empty Grout vaults (218-E16-104 and 218-E16-105);
- utilize two of the four empty Grout vaults, modified to install primary containment tanks or bladders inside the vaults;
- utilize double-contained receiver tanks (DCRTs); and
- utilize a large (~500 kgal) storage tank near the PUREX facility.

Combine Emergency Reserve Capacity

Currently, a total of 2,280 kgal of DST capacity is reserved for emergency storage in the event of a DST failure and for return of off-specification waste feed from the WTP. The probability of a DST failure and a WTP emergency return occurring simultaneously is low. Little risk is incurred by revising the WTP feed staging strategy to reduce this emergency reserve requirement to 1,140 kgal. Capacity is made available in WTP feed source tanks as the waste is transferred to the WTP. If the emptied feed tank is not refilled until the WTP feed is accepted, the capacity is available for waste return should the feed be determined to be out-of-specification. A letter of guidance from the ORP would be required to implement this change.

Grout Vaults without Modification

Five underground vaults were constructed for the purpose of disposal of grouted low-level tank waste. One was filled with grouted waste. The remaining four are empty and do not have an identified mission. Each vault has a total capacity of 1600 kgal, with a practical operating capacity of 1400 kgal.

The regulatory strategy for the Grout program in the 1990s was to operate each vault as a surface impoundment and close as a landfill after the grout had solidified. Primary containment was provided by the asphalt liner and concrete vault. Secondary containment was provided by the lined catch basin with a leachate collection sump.

The U.S. Environmental Protection Agency (EPA) considers storage of hazardous wastes in a surface impoundment to be disposal. Therefore, only wastes meeting Land Disposal Restrictions (LDR) treatment standards may be stored in an impoundment (Elsevier 1999). The tank waste does not meet LDR for several reasons. Tank waste is classified as corrosive unless treated. In addition, the chromium concentration and the concentrations of several underlying hazardous constituents typically exceed the LDR criteria. Therefore, the vaults could not be operated as surface impoundments for routine tank waste storage.

The Grout vaults could be operated as tanks for emergency backup to tank storage. The concrete tank with sprayed asphalt liner (approximately 60 mils thick) could be considered a tank for emergency storage purposes. If the sprayed liner failed, the waste could migrate through the concrete vault, down the drainage net, and along the high-density polyethylene layer located between the concrete and the 1-m thick external asphalt barrier down to the lined, gravel-filled catch basin, which provides secondary containment.

A significant issue requiring resolution is whether the 1-meter thick asphalt barrier would be considered secondary containment. The asphalt barrier surrounding the catch basin and concrete vault was designed to prevent water vapor from migrating from the soil to the grout monolith. It is clear that the asphalt barrier would divert any liquid waste leaking from the vault into the lined catch basin. However, the asphalt barrier would not typically be considered secondary containment. Design aspects that might allow waste to escape the asphalt barrier require evaluation. If the existing design is approved through the permitting process, or if a waiver to design requirements is granted, then credit could be taken for the asphalt barrier as secondary containment.

If credit cannot be taken for the asphalt barrier, then only the gravel filled, high-density polyethylene-lined catch basin would provide secondary containment. The current structure could be considered double-contained with a capacity of approximately 50,000 gallons.

Grout Vaults with Modification

If additional containment were necessary, an inner tank or bladder could be constructed inside of the vault. In this case, the sprayed asphalt liner and concrete vault would constitute secondary containment. The sprayed asphalt liner is fragile, and it would be a challenge to protect it from the rigors of construction.

The vaults have a rectangular cross section with interior dimensions of 123.5 feet x 50.5 feet and a height of 34 feet. If a rectangular cross section is chosen for an inner tank, then a volume of approximately 1000 kgal is conceivable. Another concept suggested would be to arrange prefabricated steel tanks inside a vault. One example is a tank used in the petroleum industry, commonly referred to as a Baker® tank. These tanks are 21 kgal tanks with a rectangular cross section of 8 feet by approximately 37 feet. About 15 of these tanks could be placed in a single vault, for a total capacity of 315 kgal.

Double-Contained Receiver Tanks

The 244-BX, 244-CR, 244-S, and 244-TX DCRTs have been used as lift stations for waste transfers, but will not be used during tank retrieval. The 244-U DCRT has not been used and would incur significant effort to commission. The 244-A DCRT is used as a lift station for cross-site waste transfers and is not considered to be available. The operating capacity is shown in Table 4-14.

Plutonium-Uranium Extraction (PUREX) Storage Tank

A PUREX storage tank was identified during preliminary planning discussions for this study. The tank has been identified as tank A-201. This is a single-wall, aboveground tank located east of the PUREX facility originally used for storing emergency cooling water. The tank is not acceptable for storing tank waste, which requires shielding and double containment. This tank is not evaluated any further.

Summary of Alternative Storage for Emergency Reserves

Table 4-14. Summary of Alternative Storage for Emergency Reserves

Facility Type	Facility Name	Capacity (kgal)	Operating Capacity (kgal)
Grout Vaults	218-E16-104, 218-E16-105	1600 per vault	1400 per vault
Modified Grout Vaults	218-E16-104, 218-E16-105	1600 per vault	1000 per vault
DCRT	244-A	16.3	14.3
	244-BX	31.0	24.8
	244-CR	15.0	12.0
	244-S	20.3	16.2
	244-TX	31.0	24.8
	244-U	31.0	24.8
PUREX Raw Water Tank		500	500

4.5.2 Background

The Grout vault sprayed asphalt liners were applied in 1991. The available vaults have been hydrotested. Further testing may be required to ensure that the liners still retain their integrity. Vaults 218-E16-104 and 218-E16-105 are the suggested choices. Vault 102 is more complex operationally, and the asphalt liner in vault 103 has been patched after the hydrotest (Wisness 1992).

From the 1950s through the late 1970s, several DCRTs were constructed. The purpose of these facilities was to support uranium and fission product recovery from SST waste. Later the DCRTs were used as part of the interim stabilization program for consolidation of SST liquid prior to pumping to DSTs. The 244-A, 244-BX, 244-CR, 244-S and 244-TX were all used for these purposes. The 244-U DCRT has never been activated.

4.5.3 Evaluation of Option

4.5.3.1 Additional Capacity (Gallons)

- Using two Grout vaults, as currently configured, for emergency reserve capacity could release 2280 kgal of reserved space within the DST system.
- Using two modified Grout vaults for emergency reserve capacity could release 2280 kgal of reserved space within the DST system.
- Use of DCRTs creates minimal emergency reserve capacity.

This option evaluation is based on utilization of two existing Grout vaults. Both as-is and modified approaches are presented. Modification consists of removal of the vault cover, installation of internal storage tank and necessary support systems and equipment. Start-up, testing, and turnover will be performed.

4.5.3.2 Cost

The cost estimate for the modified Grout vault option is presented in Table 4-15 and is based on the conceptual design report, HNF-1975, *Immobilized Low-Activity Waste Interim Storage Facility Project W-465* (Pickett 1998).

Table 4-15. Cost Estimate for Alternate Storage for Emergency Reserves Option - Grout Vaults with Modification

Activity Description	Cost ($K)
Obtain permitting and regulatory documentation	2000
Conduct Design	2800
Perform Construction	4800
Perform Start-Up and Testing	1000
OPTION TOTAL	**$ 10,600**

The cost estimate was based on the following assumptions:

- a bladder-style liner will be installed in both vaults;
- a RCRA Part A and Part B Permit, Notice of Construction, and Authorization Basis revision are required;
- design includes preliminary, conceptual, and detailed design activities;
- construction includes site work/excavation, vault entry, and installation of primary containment and auxiliaries;
- start-up and testing will consist of a Readiness Review, procedure writing, and training;
- approximately 2500 linear feet of hose-in-hose transfer lines will be used;
- no new transfer pumps are required;
- a new leachate sump pump is required;
- capital modifications will not be required;
- existing portable exhauster will be used;
- existing Infrastructure will be adequate; and
- no decontamination or decommissioning of existing facilities will be required.

The estimated spread of costs is as follows:

Year	Annual Total
1	$1,000K
2	$5,700K
3	$2,900K
4	$500K
5	$500K

This is a preliminary estimate and schedule of expenditures and is not of budget grade, but is for scoping purposes only.

The cost estimate for the unmodified Grout vault option is presented in Table 4-16 and is based on the modified Grout vault estimate.

Table 4-16. Cost Estimate for Alternate Storage for Emergency Reserves Option - Grout Vaults without Modification

Activity Description	Cost ($K)
Obtain permitting and regulatory documentation	1000
Conduct Design	1000
Perform Construction	2000
Perform Start-Up and Testing	1000
OPTION TOTAL	**$ 5,000**

The cost estimate for the unmodified or as-is Grout vaults was based on the following assumptions:

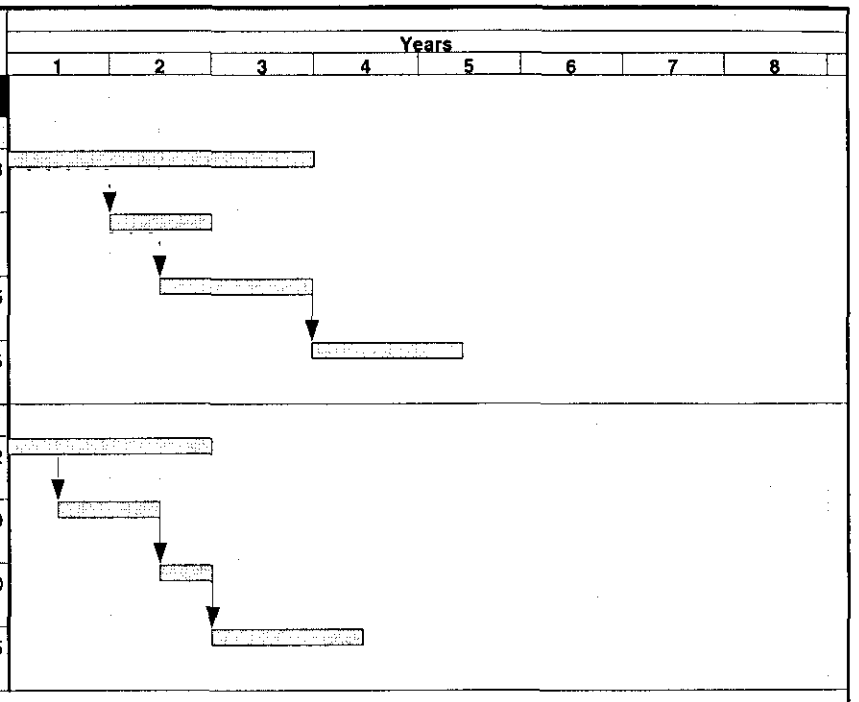
- cost estimate reductions are associated with the elimination of storage tank bladder and associated systems; and
- changes to the Authorization Basis make the cost higher than would be expected.

4.5.3.3 Schedule

The schedule for this option is presented in Figure 4-5.

Figure 4-5. Schedule for Alternate Storage for Emergency Reserves Option - Grout Vaults with Modification and without Modification

Activity ID	Activity Description	Orig Dur
OPTION 4.5		
USE MODIFIED GROUT VAULT WITH BLADDER		
P000100	OBTAIN PERMITTING & REGULATORY DOCUMENTATION	783
P000200	CONDUCT DESIGN OF BLADDER	261
P000300	PERFORM CONSTRUCTION	385
P000400	CONDUCT STARTUP & TESTING	385
USE 4 GROUT VAULTS AS IS		
P001500	OBTAIN PERMITTING & REGULATORY DOCUMENTATION	522
P001600	CONDUCT DESIGN OF GROUT VAULTS	260
P001700	PERFORM CONSTRUCTION	130
P001800	CONDUCT STARTUP & TESTING	385



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4.5.3.4 Feasibility Considerations

Additional considerations for the feasibility of alternate storage for emergency reserves are discussed below. Table 4-17 provides the summary assessment of these considerations.

Table 4-17. Feasibility Considerations for Utilize Alternate Storage for Emergency Reserves Option

Criteria	High Feasibility	Medium Feasibility	Low Feasibility
Technical Feasibility		X	
Environmental Risk	X		
Health and Safety Risk	X		
Maintainability and Operability		X	
Environmental Regulatory Impacts		X	
Authorization Basis Impacts			X

- **Technical Feasibility**

  Use of the Grout vaults in their current configuration does not pose a significant technical challenge. The principal long-lead activities would be environmental regulatory permitting and Authorization Basis amendment. The main pipelines exist, but several jumpers would need to be fabricated. In addition, emergency procedures would have to be developed.

  If tanks must be installed within the Grout vaults, then significant technical issues must be addressed. These include, but are not limited to the following:

  - excavation of the soil, 1-m thick asphalt barrier, concrete topping, and pre-stressed concrete cover panels,
  - construction of a new vault liner or protection of the integrity of the current 60-mil asphalt spray liner,
  - design, fabrication, and installation of a primary tank, and
  - replacement of cover panels and overburden.

  Dunford (1999) briefly discusses the bladder concept for SSTs. This approach would require technology development. Issues to be resolved include, but are not limited to the following:

  - fitting the bladder with a compliant leak detection system,
  - hydrostatic loads from approximately 25 feet of tank waste,
  - chemical compatibility with the waste at the storage temperature, and
  - radiation resistance of the bladder.

Dunford (1999) assumed that an off-the-shelf material with these characteristics likely does not exist, and that a research and development program would have to be funded to develop the bladder material.

- **Environmental Risk**

Presently, 2280 kgal of DST capacity is reserved in the event a DST fails or the WTP has an emergency. This reserve prevents removal of high-risk waste from SSTs that have leaked or have the significant potential to leak in the future, because there is insufficient DST capacity after retrieval of three SSTs. Designating the Grout vaults as emergency reserve capacity would provide the opportunity for retrieval of 2280 kgal of SST waste ahead of current plans. The designation of the Grout vaults for emergency reserve capacity should be for the time period after the initial "filling" of DSTs (approximately 2007) until the WTP operations free up DST space (approximately 2009 - 2011). Therefore, the Grout vaults would be backup emergency reserve for a period of only two to four years.

- **Health and Safety Risk**

Minimal additional health and safety risk to the workers or the public are expected by use of alternate storage for emergency reserves. If the modified Grout vault option is chosen, a worker confined space hazard must be addressed during modification activities.

- **Maintainability/Operability**

As the Grout vaults are not currently in use, operating the vaults as an emergency backup waste storage facility would result in increased maintenance and operations expense for the period used. If the Grout vaults must be used for waste storage, then the vaults would incur closure costs. If the need for emergency waste storage did not occur in the critical 2 to 4 year time period, there would be no incremental closure costs for the vaults.

- **Environmental Regulatory Impacts**

A significant activity required for the use of alternate storage for emergency reserves is the environmental regulatory permitting.

- **Authorization Basis Impacts**

The Grout vaults are currently inactive facilities. Utilizing the Grout vaults for waste storage would require a review of the safety analysis for the vaults, WHC-SD-WM-SSP-005, *Grout Facilities Standby Plan* (WHC 1994), and a revision to the Authorization Basis (CHG 2000a; CHG 2000b) to return the facilities to operational status. This would include facility design and operations descriptions of the alternate storage facilities and associated hazard and accident analyses.

4.6 CONCENTRATE WASTE

4.6.1 Description

A concentration limit is established for DSTs to prevent the accumulation and release of flammable gas. The current operating practice is to operate the 242-A Evaporator with a margin below the approved concentration limit to ensure that the limit is not exceeded. If the limit were raised, further concentration of the waste is possible. There are two phases to this option. The first concentrates the waste to the current limit; the second establishes a new limit and concentrates the waste to that limit.

4.6.2 Background

The 242-A Evaporator is used to reduce waste volume by removing water from tank waste up to a concentration limit. Concentration of the waste is currently limited to a density of less than 1.41 g/mL (Fowler 2000). This limit is based on the observation that the tanks with a density greater than 1.41 g/mL exhibited gas release events (Reynolds 1994, Estey and Guthrie 1996). Tanks SY-101, SY-103, AN-103, AN-104, AN-105, and AW-101 exceed a density of 1.41 g/mL and exhibited this behavior. These tanks were placed on the Flammable Gas Watch List. Tanks that are not the Flammable Gas Watch List all have densities less than 1.41 g/mL.

While all tanks on the Flammable Gas Watch List generate and retain gas, only tank SY-101 released the gas in volumes large enough for the headspace to reach flammable limits. It may be possible to concentrate the waste beyond the 1.41 g/mL density limit, but to a concentration less than tank SY-101. This option examines concentrating the waste to three different end points above the 1.41 g/mL limit thereby providing a range of additional capacity gained by further waste concentration.

Recently, another criterion has been suggested based on physical mechanisms required to accumulate and release gas from the waste. Scientists have identified four conditions that exacerbate gas retention and increase the probability of a large buoyant displacement gas release event (Meyer and Stewart 2000):

- a layer of supernatant liquid more than one to two meters deep,
- a layer of settled solids more than one to two meters thick,
- a small density difference between liquid and settled solid layers, and
- a high gas generation rate.

Although the relationship between these conditions and gas release events has been evaluated, raising the waste concentration limit would result in an increase in the risk of large buoyant displacement gas release events. A technical basis for a new concentration limit would be required.

4.6.3 Evaluation of Option

4.6.3.1 Additional Capacity (Gallons)

Increasing waste densities to the current 1.41 g/mL limit would result in an increase in tank availability of 2200 kgal. Further concentration could produce an additional 1700 kgal. Additional evaporator campaigns with accompanying transfers would be required. All operations are technically feasible. Increasing waste density to 1.41 g/mL would not require a change to safety documentation. Revisions to the Authorization Basis (CHG 2000a, CHG 2000b) are required above this level.

Table 4-18 shows those tanks that have the potential for increased capacity resulting from concentration of waste. The following tanks were eliminated from consideration:

- the 200 West Area DSTs (SY-Farm) because of the distance to the 242-A Evaporator,
- aging waste tanks discussed in Section 4.4,
- complexant tanks AN-102 and AN-107 because the waste density is near the 1.41 g/mL limit and in the past, complexants have effected the transfer properties of concentrated waste,
- Flammable Gas Watch List tanks due to existing concentrations,
- tanks containing less than 100 kgal of liquid, because these tanks are planned for additional waste storage with subsequent concentration, and
- tanks previously identified for concentration in Strode and Boyles (2000).

The current liquid volume is taken from *Waste Tank Summary Report for Month Ending December 31, 2000* (Hanlon 2001). However, Table 4-18 accounts for the recent AP-107 to AW-102 transfer.

Table 4-18. Summary of Liquid Volume Based on Further Concentration

Tank	Average Density (g/mL)	Volume (kgal)	Volume at 1.41 g/mL (kgal)	Volume at 10 M Na (kgal)	Volume at 12.5 M Na (kgal)	Volume at 15 M Na (kgal)
241-AP-101	1.31	1114	842	716	573	477
241-AP-102	1.20	1089	531	452	361	301
241-AP-103	1.08	282	55	47	37	31
241-AP-104	1.30	1109	811	690	552	460
241-AP-105	1.31	1068	808	686	549	458
241-AW-103	1.06	146	21	18	15	12
241-AW-105	1.03	172	13	11	9	7
241-AY-102	1.13	395	125	106	85	71

Concentration of the existing waste identified in Table 4-18 to the current 1.41 g/mL density limit gains 2200 kgal of waste storage volume. Further concentration would create more storage capacity but would also create potential operational concerns. Two cases are evaluated. One case is concentration to 12.5 gram-moles per liter (M) sodium, which approximates double-shell slurry feed, the waste type in some of the current Flammable Gas Watch List tanks. The second case is concentration to 15 M sodium, which approximates double-shell slurry, the waste type that was stored in tank SY-101. The maximum amount that could be saved through the creation of double-shell slurry waste could be as high as 3500 kgal.

Concentration of waste to the 1.41 g/mL density limit will be performed by the 242-A Evaporator. A total of approximately 6000 kgal will be processed over a six-year period. This would add one evaporator campaign per year to the current planning base. Two evaporator campaigns per year are scheduled through 2003. An evaporator outage is planned for all of 2004.

4.6.3.2 Cost

The cost estimate for concentration of waste to the 1.41 g/mL density limit is presented in Table 4-19.

Table 4-19. Cost Estimate for Concentrate Waste Option

Activity Description	Cost ($K)
Sample and Analyze Tanks	4000
Perform Compatibility Assessments	280
Revise Procedures	150
Perform Transfers to AW-102	1040
Perform Evaporator Campaigns above existing baseline	2500
Perform Transfers from AW-106 to DSTs	780
OPTION TOTAL	**$ 8,750**

The cost estimate is based on the following assumptions:

- waste is concentrated to a density of 1.41 g/mL,
- current evaporator operating costs are prorated by processed waste volume,
- waste from eight tanks will be processed in six evaporator campaigns,
- eight grab samples are collected and analyzed per evaporator waste acceptance criteria at $500K each,
- fourteen compatibility assessments are performed at $20K each, and
- eight transfers to the evaporator feed tank and six transfers from evaporator receiver tank are performed at $130K each.

A preliminary schedule of expenditures for each additional evaporator campaign follows:

- perform all activities for single feed tank campaign in less than one year each, $1,245K, and
- perform all activities for two feed tanks per campaign in less than one year each, $1,885K.

The following potential costs are excluded from the estimate:

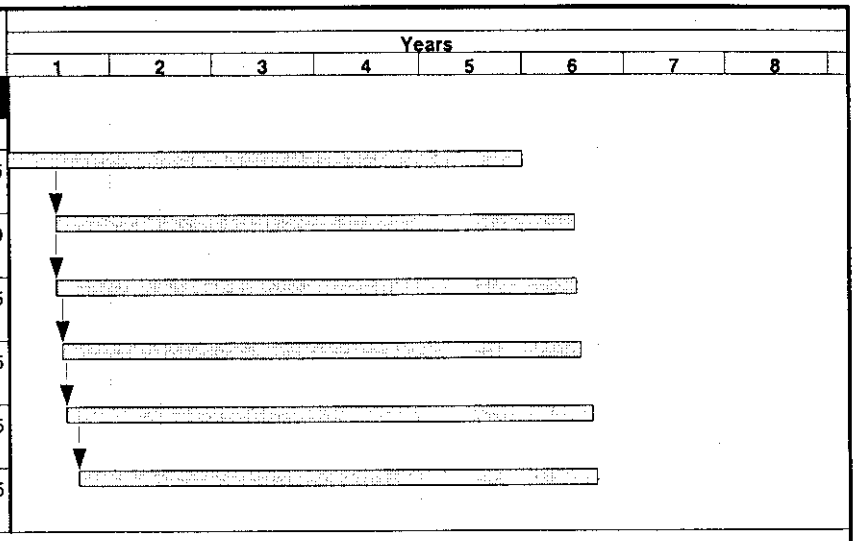
- feasibility studies and safety analyses for concentrating waste above 1.41 g/mL,
- processing waste to densities above 1.41 g/mL,
- modifications to Tank Farm facilities for safe storage of waste processed to density grater than 1.41 g/mL, and
- evaporator upgrades and maintenance.

4.6.3.3 Schedule

The schedule for this option is presented in Figure 4-6 and is based on one additional evaporator campaign per year. The review and complete implementation of this option would take approximately six years. Some additional capacity would be realized on an annual basis. The schedule could be compressed to three years by running two additional campaigns per year instead of one.

Figure 4-6. Schedule for Concentrate Waste Option

Activity ID	Activity Description	Orig Dur
OPTION 4.6		
O100100	SAMPLE & ANALYZE TANKS	1,305
O100200	PERFORM COMPATABILITY ASSESSMENTS	1,320
O100300	REVISE PROCEDURES	1,325
O100400	PERFORM TRANSFERS TO AW-102	1,315
O100500	PERFORM EVAPORATOR CAMPAIGNS	1,335
O100600	PERFORM TRANSEFRS FROM AW-106 TO DST'S	1,315



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4.6.3.4 Feasibility Considerations

Additional considerations for the feasibility of concentration of the waste in DSTs are discussed below. Table 4-20 provides the summary assessment of these considerations based on concentrating waste up to the 1.41 g/mL density limit.

Table 4-20. Feasibility Considerations for Concentrate Waste Option

Criteria	High Feasibility	Medium Feasibility	Low Feasibility
Technical Feasibility	X		
Environmental Risk	X		
Health and Safety Risk	X		
Maintainability and Operability	X		
Environmental Regulatory Impacts	X		
Authorization Basis Impacts	X		

- **Technical Feasibility**

  Minimal technical feasibility issues are identified for the concentration of DST waste to a density of 1.41 g/mL. The activities that are necessary to concentrate the waste are standard operations at the Hanford Site and no new technology would be required. The waste chemistry and potential for significant solids precipitation would be evaluated prior to concentration of waste to the 1.41 g/mL density limit. However, concentrating waste beyond a density of 1.41 g/mL is not currently allowed in the tank farm Authorization Basis (CHG 2000a, CHG 2000b) and DST facility modifications for the safe storage of wastes concentrated to a higher density are probable. The 242-A Evaporator Authorization Basis (Campbell 1998) would need to be evaluated for constraints on additional waste concentration. A cost benefit analysis is needed to determine if concentration beyond a 1.41 g/mL density should be pursued.

- **Environmental Risk**

  No incremental environmental risk is incurred by concentration of DST waste.

- **Health and Safety Risk**

  Concentration of waste to 1.41 g/mL has been fully evaluated and does not pose additional worker and safety risks. Concentration of tank waste to a density greater than 1.41 g/mL increases the potential that the waste will generate and retain flammable gas (Reynolds 1994, Estey and Guthrie 1996). This presents a safety concern that requires technical evaluation.

- **Maintainability/Operability**

  No maintainability or operability issues are expected by concentration of DST waste. Concentration of tank waste to a density greater than 1.41 g/mL is likely to require DST facility modifications for the safe storage of wastes, thereby increasing operations activities and maintenance.

- **Environmental Regulatory Impacts**

  No environmental regulatory issues are incurred by concentration of DST waste.

- **Authorization Basis Impacts**

  The tank farm Authorization Basis (CHG 2000a, CHG 2000b) currently allows concentration up to 1.41 g/mL. No amendment would be required for concentration up to this limit. An amendment would be required for concentration in excess of this limit. The 242-A Evaporator Authorization Basis (Campbell 1998) would need to be evaluated for constraints on additional waste concentration beyond 1.41 g/mL.

4.7 UTILIZE DOUBLE-CONTAINED SURFACE STORAGE

4.7.1 Description

Alternatives to the construction of new DSTs have been proposed as potential methods for increasing waste storage capacity. Two alternatives for double-contained surface storage evaluated in this option are as follows:

- use a compliant bladder in a lined basin similar to Liquid Effluent Retention Facility for interim storage, and
- expand capacity of planned Waste Receiving Facilities.

4.7.2 Background

This option presents two alternatives to traditional buried underground storage tanks for increasing waste storage capacity. Potentially cost-effective alternatives to construction of new DSTs are presented here.

Option 4.7A - Compliant Bladder in a Lined Basin

This alternative would store tank waste in a regulatory compliant bladder within a lined open-air basin with leak detection. A bladder would be installed inside a Liquid Effluent Retention Facility style basin and would be the primary containment. The secondary containment would be the lined basin. This system would require a feed with low radioactive content to minimize shielding requirements and radiation damage to the bladder. To reduce radioactive content, the SST waste would have to be treated at a Waste Receiving Facility that has been modified to separate cesium from the waste. The feed could not contain solids because retrieving solids from a bladder is not typically performed. The cost estimate for this alternative includes upgrades to the planned Waste Receiving Facilities to separate cesium and solids from tank waste.

Option 4.7B - Waste Receiving Facilities

Three Waste Receiving Facilities will be constructed to support retrieval of SSTs (Garfield et al. 2000). Waste Receiving Facilities, which are similar in function to the existing DCRTs, are planned to be operational near B-Farm, T-Farm, and U-Farm in 2014. These facilities with a planned total capacity of 2500 kgal could be used to store tank waste. Expanding the capacity of the Waste Receiving Facilities tanks is feasible at this time since their design has not been started.

Presently, the design concept is to have two to six small 150-kgal tanks constructed in a concrete vault. There are three such facilities planned, for a total of 14 small tanks. The mission of the

tanks is staging retrieved SST waste prior to sending the waste to DSTs. There are a number of options for expanding the Waste Receiving Facilities capacity including increasing the size of the planned tanks from 150 kgal to 300 kgal or adding additional 150-kgal tanks. However, these facilities are not scheduled to be available in the 2007 - 2011 time period. Implementation of this option would also require acceleration of the project schedule.

4.7.3 Evaluation of Option

4.7.3.1 Capacity

Option 4.7A - Compliant Bladder in a Lined Basin

Each Liquid Effluent Retention Facility-style basin with a compliant bladder would add 1000 kgal of waste capacity beyond that available in the DST system.

Option 4.7B - Waste Receiving Facilities

If the Waste Receiving Facilities design was expanded by two additional tanks for each of the three Waste Receiving Facilities, 900 kgal of waste storage capacity would be created beyond that available in the DST system (150 kgal x 2 x 3 = 900 kgal).

4.7.3.2 Cost

Option 4.7A - Compliant Bladder in a Lined Basin

Installation of a double-containment surface storage basin and modification to an associated Waste Receiving Facility were costed. A double-containment surface storage basin will be designed, constructed, tested, and turned over to tank farm operations for beneficial use. The double-containment surface storage will consist of a bladder-type tank located inside a lined earthen basin. The configuration of the basin is similar to the basin that forms part of the existing Liquid Effluent Retention Facility located in the 200 East Area. The storage capacity and size of the bladder tank will be 1 million gallons. In order to utilize a bladder-type tank within an earthen basin for waste storage, cesium and solids must be removed from the waste. The modifications to the Waste Retrieving Facilities will consist of expanding the size of the vault to enable the installation of two new process lines that will remove the cesium and solids. The new process equipment will need to be shielded because of high radiation levels and operated remotely. The cost for these relatively complex equipment are not included in the following cost estimate.

The cost estimate for this option is presented in Table 4-21 and is based on process system cost based on interviews with subject matter experts.

Table 4-21. Cost Estimate for Option 4.7A - Compliant Bladder in a Lined Basin

Activity Description	Cost ($K)
Obtain Permitting and Regulatory Approval	1000
Prepare Bladder/Basin Design	800
Perform Bladder/Basin Procurement and Construction	2000
Perform Design, Procurement, Installation, and Testing of Waste Receiving Facilities Modifications *	4000
Conduct Start-Up and Testing	1000
OPTION TOTAL	**$ 8,800**

*The costs for this activity reflect a delta or "additional" cost for only the expanded scope. The expanded scope includes specifying two new separation process systems and modifying the facility to accept and operate these systems. The costs for the cesium and liquids removal process equipment are not included in the cost estimate.

The baseline cost of $127,400K for a six-tank Waste Receiving Facility would need to be accelerated by three to seven years to support this option. The Waste Receiving Facility would need to be completed between 2007 and 2011 to alleviate tank space shortage in that time period.

The cost estimate is based on the following assumptions:

- a single Bladder/Basin will be located adjacent to a Waste Receiving Facility;
- the location of the single Bladder/Basin/Waste Receiving Facility will be sufficient service for all tank farms;
- the scope of this option will become part of the original design requirements document for the Waste Receiving Facility and will result in minimal cost increase to the project.; and
- the project is of medium complexity based on using standard technologies for the Bladder/Basin, ion exchange, and filtration systems in a radioactive/hazardous environment.

Option 4.7B - Waste Receiving Facilities

The modifications to the Waste Receiving Facilities will consist of expanding the size of the building to enable the installation of additional storage capacity. Two additional 150-kgal storage tanks will be added to each of three Waste Receiving Facilities. The net result will be an additional 900 kgal of storage.

The cost estimate for this option is presented in Table 4-22.

Table 4-22. Cost Estimate for Option 4.7B - Waste Receiving Facilities

Activity Description	Cost ($K)
Obtain Permitting and Regulatory Approval	1000
Prepare Waste Receiving Facilities design	500
Perform Waste Receiving Facilities Procurement and Construction*	4000
Conduct Start-Up and Testing	250
OPTION TOTAL	**$ 5,750**

*The costs for this activity reflect a delta or "additional" cost for only the expanded scope. The expanded scope for each Waste Receiving Facility includes specifying two new 150 kgal storage tanks and modifying the facility to accept and operate these tanks.

The River Protection Project baseline presently include $313,000K to design and construct three Waste Receiving Facilities starting in 2008 with completion in 2014. To implement Option 4.7B, budget to construct the three facilities would need to be accelerated three to seven years to make them available between 2007 and 2011.

The cost estimate is based on the following assumptions:

- the scope of this option will become part of the original design requirements document for the Waste Receiving Facilities that will result in a minimal cost increase to the project;
- the original Waste Receiving Facilities requirements, other than volume, are sufficient for this option;
- the project is of medium complexity based on using standard technologies for the storage tank in a radioactive/hazardous environment; and

A preliminary schedule of expenditures is as follows:

Year	Annual Total
1	$250K
2	$375K
3	$1,625K
4	$1,625K
5	$1,775K
6	$100K

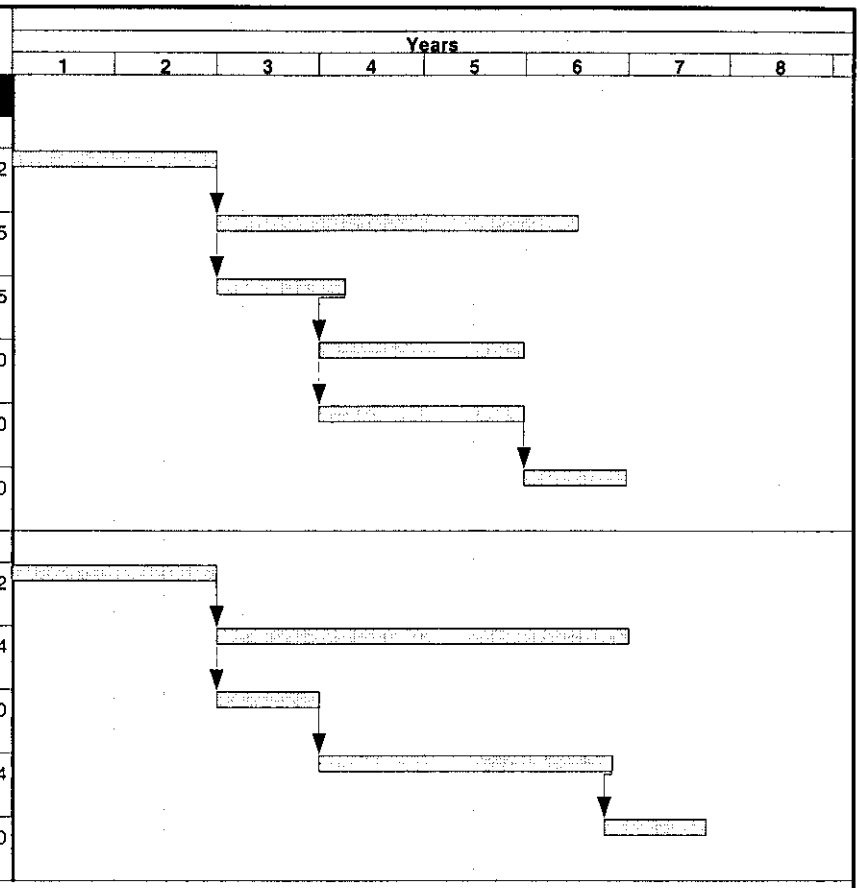
This preliminary schedule of expenditures is not budget grade, but is for scoping purposes only.

4.7.3.3 Schedule

The schedule for this option is presented in Figure 4-7.

Figure 4-7. Schedule for Utilize Double-Contained Surface Storage Options

Activity ID	Activity Description	Orig Dur
OPTION 4.7A & 4.7B		
USE LERF FOR INTERIM STORAGE		
P100100	AQUIRE FUNDING	522
P100200	OBTAIN PERMITTING & REGULATORY APPROVAL	915
P100300	PREPARE BLADDER/BASIN DESIGN	325
P100400	PERFORM BLADDER/BASIN PROCUREMENT & CONSTRUCTION	520
P100500	DESIGN, PROCURE, INSTALL & TEST WRF MODIFICATION	520
P100600	CONDUCT STARTUP & TESTING	260
EXPAND CAPACITY OF WASTE RECEIVING FACILITIES		
P100700	AQUIRE FUNDING	522
P100800	OBTAIN PERMITTING & REGULATORY APPROVAL	1,044
P100900	PREPARE WASTE RECEIVING FACILITIES DESIGN	260
P101000	PERFORM WRF PROCUREMENT & CONSTRUCTION	744
P101100	CONDUCT STARTUP & TESTING	260



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4.7.3.4 Feasibility Considerations

Additional considerations for the feasibility of utilization of double-contained surface storage are discussed below. Tables 4-23 and 4-24 provide summary assessments for the use of a compliant bladder in a lined basin and Waste Retrieving Facilities.

Table 4-23. Feasibility Considerations for Option 4.7A - Compliant Bladder in a Lined Basin

Criteria	High Feasibility	Medium Feasibility	Low Feasibility
Technical Feasibility			X
Environmental Risk		X	
Health and Safety Risk		X	
Maintainability and Operability			X
Environmental Regulatory Impacts		X	
Authorization Basis Impacts		X	

Table 4-24. Feasibility Considerations for Option 4.7B - Waste Receiving Facilities

Criteria	High Feasibility	Medium Feasibility	Low Feasibility
Technical Feasibility		X	
Environmental Risk	X		
Health and Safety Risk	X		
Maintainability and Operability	X		
Environmental Regulatory Impacts	X		
Authorization Basis Impacts	X		

- **<u>Technical Feasibility</u>**

  For Option 4.7A to be viable, it will be necessary to combine a compliant bladder in a lined basin with another concept to remove cesium and solids from the tank waste. Two new processes to remove cesium and solids will need significant shielding and also be operated remotely. While these operations have been performed previously at the Hanford Site and elsewhere, they are relatively complex and are expensive compared to tank waste storage. The combined impact of two new systems decreases the technical feasibility of this option. The bladder material may also require development to meet the waste storage needs, which may require several years of development to meet waste storage needs.

  Option 4.7B is technically feasible because the Waste Receiving Facilities are planned for future use during SST retrieval but have not yet been designed or built. The designs are based on DCRTs and do not require new technologies. The design concepts are based on DCRTs and do not require new technology.

- **Environmental Risk**

  There will be some inherent increase in environmental risk due to the open-air nature of the secondary containment on Option 4.7A, even with the cesium-137 removed from the waste. Even though the cesium-137 would have been removed, the transuranic and strontium-90 contents of the exposed waste would contribute significant risks due to dispersal of the waste.

  There are no new environmental risks introduced by expanding the size of the planned facilities in Option 4.7B.

- **Health and Safety Risk**

  Storing tank wastes at a Liquid Effluent Retention Facility style basin with a compliant bladder should not pose any additional concerns for worker safety and health. However, only low dose, low solids content supernatant that has been treated at the Waste Receiving Facilities to remove cesium-137 could be stored. The operation of the cesium-137 removal system could add new health and safety risks due to the expected dose of the initially retrieved wastes.

  Expanding tank waste storage at Waste Receiving Facilities will not pose any additional concerns for worker safety and health.

- **Maintenance and Operability**

  A Liquid Effluent Retention Facility style basin with compliant bladder option will be more difficult to maintain and operate than the Liquid Effluent Retention Facility. There would be additional equipment required to transfer the waste back to DSTs. Decontamination and decommissioning of the bladder will be difficult. Adding cesium removal to the Waste Receiving Facilities to support Option 4.7A will increase operational complexity.

  Option 4.7B should be no more difficult to operate than the current plans for operating the Waste Receiving Facilities and should be very similar to present DCRT operations.

- **Environmental Regulatory Impacts**

  Storing tank wastes at a Liquid Effluent Retention Facility style basin with a compliant bladder would be covered by a new permit due to the required initial treatment of the waste.

  Storing tank wastes at Waste Receiving Facilities would require minor modification to the existing tank storage permit or perhaps a new permit. However, there would be no increase in the permitting effort to achieve the increased storage capacity.

- **Authorization Basis Impacts**

  Authorization Basis amendments will be needed to implement Option 4.7A, because of the relatively complex cesium and solids removal processes and bladder storage.

  Authorization Basis amendments would also be required for Option 4.7B. However, there would be no new functions beyond present DCRT operations, and therefore, the amendments may be accomplished as part of the annual update.

4.8 CONSTRUCT NEW DOUBLE-SHELL TANKS

4.8.1 Description

This option would create additional waste storage capacity by construction of DSTs similar to the existing design. These new tanks will meet state and federal regulations and will have a 50-year design life. Each additional DST would increase available capacity by 1200 kgal.

4.8.2 Background

This option is consistent with current program strategy of moving SST wastes to compliant DST storage. The tanks will be designed using lessons learned from the Waste Tank Safety Program, the Multi-Function Waste Tank Facility design (WHC 1995), and the AQ and AT Tank Farm designs. Additional waste storage capacity could be available for use in the 2007 - 2011 time frame. The funding process is expected to take approximately two years; design and construction are expected to take five years. It is expected that savings would be obtained if a tank farm were built instead of individual tanks. The costs were based on a design that contained four tanks.

4.8.3 Evaluation of Option

4.8.3.1 Additional Capacity (Gallons)

Construction of each new DST will create 1200 kgal of additional capacity using an existing design.

4.8.3.2 Cost

The cost estimate for this option is presented in Table 4-25.

Table 4-25. Cost Estimate for Construct New Double-Shell Tanks Option (Based on Each One of at Least Four Tanks)

Activity Description	Cost ($K)
Obtain Permitting and Regulatory Approval	1000
Design	7000
Procurement and Construction	66000
Start-Up and Testing	1000
OPTION TOTAL	**$ 75,000**

The cost estimate is based on the following assumptions:

- adjustments were made to the $360M Advanced Conceptual Design cost estimate of Project W-236A, "Multi-Function Waste Tank Facility," a four-tank facility (WHC 1995);
- the Project W-236A estimate is used as a basis without detailed evaluation;
- an escalation factor of 3% per year was used to calculate past cost to present cost;
- weather enclosure for the tank farm was deleted from the Project W-236A estimate;
- mixer pumps are not used and were deleted from the Project W-236A estimate;
- tanks are constructed of carbon steel instead of 304L stainless steel;
- modification of the Environmental Impact Statement is required; and
- a tank farm containing four tanks, the same as Project W-236A was used as the basis for the cost of one tank. Additions of less than four tanks are likely to cost more per unit of volume.

An annual estimate of expenditures per tank in groups of four is as follows:

Year	Annual Total
1	$250K
2	$250K
3	$6,100K
4	$18,100K
5	$17,100K
6	$16,100K
7	$17,100K

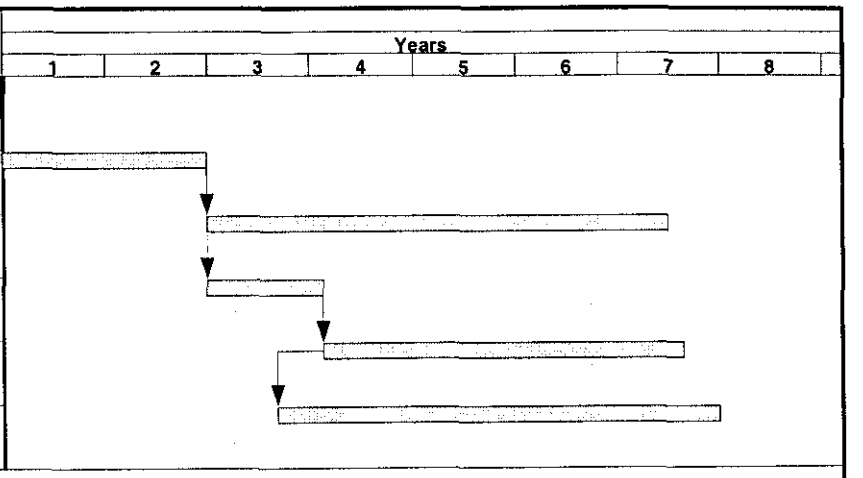
This preliminary schedule of expenditures is not budget grade, but is for scoping purposes only.

4.8.3.3 Schedule

The schedule for this option is presented in Figure 4-8.

Figure 4-8. Schedule for Construct New Double-Shell Tanks Option

Activity ID	Activity Description	Orig Dur
OPTION 4.8		
P200100	ACQUIRE FUNDING	519
P200200	OBTAIN PERMITTING & REGULATORY APPROVAL	1,173
P200300	DESIGN	300
P200400	PROCUREMENT & CONSTRUCTION	918
P200500	STARTUP & TESTING	1,127



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4.8.3.4 Feasibility Considerations

Additional considerations for the feasibility of constructing new DSTs are discussed below. Table 4-26 provides the summary assessment of these considerations.

Table 4-26. Feasibility Considerations for Construct New Double-Shell Tanks Option

Criteria	High Feasibility	Medium Feasibility	Low Feasibility
Technical Feasibility	X		
Environmental Risk	X		
Health and Safety Risk		X	
Maintainability and Operability		X	
Environmental Regulatory Impacts			X
Authorization Basis Impacts		X	

- **Technical Feasibility**

  Construction of new DSTs is technically feasible based upon previous engineering, construction, and operations experience. Detailed analysis of previous conceptual design estimates for DST construction is warranted and has the potential to reduce the cost per gallon derived from cost estimates for the Multi-Function Waste Tank Facility. For example, the River Protection Project plans to build 1500 kgal of low-activity waste feed storage capacity at the WTP for $43M.

- **Environmental Risk**

  New DSTs would be constructed per the requirements of Washington Administrative Code 173-303-640 (4)(c)(iii) that double walled tanks be designed as an integral structure (i.e., an inner tank completely enveloped within an outer shell) and be provided with a built-in continuous leak detection system. Operation of new DSTs would incur minimal incremental environmental risk; however, additional DSTs will result in an increase in closure costs for the Hanford Site.

- **Health and Safety Risk**

  The construction of new DSTs is a major construction activity that presents industrial safety hazards commensurate with other projects of this magnitude. No additional health risk to the public is expected from construction of new DSTs.

- **Maintainability/Operability**

  Additional maintenance or operational expense is incurred for the routine operation of additional DSTs. The maintenance and operational activities are similar current activities, although the newer DSTs are likely to be subject to fewer equipment failures.

- **Environmental Regulatory Impacts**

  Construction of new DSTs would require a change to the RCRA Part B permit to incorporate the new facilities. In addition, supplemental *National Environmental Policy Act* (NEPA) documentation would be needed. Significant public comment would be expected.

- **Authorization Basis Impacts**

  Construction of new DSTs would require an amendment to the tank farm Authorization Basis (CHG 2000a, CHG 2000b) to incorporate the new facilities. However, this would not involve new processes.

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5.0 OPTIONS EVALUATED LESS LIKELY TO ALLEVIATE 2007 - 2011 TANK SPACE SHORTAGE

In addition to the eight options considered likely to increase waste storage capacity during 2007 - 2011, several options were identified for evaluation that have the potential of increasing storage capacity in the longer term. Although these options require longer to develop and implement, successful deployment would reduce the need for additional DSTs. Given the implementation time and the greater uncertainties associated with these options, cost estimates and schedules were not developed.

The long-term options are categorized as follows:

- options that save or add to existing waste storage capacity,
- options for enhanced treatment alternatives at the WTP,
- options to store and/or treat waste outside the present system, or
- options that were evaluated and determined to be nonviable.

5.1 LONG TERM OPTIONS THAT SAVE OR ADD TO EXISTING WASTE STORAGE CAPACITY

These options increase existing waste storage capacity by utilizing alternate operating strategies to retrieve SST waste. The following alternatives are presented in this section:

- reduce or eliminate water added to retrieve SSTs, and
- retrieve and transport SST waste as solids.

5.1.1 Reduce or Eliminate water added to retrieve SSTs

Description

The planning basis for SST waste retrieval assumes that facility process water is used to mobilize solids to enable pumping of the waste. This option evaluates four SST retrieval approaches that reduce or eliminate water addition.

Background

Liquid in SSTs is being removed as part of the interim stabilization program to reduce the risk of leaks to the environment. The waste is diluted prior to transport to DSTs to prevent pipeline plugging. This waste is then pumped to the DST system, consuming extra DST capacity until it is evaporated. It would be possible to conserve DST space by modifying interim stabilization operations to segregate SST liquid in a DST that is planned for storage of SST retrieval waste. Interim stabilization will be completed in 2004, but the liquid could be used as an alternate retrieval fluid to reduce water addition. This will indirectly increase DST waste storage capacity available for SST retrieval.

Evaluation

Past-practice sluicing was used to retrieve SST C-106 waste to DST AY-102. This method used a liquid stream to mobilize solids in C-106 for transport to AY-102. The retrieval system recycled supernatant liquid from AY-102 to provide the carrier fluid for this operation. Future SST retrieval could use interim stabilization liquid as a carrier fluid for SST retrieval, thus reducing the amount of process water added for retrieval. This would reduce the final waste volume requiring DST storage. However, past-practice sluicing is not presently planned for any future SST retrieval.

A second approach is remote vehicular-deployed confined sluicing. This process is similar to past-practice sluicing in that a water stream is used to mobilize and transport solids from an SST to a DST receiver tank. However, the confined sluicer removes the water immediately after it is added. This method is more attractive than past-practice sluicing because much less water is added to the SST, reducing the potential for leaks. The mobilization liquid and the transfer dilution liquid could both use interim stabilization liquid, thereby reducing the volume of process water required to retrieve the SST waste. This method, utilizing process water, is being demonstrated in tank C-104 in response to HFFACO M-45-03I (Ecology et al. 1997). Development of a system using interim stabilization waste as the carrier fluid is required.

A third approach is fluidic mixing, a technology that mixes and pumps solids with no moving parts. For this retrieval method, a small amount of water is injected into the SST and vacuumed into a reservoir. The reservoir is then pressurized and the water jetted back into the tank. The process is repeated until sufficient mixing has occurred. The mixture is then pumped to a DST. This technology has been used successfully at the Oak Ridge National Laboratory to retrieve waste from an underground tank. This method is being evaluated for retrieval of tank S-102 waste in response to HFFACO M-45-05A (Ecology et al. 1997). The carrier fluid used to mobilize sludge could be interim stabilization liquid, thereby reducing the total retrieved waste volume. Development of a system using interim stabilization waste as the carrier fluid is required.

Saltcake dissolution is being developed for retrieval of tank S-112 in response to HFFACO M-45-03C (Ecology et al. 1997). In saltcake dissolution, water is sprayed over the surface of the waste to dissolve the salts. The waste is then pumped to a DST. The use of interim stabilization liquid for dissolution of saltcake is not feasible because the interim stabilization liquid is already saturated at ambient temperatures.

Water additions would eventually be evaporated; therefore, the evaluation will need to weigh the time and cost of additional evaporator runs versus the cost and increased operational complexity of using dilute waste to support retrieval.

5.1.2 Dry Retrieval and Transport of Solids

Description

The planning basis for SST waste retrieval assumes that facility process water is used to mobilize solids to enable pumping of the waste. This option evaluates the use of dry methods to retrieve and transport SST waste.

Background

The use of dry methods to retrieve and transport SST waste has been under consideration since 1969 (Krieg 1990). Early concepts adapted commercial earth moving equipment. For example, clamshells, backhoes, and jack hammers were to be operated through an opening in the top of the tank to remove the waste for transport in a dry conveyance system. In 1980, these efforts culminated in the design of a dry retrieval system that consisted of a large bridge structure that straddled the SST. Earth moving equipment was manipulated in the tank by a massive arm. The waste was to be placed in barrels for transport to a storage or treatment facility. The concept was never pursued based on cost and limited retrieval efficiency.

In 1992, the Retrieval Technical Working Group was formed to bring together a diverse body of technical experts to formulate a strategy for retrieval of SST and DST wastes. Wet and dry retrieval and transport methods were evaluated and none were recommended (DOE-RL 1992).

In 1995, the Acquire Commercial Technology for Retrieval (ACTR) program solicited private industry for proposals for retrieval systems for Hanford Site waste. The Hanford Tanks Initiative (HTI) project completed four demonstrations of proposed wet and dry retrieval systems from the ACTR program. No dry solid retrieval or transport technologies were considered viable.

Evaluation

Dry solids retrieval and transport approaches have developed and tested in previous retrieval program initiatives. None of the deployments were viable.

5.2 LONG TERM OPTIONS FOR ENHANCED TREATMENT ALTERNATIVES AT THE WASTE TREATMENT PLANT

These options increase available waste storage capacity by utilizing enhanced treatment strategies at the Waste Treatment Plant by optimizing the waste treatment sequence. The following options are presented in this section:

- pre-concentrate prior to transfer to the WTP,
- blend DST feed, and
- blend retrieved SST waste with WTP feed.

5.2.1 Pre-Concentrate Feed Prior Transfer to the Waste Treatment Plant

Description

This alternative considers pre-concentration of the WTP feed prior to transfer of the waste in order to increase existing DST capacity.

Background

Pre-concentration of the waste to the current limit of 1.41 g/mL prior to transfer to the WTP would remove water contained in the waste and reduce the total waste volume. This option is similar to the concentration of waste option presented in Section 4.6. However this idea was focused on the ability to transfer more concentrated waste to the WTP. The purpose was to increase storage space in the WTP low-activity feed tanks. Pre-concentration would effectively increase the receiving available space above that in the current planning baseline. Waste would be diluted at the WTP for processing.

Evaluation

This option is a restatement of the *Concentrate Waste Option* presented in Section 4.6 presented from the WTP operations perspective rather than the Tank Farms operations perspective. See Section 4.6 for the evaluation. Slurry transport issues have not been resolved. Transfer of concentrated WTP feed increases the time between feed deliveries.

5.2.2 Blend Double-Shell Tank Feed to the Waste Treatment Plant

Description

This alternative considers blending of WTP feed source tanks to improve WTP processing rates thereby making additional capacity available for SST retrieval.

Background

The concept involves blending WTP feed sources to reduce the variability of feed compositions. Specifically, the blending has the potential to increase WTP operational efficiency by reducing the peak concentration of waste constituents detrimental to the WTP process. For example, blending to reduce the peak sulfate concentration in WTP feeds could reduce glass formulation complexity and associated costs. The potential exists to increase WTP processing rates by optimizing the amount of constituents that limit waste loading. Increased WTP processing rates will empty DSTs more quickly, making additional capacity available for SST waste retrieval.

Blending feed prior to transfer to the WTP would be performed for cases where the volume of glass would remain constant or could be reduced. If enough waste can be blended and the tanks filled to the maximum working volume, additional storage capacity would be made available. Blending of waste may also provide an opportunity to increase the concentration of the waste and thereby reduce storage volume requirements.

Evaluation

Preliminary evaluation of WTP feed blending indicates that blending of low-activity feeds could benefit WTP by providing a more uniform feed. The preliminary evaluation considered the use of the AP tank farm for blending of waste streams and feeding waste to WTP. Although, the preliminary evaluation indicated that blending appeared promising, the ability of feed blending to provide additional waste storage capacity was not considered and would require further evaluation.

Blending will affect both DSTs and the WTP operations. Flow sheet evaluations, waste volume projections, and transfer evaluations will be required to identify specific blend candidates. Initial scoping work would require 6 to12 months to identify potential blending strategies. Additional detailed follow-up is required to confirm specifics and quantify advantages. This effort will require a modification of the modeling activities in the existing program. Requirements and safety analyses in the tank farms and the WTP could be affected.

5.2.3 Blending Retrieved Single-Shell Tank Material with Waste Treatment Plant Feed

Description

This option is a variation of the ideas discussed in Section 5.2.2.

Background

The waste retrieved from SSTs provides a broader spectrum of waste types for potential blending than the waste currently stored in the DSTs. By considering the use of the SST wastes as potential WTP feed earlier in the disposal process, potentially optimal WTP feeds can be obtained.

Evaluation

As discussed in Section 5.2.2, a preliminary evaluation of low-activity waste feeds indicated that blending appeared promising; however, the ability of feed blending to provide additional waste storage capacity was not considered and would require further evaluation. Although the preliminary evaluation did not consider SST waste, it is likely that appropriate SST waste could be blended with WTP feed sources with beneficial results.

The blending of retrieved SST waste with WTP feed sources is a change in the WTP feed delivery strategy and would require integration of SST retrieval plans, DST waste feed delivery plans and WTP operating plans. An alternatives generation and analysis would be required to assess the benefits of SST waste blending and the cost of implementation.

5.3 LONG TERM OPTIONS TO STORE AND/OR TREAT OUTSIDE PRESENT SYSTEM

These options increase available waste storage capacity through storage and/or treatment in facilities outside the current DST and WTP system. Options considered include:

- separate non-hazardous, non-radioactive fractions,
- Grout vaults with better waste form,
- use evaporators for chemical reactor space, and
- deploy low volume capacity processing units.

5.3.1 Separate Non-Hazardous, Non-Radioactive Waste Fractions

5.3.1.1 Separate Non-Radioactive Salt from the Waste

Description

The option considers the use of modular ex-tank processing units to remove a significant volume of non-radioactive salt from SST or DST waste. The salt stream would then be converted into a material suitable for disposal or aboveground interim storage, thereby creating available DST space.

Background

Waste storage capacity is created in the DST system by extracting a large volume of non-radioactive salts, considered low-activity waste. The salts would be converted into a non-hazardous material and/or immobilized into a non-hazardous material for disposal. Removal of the non-radioactive, non-hazardous materials from SSTs results in a smaller volume of waste requiring transfer to the DST system.

The unique merit of this concept is that non-radioactive chemicals comprise the majority of the high-level waste volume in the DSTs and SSTs. Direct extraction of the non-radioactive species would create useable DST space. The approach is effectively a pretreatment process, but differs significantly from the baseline pretreatment in that it selectively removes target radionuclides. In this concept, the non-radioactive salts are selectively removed in a manner conceptually similar to the waste evaporation to reduce waste volume.

Evaluation

The removed salt must be declared incidental waste, that is, no longer high-level waste requiring storage in a deep geologic repository for successful deployment of this option. A clearly defined disposal pathway must be defined that meets regulatory requirements and achieves stakeholder

acceptance. The extracted salt stream must have sufficiently low levels of radionuclides and will need to be converted into an acceptable non-hazardous material to allow disposal.

Candidate technologies to extract the salt with negligible radionuclides have been investigated. These technologies can be broadly grouped under the topics of crystallization, electrochemical separation (salt splitting for example), and solvent extraction. Both the crystallization and electrochemical technologies have had significant development and have been proven at the laboratory bench scale with actual waste, but technical issues for operational implementation remain. The solvent extraction approach for this specific purpose is relatively new.

One issue with the crystallization technology involves the fate of sulfate, which is the chemical species limiting the low-activity waste glass waste loading. Previous crystallization studies focused on acidifying waste and then conducting crystallization because testing showed much better radionuclide separation with acidified waste. The formation of gels with alkaline waste was also avoided. However, it may be necessary or preferable to do crystallization with alkaline wastes to additionally crystallize sulfate salts. The ability to achieve necessary radionuclide removal and avoid gelling will require development.

This approach is an alternate treatment, storage, and/or disposal option for some of the low-activity waste fraction. Accordingly, the regulatory requirements, issues, and drivers are the same as those that apply to the current baseline for low-activity waste glass. The current baseline employs ex-tank pretreatment in a facility to separate high-level waste feed into a high-level waste stream containing essentially all of the radioactivity and a low activity fraction that has key radionuclides removed.

Finally, the waste is a listed hazardous waste, as defined by RCRA, and will need to be delisted, which will require that the waste be rendered non-hazardous and meet land disposal restrictions.

5.3.1.2 Separate Low-Activity Waste from High-Activity Waste

Description

In this concept, the SST wastes would be retrieved from the tanks and would be treated in low capacity systems to separate the wastes. A low-activity waste stream would be stabilized for interim storage or disposal; and a low-volume, high-activity waste stream would be transferred to the DST system for future vitrification. This differs from the option in 5.3.1.1, which only removes non-radioactive components. In this option, the removed stream contains low activity radionuclides, as well as non radioactive components.

Background

Saltcake, composed primarily of sodium nitrate and sodium hydroxide, would be dissolved and the aqueous solution would be sent to a separation process where the sodium and nitrate would be removed. Several technologies are being developed that could be used including:

- steam reforming to destroy the nitrate via reduction. The sodium is tied with clay that is added to the process resulting in an inert solid and a clean salt. Both resulting wastes should be suitable for low-level waste disposal;
- electrochemical nitrate destruction followed by electrochemical/membrane technology for sodium removal;
- electrochemical nitrate destruction followed by sodium removal using solvent extraction; or
- Clean Salt, a precipitation process.

Sludges, undissolved solids, and the residual waste stream after nitrate and sodium removal would be sent to the DSTs. The recovered sodium could be converted to a form for use later as a processing chemical (such as sodium hydroxide), for storage as a stabilized low-activity waste for future immobilization, or for immediate disposal as a glass, grout, or clay mineral. The removed sodium would still be contaminated and would need to be managed as a radioactive and possibly hazardous waste.

Evaluation

The technologies for removing the sodium and nitrate from the wastes are at various stages of development and would need additional development and demonstration before implementation. The forms selected for management of the wastes would need to be selected and qualified as appropriate. New facilities would need to be designed, constructed, and permitted.

In concept, this is very similar to the project baseline strategy, but could use small "packaged" treatment units, to create alternate low-activity waste forms of much of the waste volume, while following the same pathway for the high-level waste fraction. The environmental and regulatory activities would need to be further developed.

5.3.2 Grout Vaults with Better Waste Form

Description

The objective of this concept is to use the existing Grout vaults as a facility to dispose a substantial volume of low-activity waste and thereby create useable DST space. To be successful, the immobilized waste form combined with the containment provided by the Grout vault would need to meet regulatory requirements and achieve stakeholder acceptance.

Background

In the early 1990s, the strategy for low-activity tank waste disposal changed from immobilization as grout for disposal in vaults to immobilization in glass and packaging in individual stainless steel containers for near surface disposal. The current pretreatment plant removes radionuclides to a lower level than the low-activity waste that was originally planned for the Grout facility and improved waste forms have since been developed.

Use of the vaults for disposal of low-activity waste could be considered if improved pretreatment, immobilized waste form and waste packaging gained DOE, regulator, and stakeholder acceptance. Additionally, the approach must process tank waste sooner than the baseline plan of vitrification to be considered viable.

Waste volume can be removed from the DST system by extracting a low-activity waste stream via pretreatment of high-level waste and then immobilizing and disposing of the low-activity waste in the Grout facility. Rather than focusing on all low-activity waste streams, those that would be most compatible with the Grout facility could be used.

Evaluation

The key technical issues for this option are the selection of technologies that will achieve the necessary radionuclide removal and then the selection of an immobilization technology that will meet regulations and achieve stakeholder acceptance. There are a number of near term possibilities. For example, the WTP pretreatment facility will be designed to provide 60 metric tons per day of feed for low-activity waste glass, which is twice the capacity of the initial low-activity waste immobilization plant. This extra pretreatment capacity can enable a two-fold low-activity waste glassification expansion without expanding the pretreatment facility. The decision to expand the low-activity waste immobilization capacity is scheduled to occur in the 2009 - 2011 period, and hot processing to begin in 2018 if the decision is made to construct a second low-activity waste immobilization facility.

The lengthy time period between the 2007 hot start and the full pretreatment capacity being utilized in 2018 is an opportunity to use the pretreatment plant to process additional waste for immobilization in the grout facility. An additional processing step is required to transform the treated liquid waste coming from the pretreatment facility into acceptable waste form for the grout vaults.

A second option would be to conduct extensive in-tank separations to provide a sufficiently cleaned low-activity waste stream for immobilization and disposal in the grout facility. Again, the separations and waste form would need to be superior to what was considered in the early 1990s and has since been abandoned. This approach would present a number of technical issues in radiochemical and solid/liquid separations and waste form development that require resolution.

This option is an alternate disposal strategy for a low-activity waste fraction. Accordingly, the regulatory requirements, issues, and drivers are the same as those that apply to the current baseline for low-activity waste. Resolution of these issues and deployment of different low-activity waste disposal strategy sooner than the current baseline presents significant challenges.

5.3.3 Use Evaporators For Chemical Reactor Space

Description

This alternative considers the use of existing containment facilities to avoid building new facilities.

One obstacle to the use of small scale processing to reduce the volume of retrieved waste and the volume of waste ultimately converted into glass or waste form is the cost of construction of new containment for radioactive waste processing facilities.

Background

Evaporators were built inside suitable containment buildings. Use of the 242-S Evaporator building or unused space in the operational 242-A Evaporator could be used for small-scale waste processing facilities.

During site operations, evaporator facilities were built to reduce the volume of waste placed into storage. In the 200 East Area, the 242-A Evaporator is operational. In the 200 West Area, the 242-S Evaporator is idle and likely will not be operated as an evaporator again. The building is intact and ventilation is operational.

Successful use of existing available evaporator building space for small scale processing of retrieved waste could facilitate the reduction of waste volume, thereby making the existing DST capacity capable of accommodating a greater percentage of retrieved waste.

Evaluation

There are a number of technical issues that affect the use of evaporator buildings to contain chemical reactors. These include, but are not limited to, the following:

- the installation of processes in 242-A Evaporator would need to be planned so as not to interrupt evaporator operations,
- access to evaporator building containment areas is typically limited to cover blocks on the roof,
- existing lines into and out of the 242-S Evaporator are likely to be unusable, requiring replacement for connection to the tank farms, and

- the ventilation system acceptable for the idle 242-S Evaporator facility would require refurbishment to increase reliability.

Changes to the 242-A Evaporator or use of the 242-S Evaporator building require regulatory treatment permits, possible upgrades to ventilation and monitoring systems, and updates to the existing Authorization Basis (CHG 2000a, CHG 2000b).

5.3.4 Deploy Low Volume Capacity Processing Units

This option is the deployment of a skid mounted low-volume-capacity processing unit to treat tank waste thereby creating the opportunity for additional SST waste retrieval. The unit could be deployed to process DST waste for volume reduction or to process SST waste as it is retrieved. Two processes that could be deployed on small skid mounted units include, but are not limited to:

- separation of non-hazardous non-radioactive fractions from the waste, and
- waste vitrification.

5.3.4.1 Separation of Non-Hazardous Non-Radioactive Fractions

Description

This option involves separation of non-hazardous non-radioactive fractions from the SST waste. The volume of the remaining hazardous radioactive waste to be stored and vitrified could be significantly reduced. The Tank Focus Area is supporting development of skid-mounted systems capable of removing or recycling the sodium and nitrate in dissolved saltcake streams to significantly reduce the volume of waste to be sent to the DST tanks. This has a potential large cost saving because:

- the DST tank capacity required to handle the waste would be minimized,
- low-level waste vitrification costs could be reduced if a fraction of the waste can be separated for disposal as low-level waste, and
- disposal costs could be reduced further if supernate can be cleaned up sufficiently for disposal through the Liquid Effluent Retention Facility/Effluent Treatment Facility.

Background

The Tank Focus Area, a U.S. Department of Energy (DOE) sponsored technology development program, has been investigating potential waste treatment technologies for the past decade. Processes that have been identified as potentially viable for deployment as a small operating unit include:

- electrochemical nitrate destruction followed by electrochemical caustic recycle, as demonstrated the Savannah River Technology Center (SRTC) and by Pacific Northwest National Laboratory,
- electrochemical nitrate destruction followed by caustic recycle using solvent extraction,
- Clean Salt, a precipitation process developed at the Hanford Site, and
- Studsvik™ steam reforming to destroy the nitrate via reduction.

The electrochemical nitrate destruction has been demonstrated at Savannah River Technology Center in large-scale equipment, and this cell is available for Hanford use. In discussions with a private company, Electrosynthesis™, and Savannah River Technology Center, a skid-mounted process was proposed. A project outline was been drafted by Tank Focus Area and studies continue. There is a potential problem with the caustic recycle because the technology requires a membrane that complicates the maintenance requirements for this process.

When nitrate is destroyed via electrochemical system, a large volume of caustic is generated. This byproduct can be recovered and used for caustic addition to tanks or used for sludge washing. The stream also could be treated directly with a grout former to make a low-level waste form.

Electrochemical nitrate destruction followed by solvent extraction is a promising technology. The process maintains low reagent inventory, and is easy to flush for maintenance. The solvent extraction process appears promising, but has not yet been demonstrated.

Addition of the Clean Salt Process to the baseline operating plan would divert most of the low-activity waste stream to a new stream, non-radioactive salt. The Clean Salt Process does not address the high-level waste stream, which is low in sodium. It deals only with the low-activity waste stream, either before or after cesium ion exchange, where sodium salts account for over 90 percent of the estimated 200,000 metric tons of waste (dry weight basis).

The low-activity waste stream is acidified with nitric acid to pH 2. The acid solution is filtered to remove traces of insoluble solids, which are routed to the high-level waste. The clarified solution is evaporated until sodium nitrate ($NaNO_3$) crystals form. The $NaNO_3$ slurry is filtered. The filtrate, which contains the radionuclides, becomes the new salt-depleted low-activity waste stream. The $NaNO_3$ solids are washed with water or clean $NaNO_3$ solution to remove contaminated interstitial liquid. The wash liquid is recycled to the evaporator, and the washed solids are recrystallized from water as often as required to reach the desired level of decontamination.

The Studsvik™ process is a complete process to treat the tank wastes. Low-level waste (LLW) supernate is reacted with steam, a carbon source (a reducing agent and a fuel to keep bed temperature acceptable), and clay to tie up the sodium. The process operates at 550 to 650 °C. All of the anions are either destroyed (nitrate, oxylates, carbonates) or are scrubbed in the off gas (sulfates, chlorides, fluorides). The sodium is tied as sodium aluminasilicate, a solid

nonleachable material suitable for disposal. The water is evaporated. The solids are collected as sodium aluminum silicate ($NaAlSiO_4$), and as a clean salt composed primarily of sodium sulfate (Na_2SO_4). This salt can be sent to a low-level waste disposal facility. The process is operated at temperatures below that of an incinerator. Large volumes of gas are evolved which must be processed.

All of these technologies perform better with cesium-137 removal before processing. Removal of cesium-137 from has been demonstrated at the 1-gpm rate at Oak Ridge National Laboratory (ORNL), and three processes are being demonstrated in a rigorous evaluation of competing technologies at the Savannah River Site. The most mature process is ion exchange. A column 4-ft tall, 2 ft in diameter, with a backup guard column will be sufficient to handle the Hanford low volume capacity processing unit requirements. This configuration is appropriate because it can fit in a shielded cask. It may also be possible to remove cesium in the Waste Receiving Facilities (see Section 4.7).

Evaluation

The technology for separation of the non-hazardous, non-radioactive fraction from tank waste has been demonstrated on an experimental scale and would require significant additional development to be implemented in the proposed manner.

This alternative will add to maintenance or operational expense. Start-up of new technology will present maintenance and operational challenges including an infrastructure for control, feed staging and handling, waste stream storage and recycle, and off-gas treatment. This option will be slightly more difficult to operate than the current option used. The units are small but since they are experimental, they will require operational supervision.

Assuming five years of operation, low volume capacity processing units such as described in this section would make approximately 1,000 kgal of existing DST capacity available. A 1-gpm low volume capacity processing unit operating at 50 percent efficiency for 5 years would remove approximately 1,000 kgal from the DSTs.

These technologies are experimental, but have been successfully demonstrated experimentally on low-level waste; therefore, the safety issues should be understood. There is an environmental risk due to the experimental nature of this technology. Installation of a low volume capacity-processing unit will require permitting, and because these technologies are experimental, the permitting issues may not be completely understood. Changes to the Authorization Basis (CHG 2000a, CHG 2000b) will also be required.

5.3.4.2 Small Mobile Vitrification Plant

Description

Vitrification is a waste treatment process that turns mixed waste into glass. It provides a stable, non-leaching waste glass product suitable for long-term storage. Vitrification also reduces the volume of waste by evaporating water, oxidizing organics into harmless gases, and consolidating metals and other contaminants into non-porous solids. Issues with vitrification include transporting waste to vitrification facilities that increase the risk of worker exposure and waste-related transportation incidents. Additionally, vitrification facilities can be expensive to construct.

Background

One possible solution to issues associated with vitrification for some of the waste streams is a modular, transportable vitrification system for mixed waste called the Transportable Vitrification System, which costs less than $5 million. The Transportable Vitrification System was designed and fabricated by Envitco, Inc. of Toledo, Ohio, which has an U.S. patent pending. The Transportable Vitrification System was built to be moved from site to site to treat some of the U.S. Department of Energy's low-level mixed waste streams.

The first process step in the Transportable Vitrification System is mixing wastes with additives, such as sand, soda ash, borax, lime, or alumina, to promote the formation of a stable glass product. The mixture enters the Joule-heated melter, where currents passing between electrodes transform the waste mixture into a molten state. This process decomposes and dissolves inorganics and locks radioactive materials into the glass melt. The melter's off-gas system treats any vapors evolved from the melt. The molten material is poured into steel containers as it is produced. After cooling, the containers of glass are stored for eventual disposal.

Moving the Transportable Vitrification System requires about 12 tractor-trailers for its modules including feed preparation, melter, off-gas, control and services, and process laboratory. Transport and reassembly of the transportable vitrification system takes about six weeks. The Transportable Vitrification System is designed to produce 300 pounds of glass per hour (depending on the type of waste) and to process wet, dry, and slurried waste.

Evaluation

This technology would have to be used in conjunction with a cesium-137 removal process to provide low-level waste to the melter. The cesium-137 would be sent to the WTP. This option is not a replacement to the WTP, because the Transportable Vitrification System could not handle the high-level waste fractions nor does it have enough throughput capacity.

Assuming five years of operation, the Transportable Vitrification System, a 1-gpm unit operating at 50 percent efficiency for 5 years would remove approximately 1,000 kgal from the DSTs or from SSTs (via waste receiver tanks). It, therefore, would make approximately 1000 kgal of existing DST capacity available.

The mobile vitrification process unit would require a significant development program to implement. The technology is experimental but has been successfully demonstrated on low-level waste; therefore, the safety issues should be understood. There is a possible new environmental risk due to the experimental nature of this technology. The process will require permitting. Because these technologies are experimental, the permitting issues may not be completely understood. Installing the processing unit will also require changes to the Authorization Basis (CHG 2000a, CHG 2000b).

This alternative will add to maintenance and operational expense. Start-up of new technology will present maintenance and operational challenges including an infrastructure for control, feed staging and handling, waste stream storage and recycle, and off-gas treatment.

5.4 OPTIONS EVALUATED WHICH WERE DETERMINED TO BE NONVIABLE

Several options were identified in the workshops as having potential to increase available tank capacity. After evaluation, the following options were determined to be nonviable:

- consolidate SST Waste in the SST system,
- place liners in SSTs,
- delay caustic addition to the DSTs,
- postpone deactivation of facilities, and
- use existing facilities at Energy Northwest.

5.4.1 Consolidate Single-Shell Tank Waste in Single-Shell Tank System

Description

This option considers consolidation of SST wastes in the SST system.

Background

Many of the SSTs are considered sound. If these noncompliant storage tanks can be used for storage pending treatment, then the need for additional DST storage capacity would be reduced.

Sound tanks exist in the S-Farm in the 200 West Area and BX and BY Farms in the 200 East Area that could be used in lieu of DSTs to consolidate retrieval waste from other SSTs until compliant capacity becomes available. These specific farms are located in close proximity to active DSTs and to the cross-site transfer system. Total available sound SST capacity in the BX and BY Farms is approximately 5600 kgal. There are eight sound tanks in S-Farm that could be used with over 2,900 kgal of capacity.

Evaluation

The SSTs do not meet RCRA standards for waste storage based on a lack of double containment. In addition, all SSTs are beyond or very close to their design life. Every SST farm contains tanks that are known to have leaked. Storing large volumes of liquid in SSTs presents an environmental risk of future leaks. Appropriate leak detection and monitoring and leak mitigation strategies would reduce risk. In most cases, it would also mean adding liquefied waste to SSTs that have already been interim stabilized to remove as much liquid as practical.

Analyses of the potential for hazardous gas retention and release would be required. The relative benefits and risks of storing only dilute interim stabilization liquid, retrieving both solids and liquids from other SSTs, or reducing volume by staging liquids through the 242-A Evaporator would require assessment. Solids consolidation, as proposed for DSTs, could also be considered

at the risk of making future retrieval more costly. Satisfactory resolution of regulatory issues is an essential part of application of this option. At this time, satisfactory resolution would be very challenging and is not expected to be successful.

5.4.2 Place Liners In Single-Shell Tanks

Description

This option considers deployment of liners in SSTs in order to provide double containment of the waste.

Background

The SSTs were built with a single primary steel tank that is surrounded with concrete. Leaks to the environment have resulted from failed steel liners. Installation of at least one liner in the sound tanks and two liners in the failed tanks would restore SSTs to a sound condition for waste storage, provide double containment, and meet the underlying requirement that waste be stored in RCRA compliant tanks. Liners based on a bladder design could be deployed through a tank riser.

Evaluation

There are serious technical issues that limit the feasibility of this option. The tanks would need to be emptied of waste in order to install the liner. Radiation levels and confined space concerns will require a remote installation approach.

Many of the SSTs contain significant equipment, either hanging from the risers or dropped into the waste in the tank during operations. Items that would obstruct remote installation of liner would have to be removed before the liner is installed. In addition, the liner would have to be lightweight because of the overall size of the liner and be flexible enough to be remotely installed. No lightweight, flexible material has been identified that can withstand the elevated radiation fields for an extended period. Successful deployment of this option would require a research and development program to select and test the appropriate liner material.

Installation of leak detection, monitoring, and mitigation capability would need to meet the surveillance requirements for stored waste. Permitting for such a hybrid tank would be difficult.

5.4.3 Caustic Addition Alternative

Description

This option considers deferral of caustic addition to the DSTs required to maintain tank chemistry to avoid corrosion.

Background

Current practice for prevention of DST corrosion is the addition of caustic solution as required to comply with operating specifications. One alternative to avoid adding caustic is the use of an electrochemical cell to generate hydroxide from tank contents (Hobbs 1998; Kurath et al. 1997; DeMuth and Kurath 1998). This technology has been commercialized for the pulp and paper industry. However, it is not known if the unit will be suitable for use in radioactive systems. .

Evaluation

Four DSTs are currently outside of the chemistry specification for control of corrosion (CHG 2000a, CHG 2000b), AN-102, AN-107, AY-101, and AY-102. Caustic additions to tanks AY-101 and AY-102 have been completed to bring them within specification. Caustic additions to tanks AN-102 and AN-107 are planned in 2001. Deferral of these caustic additions would add minimal DST waste storage capacity and would result in a Technical Safety Requirement violation, placing operations outside of the Authorization Basis (CHG 2000a, CHG 2000b). There are minimal direct savings of existing capacity, approximately 120 kgal, with deferral of planned caustic addition.

5.4.4 Postpone Deactivation Of Facilities

Description

This option considers elimination or postponement of the receipt of waste resulting from deactivation of Hanford Site facilities, thereby allowing DST capacity to be redirected to storage of retrieved SST waste.

Background

Deactivation of Hanford facilities will generate liquid waste either directly from cleanup activities or from removal of stored waste. The deactivation of the B-Plant and PUREX facilities has been completed. The deactivation of PUREX resulted in the transfer of 469 kgal of dilute waste to DSTs during 1995 and 1996. Deactivation of B-Plant resulted in the transfer of 103 kgal of dilute waste to DSTs between 1996 and 1998.

The remaining Hanford facilities planned for deactivation that require transfer of wastes to DSTs are the PFP, the 105-F and 105-H Basins, and the inactive miscellaneous underground storage tanks (IMUSTs). Table 5-1 provides the projected deactivation date, waste volume, and waste volume reduction factor for each tank. The waste volume reduction factor is defined as the percent of water (by volume) that can be removed from a waste stream to achieve a concentrated interim waste form such as double-shell slurry feed.

Table 5-1. Facility Deactivation Waste Volume Projections

Facility	Deactivation Date	Deactivation Volume As Received (kgal)	Waste Volume Reduction Factor (%)	Stored Waste Volume (kgal)
PFP	2000-2012	33	81	8
105-F Basin	2001	40	99	1
105-H Basin	2006	200	99	3

Evaluation

Deactivation of PFP, 105-F Basin, and 105-H Basin consumes minimal DST storage capacity when waste concentration using the 242-A Evaporator is included in the waste volume projections. Deactivation of these facilities is necessary to prevent liquid wastes from leaking to the environment and extending site cleanup.

5.4.5 Use Grout Vaults for Long-Term Storage of Liquid Tank Waste

Description

This option considers the use of the unutilized Grout vaults for the long-term storage of liquid tank waste.

Background

The Grout vaults were built to accommodate low-activity waste immobilized in grout especially formulated for the purpose. The project was cancelled after four of the vaults were built for several reasons. These vaults were built to meet the requirements of existing laws for grout storage. Use of the Grout vaults to store retrieved waste during site cleanup and closure could be an economical alternative to the construction of new DSTs.

Evaluation

The provisions for use of the Grout vaults for emergency storage in Section 4.5 would apply to this option, including the technical issues presented. If only one of the four Grout vaults were dedicated to emergency storage requirements, the remaining three 1600-kgal vaults with a total of 4800 kgal could be available to provide additional storage for SST retrieval. In addition to the actions required in Section 4.5, the impact of long-term storage of liquids in a facility not originally designed to contain liquids would have to be addressed. In Section 4.5, the vaults were evaluated as emergency backup storage during the 2007 - 2011 period. This option would require storage of liquids for up to 15 years. A more robust transfer and control system than that specified in the emergency storage option would be required in order for tank waste to be added and removed from the vaults on a routine basis.

5.4.6 Use Existing Facilities at Energy Northwest

Description

This option would utilize existing facilities at Energy Northwest to store tank waste as an alternative to traditional buried underground storage tanks for increasing waste storage capacity.

Background

Two partially completed nuclear power plants, WNP-1 and WNP-4, are located on the Hanford Site near the Columbia Generating Station of Energy Northwest. It was suggested in the workshops that tank waste could be stored in these existing structures.

Evaluation

There are no large compliant storage facilities available.

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6.0 OPTIONS ALSO CONSIDERED

During the initial workshop (see Appendix A), a brainstorming session was held to elicit the participants' ideas to increase available DST space for storage of retrieved SST waste. Initially, only a brief description was requested. The ideas were reviewed to remove duplicates and combine alternatives. As part of the process, a number of options identified during brainstorming were eliminated because they did not meet required attributes. These ideas are summarized below as a record of the possibilities explored.

1. **Separate aluminum to concentrate.** Compounds of aluminum can create situations where concentrated solutions of tank waste crystallize and cannot be pumped. Removal of aluminum salts would increase the allowable specific gravity. The expected cost of treatment before the aluminum could be removed is thought to be quite high.

2. **Release retained gas.** Typical steps to release retained gas include dilution with water or operation of large mixer pumps. In the case of dilution, the resulting waste volume is greater than the initial volume.

3. **Concentrate all DST waste to solids and remove all supernate.** This would add volume but would increase costs and could result in safety problems (e.g., SY-101).

4. **Cool waste until it contracts.** This would require constant cooling and provide little additional capacity.

5. **Heat tanks until they expand.** This would cause structural damage and again provide little additional capacity.

6. **Fill the DST annulus.** This defeats the purpose of putting the waste into compliant storage, and provides little additional capacity.

7. **Put barriers around SSTs (add double containment).** The possibility of damage to the SSTs, the radiation exposure to workers when the tanks are excavated, and the probable costs make this an unlikely approach.

8. **De-list tank waste.** The amount of known hazardous constituents in the tank wastes makes this improbable.

9. **Drill lateral drywells under the SSTs.** This could provide an alternate method for leak detection; by itself, it does not provide additional tank capacity.

10. **In-situ vitrification in SSTs.** The waste would be immobilized but most likely would not meet land disposal restrictions. Control of offgases during the process could create additional waste management issues.

11. **Allow the SSTs to leak.** This is unacceptable.

12. **Account for released gas in SST.** Accounting for released gas does not create additional tank space.

13. **Evaporate dissolved ammonia in DSTs.** Evaporating dissolved ammonia is not expected to yield significant additional tank capacity.

14. **Pack particles closer together.** This idea assumes that solids in the tanks are loosely packed and that there is a feasible way to cause them to take up less volume after retrieval. Packing is not likely to be the source of significant additional volume and a technique for doing this with the diverse forms of waste on site is not known.

15. **Relax 99 Percent Retrieval Constraint.** This does little to change the need for tank capacity for the bulk of SST waste.

16. **Use 244-AR or 244-CR Vault Tanks.** There is a small storage volume available in these tanks. The tanks are old and are slated for decommissioning.

17. **Store waste in inactive transfer lines.** Small volume to be gained; the lines are inactive for compliance and reliability reasons.

18. **Do not flush active cross-site transfer lines.** The flush water is removed when waste is run through the evaporator. In addition, the flush water is necessary to prevent line plugging, corrosion, and to maintain lower radiation levels in piping systems.

19. **Grout and fill existing inactive buildings, e.g., Canyon Buildings, old reactors, old evaporators.** These old facilities were not designed for disposal. Contamination and potential worker dose complicate any use of these facilities.

20. **Put bladders in canyon building.** This would be a subset of the previous item. This or addition of new tanks would be an integral part of use of any canyon facility for temporary waste storage. High dose areas in canyons make this idea impractical.

21. **Fleet of rail cars**. This idea is potentially costly because of acquisition of rail cars. Multiple problems with radiation control exist whether new doubled walled or older modified rail cars are used.

22. **Retrieve low volume tanks first.** This approach defers the capacity problem creating a larger problem later in the project. Additionally, this idea does not reduce risk near-term.

23. **Reconnect and fill the Inactive Miscellaneous Underground Storage Tanks (IMUSTs).** The miscellaneous underground storage tanks have not been characterized. Each has small capacity. None meet RCRA standards.

24. **Line and fill abandoned catch and fill boxes (i.e., diversion boxes).** Diversion boxes are not normally double-contained. Radiation conditions would cause most lining operations to be remote, and would be very expensive.

25. **Fuel storage basins.** The K Basins are too close to the river and are believed to have leaked in the past.

26. **Market millions of milligram samples.** This is not a viable option.

27. **Use old tank farm designs.** Tank farm facility designs were prepared in the 1980s (e.g., AQ Farm). They were not designed to be RCRA-compliant. The Multifunction Waste Tank Facility (W-236) is a newer design that was RCRA compliant. (see Section 4.8)

28. **Ship waste to Defense Waste Processing Facility (DWPF) or West Valley Processing Facility.** Shielding during shipping would make this very costly even if Savannah River could take the waste.

29. **Build multiple vitrification plants.** Processing at dispersed regular vitrification plants is likely to be impractical and loses the economy of scale provided by the WTP.

30. **Ship liquid waste to the High-Level Repository at Yucca Mountain, Nevada.** Liquid waste is not an approved waste form for shipping or receipt.

31. **Use abandoned Basalt Waste Isolation Project (BWIP) tunnels.** Canister storage in BWIP facility was not approved. The tunnels have been filled in.

32. **Bladders in burial boxes**. This is a costly retrieval option. Significant shielding is required.

33. **Delist waste and ship to Waste Isolation Pilot Plant (WIPP).** This is an unlikely option given the permitting and Environmental Impact Statement for WIPP and the present designation of tank waste.

34. **Solidify and drum**. This option would produce high radiation levels from untreated waste.

35. **Fill submarine vaults.** The submarine reactor compartments have already been carefully sealed for disposal.

36. **Dry waste form in canister barrels and put back in SSTs for later retrieval.** This idea is similar to some options presented in Section 5.0. However, this approach has an added complication of adding drums to old structures with little access and limits the ability to perform routine inspections.

37. **Melt and pour directly into emptied SST.** High temperatures could damage the concrete structures of the SST.

38. **Evaporate low aluminum containing waste only/first.** Selective retrieval sequence will account for waste content.

39. **Postpone deactivation of IMUSTs.** IMUST deactivation is scheduled after 2011.

7.0 REFERENCES

Allen, D. I., 2001, "Contract Number DE-AC27-99RL14047; Waste Volume Case Studies to Support the State of Washington Department of Ecology's Request," (Attachment: *Draft Report on the Case Studies Requested by Ecology*), (Letter CHG-0007064 R1 to A. B. Sidpara, ORP, February 16), CH2M HILL Hanford Group, Inc., Richland, Washington.

Boston, Harry L., 2000, "Contract DE-AC06-99RL14047 – Configuration Control of Waste Feed Delivery Contents," (Letter 00-ORP-079 to M. P. DeLozier, CHG, September 8), U.S. Department of Energy, Office of River Protection, Richland, Washington.

Campbell, T. A., 1998, *242-A Evaporator Safety Analysis Report*, HNF-SD-WM-SAR-023, Rev. 3, Waste Management Federal Service Hanford, Richland, Washington.

CHG, 2000a, *Tank Farms Final Safety Analysis Report*, HNF-SD-WM-SAR-067, Rev. 2, as amended, CH2M HILL Hanford Group, Inc., Richland, Washington.

CHG, 2000b, *Tank Farms Technical Safety Requirements*, HNF-SD-WM-TSR-006, Rev. 2, as amended, CH2M HILL Hanford Group, Inc., Richland, Washington.

CHG, 2000c, *Operating Specifications for Aging Waste Operations in 241-AY-and 241-AZ*, OSD-T-151-00017, Rev. D-12, CH2M HILL Hanford Group, Inc., Richland, Washington.

DeMuth, S., and D. E. Kurath, 1998, *Cost Benefit of Caustic Recycle for Tank Waste Remediation at the Hanford and Savannah River Sites*, LA-UR-98-3339, Los Alamos National Laboratory, Los Alamos, New Mexico.

DOE-RL, 1992, *TWRS National Technology Workshop Proceedings*, HNF-2832, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

Dunford, G., 1999, *Double-Shell Tank Space Trade Study*, TWR-4654, Rev. 0, CH2M HILL Hanford Group, Inc., Richland, Washington.

Ecology, EPA, and DOE, 1997, *Hanford Federal Facility Agreement and Consent Order,* as amended, Washington State Department of Ecology, U.S. Environmental Protection Agency, and U.S. Department of Energy, Olympia, Washington.

Elsevier, 1999, *Land Disposal Restrictions Compliance Guide*, Elsevier Science Inc., New York, New York.

Estey, S. D., and M. D. Guthrie, 1996, *An Analysis of Parameters Describing Gas Retention/Release Behavior in Double Shell Tank Waste*, WHC-SD-WM-TI-755, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

Fowler, K. D., 2000, *Tank Farm Waste Transfer Compatibility Program*, HNF-WM-OCD-015, Rev. 3A, CH2M HILL Hanford Group, Inc., Richland, Washington.

Garfield, J .S., R. A. Kirkbride, T. M. Hohl, and W. J. Stokes, 2000, *Single-Shell Tank Retrieval Sequence: Fiscal Year 2000 Update*, RPP-7087, Rev. 0, CH2M HILL Hanford Group, Inc., Richland, Washington.

Giller, R. A., and E. O. Weiner, 1991, *Soil Structure Interaction Analysis for Hanford Site 241-SY-101 Double-Shell Waste Storage Tanks*, WHC-EP-0504, Westinghouse Hanford Company, Richland, Washington.

Hanlon, B. M., 2001, *Waste Tank Status Summary Report for December 31, 2000*, HNF-EP-0182-153, CH2M HILL Hanford Group, Inc., Richland, Washington.

Hobbs, D. T., 1998, *Radioactive Demonstration of Caustic Recovery from Low-Level Alkaline Nuclear Waste by the Electrochemical Separation Process*, Westinghouse Savannah River Company, Aiken, South Carolina.

Kirkbride, R. A., G. K. Allen, B. A. Higley, R. M. Orme, R. S. Willman, J. H. Baldwin, T. W. Crawford, J. Jo, J. N. Strode, T. M. Hohl, S. L. Lambert, D. E. Place, and J. A. Seidl, 2000, *Tank Farm Contractor Operation and Utilization Plan*, HNF-SD-WM-SP-012, Rev. 2, CH2M HILL Hanford Group, Inc., Richland, Washington.

Kirch, N. W., G. J. Gauck, C. H. Mulkey, J. M. Grigsby, L. J. Julyk, and W. L. Willis, 1998, *Evaluation of Waste Level Limits in Tank 241-SY-101*, HNF-3555, Rev. 0, Lockheed Martin Hanford Corporation, Richland, Washington.

Krieg, S. A., 1990, *Single-Shell Tank Waste Retrieval Study*, WHC-EP-0352, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

Kurath, D. E., K. P. Brooks, G. W. Hollenberg, R. Clemmer, S. Balagopal, T. Landro, and D. P. Sutrja, 1997, *Preconceptual Design of a Salt Splitting Process Using Ceramic Membranes*, Pacific Northwest National Laboratory, Richland, Washington.

Meyer, P. A., and C. W. Stewart, 2000, *Preventing Buoyant Displacement Gas Release Events in Hanford Double-Shell Waste Tanks*, PNNL-13337, Pacific Northwest National Laboratory, Richland, Washington.

NEPA, 1969, *National Environmental Policy Act of 1969*, as amended, 42 USC 4321 et seq.

Pickett, W. W., 1998, *Immobilized Low-Activity Waste Interim Storage Facility, Project W-465 Conceptual Design Report*, HNF-1975, Rev. 1, Fluor Daniel Northwest Services, Richland, Washington.

Public Law 101-510, 1990, "Safety Measures for Waste Tanks at Hanford Nuclear Reservation," Section 3137 of *National Defense Authorization Act for Fiscal Year 1991*.

RCRA, *Resource Conservation and Recovery Act of 1976*, as amended, Public Law 94-580, 90 Stat. 2795, 42 USC 6901 et seq.

Reynolds, D. A., 1994, "Evaluation of Specific Gravity Versus Gas Retention," (Internal Memorandum 7E310-94-024, to N. W. Kirch, June 20), Westinghouse Hanford Company, Richland, Washington

Strode, J. N., and V. C. Boyles, 2000, *Operational Waste Volume Projection*, HNF-SD-WM-ER-029, Rev. 26A, CH2M HILL Hanford Group, Inc., Richland, Washington.

WHC, 1994, *Grout Facilities Standby Plan*, WHC-SD-WM-SSP-005, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

WHC, 1995, *Multi-Function Waste Tank Facility Phase Out Basis*, WHC-SD-W236A-ER-021, Rev. 3, Westinghouse Hanford Company, Richland, Washington.

Wisness, S. H., 1992, "Grout Vault 103 Upper Liner Acceptability," (Letter 92-AMD-006 to D. B. Jansen, Ecology, January 27), U.S. Department of Energy, Richland Operations Office, Richland, Washington.

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APPENDIX A

NOVEMBER 29-30, 2000 WORKSHOP NOTES

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TANK SPACE STRATEGIC PLANNING SESSION

November 29-30, 2000

Hanford Training Center, Willamette Falls

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CONTENTS

- Scope Statement Sheet, Agenda, Guidelines and Expectations
  - Opening Remarks

- Evaluation/Creative Phase
  - Criteria/Categories
  - Brainstormed Ideas
  - Three Questions/Functions Brainstormed

- Information Phase
  - What is Known
  - Parking Lot Information Sheets/

- Conclusions/Actions and Options for Further Study

SCOPE

- Tank Space and/or system needs to facilitate SST closure
  - TPAs M-45-00, M-45-00-01A, and M-45-12-T01
  - OWVP 2000 report
  - SST Retrieval Sequence FY 2000 Update (RPP-7087)
  - Tank Waste Treatment (TWT) Project
  - DST Space Trade Study (TWR-4654, 6/99)

OBJECTIVES

- Define the problem to be solved
  - Identify what is known (TPA, OWVP, FY 2000 Sequence, TWT Project, and DST Space Trade)
  - Identify what is not known
  - Develop problem statement

- Determine potential options and select preferred approaches
  - Brainstorm potential options
  - Define evaluation criteria for ranking options
  - Evaluate and select preferred approaches for further study

- Identify supporting information (enabling assumptions, key requirements, issues/concerns, etc.)

- Develop path forward for TPA completion
  - Identify actions required to facilitate follow-on efforts with Ecology, future studies needed, and formal response commitments

- Obtain consensus and build team

DELIVERABLES

- The problem defined
- Preferred options to solve the problem
- Path forward implementation plan

TANK SPACE STRATEGIC PLANNING WORKSHOP
HTC, Willamette Falls Room
November 29-30, 2000

AGENDA

Day 1, 11/29/00

7:30 - Welcome, Introductions, and Agenda
- Review Scope Statement Sheet, Guidelines and Expectations
- Opening Remarks

8:15 - Identify What is Known and What is Not
- Review/Clarify TPAs M-45-00, M-45-00-01A, and M-45-12-T01
- Utilize parking lot sheets, as required

9:30 - **BREAK**

9:45 - Continue What is Known and What is Not
- OWVP, FY 2000 Sequence, TWT Project, and DST Space Trade Study

11:30 - **LUNCH**

12:30 - Define the Problem to be Solved
- Answer three questions
  1. What's the problem?
  2. Why is that a problem?
  3. What are the consequences if the problem is not solved?

1:45 - Brainstorm Potential Options to Solve the Problem

2:30 - **BREAK**

2:45 - Continue Brainstorm of Potential Options
- Identify opportunities and new ideas

3:15 - Evaluate Potential Options
- Define and rank evaluation criteria
- Evaluate options to eliminate the possible, but improbable

4:30 - Finish Day 1 with a review of status and day 2 agenda

TANK SPACE STRATEGIC PLANNING WORKSHOP
HTC, Willamette Falls Room
November 29-30, 2000

AGENDA

Day 2, 11/30/00

7:30 - Review Agenda, Scope Statement Sheet, and Status from Day 1

7:45 - Continue Options Evaluation
- Identify opportunities/innovations (including cost/schedule)
- Select the preferred options for future study

9:30 - **BREAK**

9:45 - Develop Path Forward for TPA completion
- Review/Validate parking-lot information sheets
- Identify needs and team members for the December 5, 2000 Ecology meeting, and future study needs
- Identify Actions to proceed

12:00 - Finish Session with a Round-Robin Closeout
- Last minute items
- Meeting utility

PROJECT SCOPE STATEMENT SHEET

Project Title: Tank Space Strategic Planning Workshop **No.** 001
Location of Workshop: Hanford Training Center, Willamette Falls **Dates:** 11/29-30/00

TEAM MEMBERS

NAME	DISCIPLINE	CO.
C. (Cherri) DeFigh-Price (TL)	SST Interim Closure Prog.	CHG
R. R. (Rex) Thompson	SST Interim Closure Prog.	CHG
N. W. (Nick) Kirch	Process Control	CHG
J. N. (Jim) Strode	Inventory Control & Model	CHG
J. A. (John) Garfield	Retrieval Engineering	NHC
D. T. (Dave) Vladimiroff	Interim Stabilization	CHG
J. P. (John) Harris	Nuclear Licensing	CHG
J. B. (Joel) Hebdon	Environmental	CHG
J. P. (Pete) Sederburg	DST Program	CHG
G. W. (George) Reddick	Strategic Planning	CHG
K. R. (Kevin) Sandgren	Nuclear Licensing	CHG
P. A. (Perry) Meyer	SST Science Team	PNNL
C. W. (Chuck) Stewart	Fluid Dynamics	PNNL
P. A. (Phil) Gauglitz	PGO	PNNL
C. C. (Colin) Henderson	Risk Performance Evaluation	JACOB
R. W. (Bob) Lober	Strategic Planning	ORP
E. J. (Joe) Cruz	Project Requirements	ORP

Team Leader (TL)

AD HOC MEMBERS

J. W. (Joe) Brothers	SST Science	PNNL
T. D. (Dave) Taylor	PGO	CHG
R. G. (Russ) Harwood	Operations Support	ORP

FACILITATORS

NAME	DISCIPLINE	CO.
R. A. (Richard) Harrington, CVS	SST	CHG
R. E. (Robin) Kummer	SST	CHG

GUIDELINES AND EXPECTATIONS

- Open and honest communications
  - Active listening
  - Courage and consideration
- Be succinct → make your point
  - Lot of ground to cover
  - Be proactive with input
  - Identify facts vs. perceptions
- This is a technical project management session
  - Wear two hats
    1. Your role/technical (engineering and science)
    2. Project management/leadership
- A lot of Good is done, remember our purpose and deliverables
  - Evaluation to select top choices
  - Don't design; level of engineering
- Use of flipcharts
- Roles: Facilitators and you
  Process versus content
- Keys to success
  - Communication/teamwork
  - Rise to the occasion
  - Make a difference and have some fun!

OPENING REMARKS

- 8/00 negotiations
  - Enforceable milestones
  - Directors determinations that could result in court dates (e.g., 2/15/01)
    - We negotiated M-45-01 for between now and 2006
      - Focus was on high-risk tanks
      - Agreed on risk definition
      - Limited tank space was a concern
        - Interfaced with the modeling group
        - "Signed up" for C-104 preparation and space for (S-112 and S-102) 2 million gallons in addition
      - Ecology wants to know how many DSTs are going to be built
  - M-45-12 submit options report to increase tank space for waste storage by 2/28/02
  - M-45-01
  - HAB is also evaluating tank space needs and the options
  - The state really does not want to build 84 more tanks
  - State does think we need to build some new tanks
    - Key is that M-45-012 report must document all the credible options; identify the preferred options; and path forward
  - Will brief the state in early December and conduct a workshop in January with State, HAB, etc.
  - The VIT plant schedule is a major risk item to available tank space
  - A lot of good options identified to date, are there others
  - The options study will be a PI due March 31, 2001
  - The state would like to retrieve tanks (~10 vs. 35) between 2007-2011

    The state would like us to look at 6-pack DST designs

EVALUATION PHASE

- **Round 1**
  - Read all items
  - Keep or toss
  - One keeper keeps, move on
  - No discussions
  - Eliminate the possible, but improbable

- **Round 2**
  - Develop/rank and use criteria
  - Limit discussions to what the idea is; don't guess, identify author
  - Keep or toss
  - Reduce the list, include memories
  - Eliminate redundancies
  - Apply criteria

- **Round 3**
  - Assign numeric identifiers on keepers (e.g., 1, 1.1, 2, 2.1, 3, 4, 5, …)
  - Combine attributes of same ideas
  - Criss/cross combinations
  - Define/use categories, as appropriate
  - Keep or toss

EVALUATION CRITERIA (RANGE)

7 Cost effective	5%
• Cost per gallon obtained (e.g., <$76/gallon)	
1 Technical feasibility	25%
• Likelihood of success	
• Robustness	
• How fast to develop/deploy	
5 Meet schedule	10%
• Develop/deploy/operate	
8 Ease of operations	5%
• Number of operators	
• Level of training	
6 Maintenance/operability	5%
• RAM	
2 Environmental risk reduction	20%
• Compared to today	
4 Supports mission requirements	10%
• Compatibility to high-level goals	
• Volume recovery	
3 Worker Health and Safety	20%
	100%

CATEGORIES

A = Saves/adds to existing space (within 31.3)
B = Adds new space (beyond 31.3)
C = Treatment alternatives at Vit
D = CHG retrieve and store or treat elsewhere

S = Strategy to consider
SA = Stand-alone action
F = Follow on recommendation to accommodate waste Post 2011

BRAINSTORMING

ACCOMMODATE (IN-TANK) WASTE

A1 Concentrate to DSSF and accept small gas releases
B1 Raise allowable liquid levels
A2 Combine currently segregated waste
A1.1 Concentrate to max and separate supernate and solids
~~- Separate aluminum to concentrate~~
A3/D1.1 Separate nonhazardous non-rad fractions ~~(After 2007-2011)~~
D1 Low volume capacity process unit
A4 Combine aging waste
A5 Reduce reserve requirements
A5.1 Utilize watch-list tanks
A5.2 Utilize feed source/staging tank head space
B2 Utilize compliant alternative storage for emergency reserves (Grout vaults)
~~- Release retained gas~~
~~- Concentrate 1.5 reduction~~
~~- Concentrate to solids and remove all supernate~~
A1.2 Create a dry/solids tank
~~- Cool waste until it contracts~~
~~- Heat tanks until they expand~~
B.2.1 Use current emergency DST space by designating temporary tanks as emergency space
~~- Fill the annulus~~
B3 Put liners in SSTs
~~- Put barriers around SST (double containment)~~
~~- De-list tank waste~~
~~- Drill lateral drywells under SSTs~~
B4 Consolidate SST waste in SST system
~~- In situ vitrification~~
~~- Allow it to leak~~
C1.2 Blend feed to vit plant

BRAINSTORMING

ACCOMMODATE (IN-TANK) WASTE

C1.1 Pre-concentrate to the vit plant
A6 Decrease operational space
- ~~Account for released gas in SST~~
- ~~Implement clean salt removal system~~
- ~~Use other salt removal systems (e.g., diagnosis, membrane, ion exchange, etc.)~~
- ~~Evaporate dissolved ammonia in DSTs~~

A7 Postpone deactivation of facilities (e.g., PFP)
A8 Postpone watch list tank dilution
C1 Optimize the waste treatment sequence (low aluminum first)
A1.3 Look at SPG limits in tank
- ~~Pack particles closer together~~
- ~~Consolidate all non-clearing C-tanks~~
- ~~Relax 99% retrieval constraint~~

BRAINSTORMING

ACCOMMODATE (IN-SYSTEM) WASTE

B2.2 Use DCRTs

- Consider emergency storage

~~- Use 244-AR vault~~

~~- Use 244-CR vault~~

~~- Line Grout facility~~

~~- Inactive cross site transfer lines~~

~~- Don't flush active cross site transfer lines~~

B5.1 Use LERF for interim storage

D1.2 Move vit plant pre-treatment processes between DSTs and SSTs

~~- Grout and fill 242T and 242S~~

C2 Use vit plant processing tank early

~~- Fill PUREX tanks~~

~~- Fill B-Plant~~

~~- Fill canyon bldgs~~

~~- Fill Redox~~

~~- Fill T-Plant~~

~~- Fill U-Plant~~

~~- Put bladders in canyon bldg~~

S1 Convert waste to dry-form and interim storage

B5 Fleet of double-contained ~~tanker trucks~~ surface storage (e.g., tanker trucks, rail cars, LERF)

~~- Fleet of double contained rail cars~~

~~- Use existing rail cars~~

~~- Bladders for existing rail road cars~~

~~- Close easy tank bite elephant from other end~~

~~- Fill abandoned pipe systems~~

~~- I am not familiar~~

~~- Fill up DCRTs~~

~~- Fill up abandoned pipe annular spaces~~

~~- I'm running out~~

BRAINSTORMING

ACCOMMODATE (IN-SYSTEM) WASTE

- ~~Reconnect and fill the IMUSTs~~
- ~~Line and fill abandoned catch and fill boxes (i.e., diversion boxes)~~
- ~~Seal and fill DCRT vaults~~

BRAINSTORMING

ACCOMMODATE (OTHER) WASTE

B6 Use grout vaults

~~- Fill FFTF~~

~~- Fill HAMMER~~

B5.2 WNP 1 and 4

~~- FMEF~~

~~- Build LERF equivalent facilities~~

~~- Field storage basins~~

~~- Fuel storage basins~~

~~- Market millions of milligram sample~~

B7 Build DST (new)

- Use old design, MWTF, AQ, AT

B5.3 Build inexpensive DST kind

B5.4 Compliant open air above ground bladders

D1.3 Use low volume capacity unit (in-coming waste)

~~- Use old tank farm designs~~

D2 Use Grout vaults with better waste form than grout

~~- Process waste direct out of SST (post 2007)~~

~~- Fill cocooned reactors~~

~~- Ship waste to DWPF~~

S2 Reduce volume of new waste at sources

S3 Build full-size vit plant

~~- Build many vit plants~~

~~- Build mini-vit plants~~

D1.4 Small mobile vit plant

C3 Accelerate vit plant commissioning

~~- Ship liquid waste to Yucca~~

~~- Use abandoned BWIP tunnels~~

~~- Bladders in burial boxes~~

~~- Delist waste and ship to WIPP~~

BRAINSTORMING

ACCOMMODATE (OTHER) WASTE

- ~~Get Yucca to accept waste as is~~
- ~~Ship waste to West Valley~~
- ~~Solidify and drum~~
- ~~Ship to former USSR in compliant barges~~
- ~~Fill submarine vaults~~

BRAINSTORMING

SHOTGUN COMBINATIONS

A9 Eliminate saltwell pumping until retrieval

A1.4 Concentrate to the max, and install mixer pump (group/concentrate)

A9.1 Use saltwell liquor from one tank to retrieve another

- ~~Small on tank clean salt routed into high integrity containers~~
- ~~Insert mini-vit plant between salt and high integrity containers~~
- ~~Dry waste form in canister barrels and put back in SSTs for later retrieval~~
- ~~Put containerized waste in grout vaults~~

C1.3 Blending retrieved SST material with Vit plant feed

C4 Use guts, feathers, and all for Vit plant (i.e., blend and vitrify)

C4.1 Vortec melter via above

- ~~Melt and pour directly into emptied SST~~

A9.2 Investigate lower dilution ratio retrieval methods (save water)

A9.3 Retrieve as solids

A9.4 Transport as solids

F1 Excavate SST farm and convert to above ground storage

F1.1 Seek Part B hazardous waste permit

- ~~Solidify waste and fill canyon facilities~~

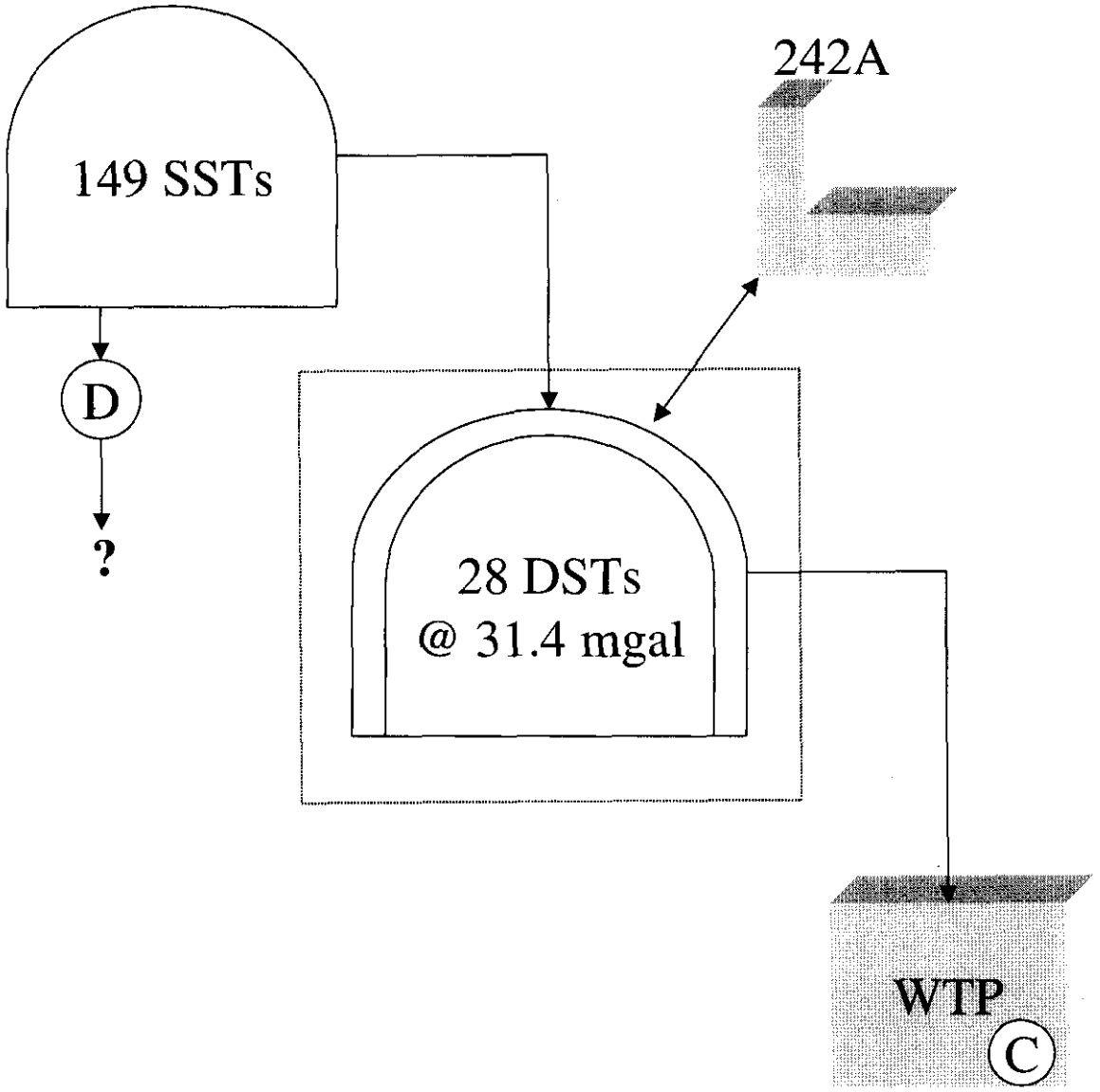
D3.1 Dry, pelletize waste form for interim storage

- ~~Use "just in time" processing (small units) to expand as needed~~

D3 Stabilize (kitty litter), interim treat (encapsulate) to store in above-ground piles

- ~~Evaporate low aluminum containing waste only/first~~

S4 Redefine high level waste to a nuclide activity basis


242A
149 SSTs
D
?
28 DSTs
@ 31.4 mgal
WTP
C

THREE QUESTIONS

1. What's the problem to be solved?

   Run out of SST retrieval space by 2007 (i.e., accommodate waste)

2. Why is that a problem?

   Need to demonstrate compliant SST retrieval progress through 2011

3. What are the consequences if the problem is not solved?

   Increase the risk of exposure to the environment and people including:

   - May require undeveloped retrieval technology
   - Significant cost increase
   - Missed TPA milestones

FUNCTIONS BRAINSTORMED

1. Accommodate (in-tank) waste
2. Accommodate (in-system) waste
3. Accommodate (other [tank/system]) waste
4. Combinations and/or shotgun (i.e., criss/cross)

WHAT IS KNOWN

- **TPA M-45-00** (Current)
  - By 2018, we will retrieve waste from all of the 149 SSTs
    - Defines heel as 360 cubic feet per tank (~1 inch of waste or ~2750 gals of residual waste)
    - Does cover additional scope items such as vadose zone, leak detection, etc.

- **TPA Change M-45-00-01A**
  - We will prepare three tanks for retrieval (C-104, S-112, and S-102) by 2006 and complete retrieval by 2007
    - S-112 retrieval by 9/05
    - S-102 retrieval by 9/06
    - C-104 start by 9/06 (end date to be negotiated; perhaps 2008)
  - Establishes renegotiation dates via Vit plant schedules, etc. (i.e., 2002 if there is a slip; 2004 if not)
  - Create M-45-012

- **TPA M-45-012-T01** (Resulting from M-45-00 and 01A)
  - Submit Options report documenting DOE assessment of actions that could be taken to increase available *tank space for SST waste retrieval
    - Evaluate/document options for additional space beyond the three tanks in 01A with principal required and detailed cost and schedule for implementation
    - Due date is Feb. 2002

- **PI 4.5.1,** Item/Requirement 3
  - Complete/submit Options report on *tank space (i.e., M-45-012-T01) by March 31, 2001

  *Compliant and/or compliance

WHAT IS KNOWN

- **OWVP Rev. 26A**
  - Current Vit plant schedule will not free up sufficient tank space to support M-45-00 by 2018 (~ 87 DSTs short)
  - Three cases identified as potential options to deal with space needs
    1. Retrieve smallest volumes first you will exceed DST space by 2010; therefore, build 87 new DSTs by 2018 for ~$6.6 billion
    2. Retrieve waste slower than Case 1, complete SST retrieval by 2033. Requires 15 new tanks (7 by 2013, 8 more by 2018) for ~$1.2 billion
    3. Run Vit plant at 5X (760% of design capacity) to accelerate schedule completion in FY 2024, requires 4 new DST at ~$500 million
       - Assumes a super fast melter (i.e., something >12 melters)
  - Case(s) Assumption

  <u>All Cases</u>
  - 2 plans have been built
  - High sodium loading
  - Interim stabilization and other waste receipts stay on schedule
  - Lose 1 DST every five years, starting in 2017
  - Vit starts in 2007
  - Case 1 and 2 operates Vit at 150%

  <u>Case 1</u>
  - SST retrieval completed by 2018
  - Meets all TPA milestones

  <u>Case 2</u>
  - Completes retrieval by 2033

  <u>Case 3</u>
  - Super Vit, completes retrieval by 2024
  - Page 84-85 identified 26 space saving alternatives
  - OWVP addresses a subset of the tank space problem/issue/concern

WHAT IS KNOWN

- **FY2000 Sequence**
  - OWVP issued in August
  - TPA negotiation finished in August
  - FY 2000 sequence was updated in September
  - Identifies that 15 tanks can be retrieved by 2018, balance by 2033
  - Identifies the tank retrieval sequence based on a 2007 Vit start and ramp up of capacity
  - Assumptions:
    - No new tanks
    - Basic upgrade of case 2 in the OWVP document. The difference is time and sequence

MEMORIES

- ✓ Identify who will lead/manage correction of the Options Study report
- ✓ Not retrieving waste <u>will not</u> be an option to this effort
- ✓ Alternate processes (e.g., grout, etc.) will not be excluded
- ✓ Seven year delay to get DST doesn't fit with a four TPA re-negotiation
- ✓ Need PIO guidance
- ✓ Identify options to run on the model
- ✓ Don't eliminate ideas that have long term value

ISSUES/CONCERNS

- ✓ Current Vit plant design will not support a 2018 date via space needs (i.e., M-60 says build a Vit plant to handle 25% of activity and 10% of volume)
  - We have a volume imbalance
- ✓ The technical community determined tank space shortage/needs as early as 1991
- ✓ Retrieving13 tanks a year after 2018
- ✓ Linking technical thoughts, and mass balance with the budget
- ✓ Ramifications of mass balance has not been defined on any schedule
  -

CONCLUSIONS/ACTIONS

1. The team to complete the formal Options Study report by 3/31/01

   Lead - TBD in Process Control by 12/15/00
   Action: Cherri DeFigh-Price/Rex Thompson

   "Key" Players:
   - DST Programs: TBD
   - Inventory Flow sheet Inventory Engineering: John Garfield
   - Environmental: Joel Hebdon
   - Waste Treatment Plant: TBD
   - SST Science Support Team: TBD
   - SST Programs: Rex Thompson
   - Nuclear Licensing: John Harris
   - Operations: TBD

   Finalize names by 12/15/00
   Action: Rex Thompson

2. Conduct informal Ecology meeting
   Action: Cherri DeFigh-Price/Bob Lober or Joe Cruz by 12/11/00

3. Schedule Options Priority Workshop for January
   Action: Rex Thompson by 12/18/00

   January team members
   WDOE – 3 TBD
   ORP – 2 TBD
   HAB – $\leq$4 TBD
   CHG etc. - ~6 Pete Sederburg, Rex Thompson, Cherri DeFigh-Price, TWT: George Reddick, SST Science, Joel Hebdon, Nick Kirch

   15 TOTAL

OPTIONS FOR FURTHER STUDY

A. SAVES/ADDS TO EXISTING SPACE (WITHIN 31.3)

1 Concentrate to DSSF and accept small gas releases
   - 1.1 Concentrate to max. and separate supernate and solids
   - 1.2 Create a dry-solids tank
   - 1.3 Look at SPG limits in tank
   - 1.4 Concentrate to the max, and install mixer pump (group/concentrate)

2 Combine currently segregated waste

3 Separate nonhazardous non-rad fractions

4 Combine aging waste

5 Reduce reserve requirements
   - 5.1 Utilize watch-list tanks
   - 5.2 Utilize feed source/staging tank head space

6 Decrease operational space

7 Postpone deactivation of facilities (e.g. PFP)

8 Postpone watch list tank dilution

9 Eliminate saltwell pumping until retrieval
   - 9.1 Use saltwell liquor from one tank to retrieve another
   - 9.2 Investigate lower dilution ratio retrieval methods (save water)
   - 9.3 Retrieve as solids
   - 9.4 Transport as solids

OPTIONS FOR FURTHER STUDY

B. ADDS NEW SPACE (BEYOND 31.3)

1 Raise allowable liquid levels
2 Utilize compliant alternative storage for emergency reserves (Grout vaults)
  2.1 Use current emergency DST space by designating temporary tanks as emergency space
  2.2 Use DCRTs
    - Consider emergency storage
3 Put liners in SSTs
4 Consolidate SST waste in SST system
5 Double-contained surface storage (e.g., tanker trucks, rail cars, LERF)
  5.1 User LERF for interim storage
  5.2 WNP-1 and 4
  5.3 Build inexpensive kind
  5.4 Compliant open air above ground bladders
6 Use Grout vaults
7 Build DST (new)
  - Use old design, MWTF, AQ, AT

C. TREATMENT ALTERNATIVES AT VIT

1 Optimize the waste treatment sequence (low aluminum first)
  1.1 Pre-concentrate to the Vit plant
  1.2 Blend feed to Vit plant
  1.3 Blending retrieved SST material with Vit plant feed
2 Use Vit plant processing tank early
3 Accelerate Vit plant commissioning
4 Use guts, feathers, and all for Vit plant (i.e., blend and vitrify)
  4.1 Vortec melter via above

OPTIONS FOR FURTHER STUDY

D. CHG RETRIEVE AND STORE OR TREAT ELSEWHERE

1 Low volume capacity process unit
   1.1 Separate nonhazardous non-rad fractions
   1.2 Move Vit plant pre-treatment processes between DSTs and SSTs
   1.3 Use low volume capacity unit (incoming waste)
   1.4 Small mobile Vit plant
2 Use Grout vaults with better waste form than Grout
3 Stabilize (kitty litter), interim treat (encapsulate) to store in above-ground piles
   3.1 Dry, pelletize waste form for interim storage

STRATEGIES TO CONSIDER

1 Convert waste to dry-form and interim storage
2 Reduce volume of new waste at sources
3 Build full-size Vit plant
4 Redefine high level waste to a nuclide activity basis

FOLLOW ON RECOMMENDATION TO ACCOMMODATE WASTE POST 2011

1 Excavate SST farm and convert to above ground storage
   1.1 Seek Part B hazardous waste permit

APPENDIX B

JANUARY 12, 2001 WORKSHOP NOTES

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TANK SPACE OPTIONS STATUS WORKSHOP

January 12, 2001

Hanford Training Center
Willamette Falls Room

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CONTENTS

- Agenda, Attendees, Guidelines and Expectations, Opening Remarks

- Options for Further Study
  - Identified as likely or less likely to alleviate 2007-2011 situation
  - Potential New Options

- Tank Space Options Annotated Report Outline

- Memories

- Action Items

TANK SPACE OPTIONS STATUS WORKSHOP
Hanford Training Center, Willamette Falls
January 12, 2001

Purpose: Review, status, and solicit input on the current tank space options path forward and define success expectations for the final report.

AGENDA

8:00 - Welcome/Purpose, Introductions, and Opening Remarks
- Review Agenda, Guidelines and Expectations

8:45 - Review and Status Tank Space Options
- Overview November Workshop Results
- Begin to use parking lot sheets, as required

9:45 - **BREAK**

10:00 - Continue Review and Status of Tank Space Options
- Solicit input on current and potential new options
- Clarify Tank Space Options Report Path Forward

11:30 - **LUNCH**

12:30 - Define Success Expectations for Final Report
- Present draft report outline with example
- Solicit and finalize final report expectations

1:45 - **BREAK**

2:00 - Develop Path Forward
- Define communications plan
- Review/Validate parking-lot information sheets
- Identify actions required to proceed

3:00 - Finish Session with a Round-Robin Closeout
- Last minute items
- Meeting utility

Project Title: Tank Space Options Status Workshop
Location of Workshop: Hanford Training Center, Willamette Falls **Dates:** 1/12/01

TEAM MEMBERS

NAME	DISCIPLINE	CO.
C. (Cherri) DeFigh-Price (TL)	SST Interim Closure Prog.	CHG
R.R. (Rex) Thompson	SST Interim Closure Prog.	CHG
J.B. (Joel) Hebdon	Environmental	CHG
D. A. Reynolds	Process Control	CHG
V. C. Boyles	Process Control	CHG
J. G. Kristofzski	DST Program	CHG
J. P. (Pete) Sederburg	DST Program	CHG
P. A. (Perry) Meyer	SST Science Team	PNNL
D. (Dan) Simpson		HAB
R.W. (Bob) Lober	Strategic Planning	ORP
E. J. (Joe) Cruz	Project Requirements	ORP
R.G. (Russ) Harwood	Operations Support	ORP
M. (Melinda) Brown		Ecology
R. V. (Richard) Heggen		Ecology

Team Leader (TL)

FACILITATORS

NAME	DISCIPLINE	CO.
R.A. (Richard) Harrington, CVS	SST	CHG
R.E. (Robin) Kummer	SST	CHG

GUIDELINES AND EXPECTATIONS

- Open and honest communication
  - Active listening
  - Courage and consideration
- Identify facts vs. perceptions
- Be succinct → make your point
- Considerable options were identified
  - Are there any others?
- Final report expectations
  - Review outline and example
  - Clarify expectations
  - Want it right the first time
- Facilitator and you (roles)
  - Process vs. content
- Use of flipcharts, etc.
- Key to success
  - Communication
  - Clarity of expectations
  - Make a difference and have some fun ☺

OPENING REMARKS

- Thanks for your participation
- This is the document that identifies the options for the person/people to select the preferred approach(s)
- Proposing three categories:
  1. Most promising, viable options
  2. Viable options that may not be possible
  3. Captured ideas that are possible, but improbable
- Looking at the SST/DST time frame
  - 2006 supporting retrieval
  - 2006-2011 is the crunch years implement the viable options
- Don't want any surprises
  - Agree to the outline
  - Identify the right detail (i.e., success expectations)
- November workshop was truly an interdisciplinary team
- Draft report will be delivered by 3/31/01

ORP

- During SST negotiations
  - A lot of commitments; some didn't come true
- Two concerns:
  1. SST waste volumes/space to facilitate retrieval
  2. Go beyond the 99 report:
     - Acceptable options
     - Solicit feedback/input
     - Integrate and/or plan with Vit. schedule
- Want to do the best we can with what we have
  - Minimize risk to success
- Need everyone to have a voice
- Lots of customers
  - A real challenge
- One essential key interface is with Operations

OPENING REMARKS

Ecology

- Appreciate the opportunity to participate
  - ➢ Our concerns are the same as yours; lots of risk
    - Primary concern is tank space
    - We want the Vit. plant to operate, retrieval success with tank space
- ➢ It is difficult to respond to TPA without solid ideas to proceed forward (e.g., viable options)

HAB

- Looking for the right answer to meet our needs
  - Successfully support the outcome

PNNL

- We are excited and impressed with the effort to date. Space is the key to retrieval.

OPTIONS FOR FURTHER STUDY

A. SAVES/ADDS TO EXISTING SPACE (WITHIN 31.3)

4 - 1 Concentrate to DSSF and accept small gas releases
- 1.1 Concentrate to max. and separate supernate and solids
- 1.2 Create a dry-solids tank
- 1.3 Look at SPG limits in tank
- 1.4 Concentrate to the max, and install mixer pump (group/concentrate)
- 1.5 Raise Sg from 1.41 to 1.5

4 - 2 Combine currently qualified waste (feed tanks)

5 - 3 Separate nonhazardous non-rad fractions

4 - 4 Combine aging waste (AZ tanks)
- 4.1 Raising the limit >5 mo of sodium for aging waste tanks
- 4.2 Remove liquid from aging waste tanks (liquid is the bottleneck for pretreatment Cs)

4 - 5 Reduce reserve requirements
- 5.1 Utilize watch-list tanks
- 5.2 Utilize feed source/staging tank head space

4 - 6 Decrease operational space (i.e., head space)

4 - 7 Postpone deactivation of facilities (e.g., PFP)

4 - 8 Postpone flag gas, caustic or corrosion tank dilution (i.e., cut gas releases; e.g., flam gas)
- 8.1 Defer caustic additions to DSTs
- 8.2 Use something similar to the on-board ship generators, with caustic addition

4/5 - 9 Modify saltwell pumping until retrieval
- 9.1 Use saltwell liquor from one tank to retrieve another
- 9.2 Investigate lower dilution ratio retrieval methods (save water)
- 9.3 Retrieve as solids
- 9.4 Transport as solids

OPTIONS FOR FURTHER STUDY

A. SAVES/ADDS TO EXISTING SPACE (WITHIN 31.3)

5 - 10 Use evaporator as a chemical reactor specifically for organic tanks (Envelope C)

OPTIONS FOR FURTHER STUDY

B. ADDS NEW SPACE (BEYOND 31.3)

4 - 1 Raise allowable liquid levels

4 - 2 Utilize compliant alternative storage for emergency reserves

- 2.1 Use current emergency DST space by designating temporary tanks as emergency space (Grout vaults)
- 2.2 Use DCRTs
  - Consider emergency storage
- 2.3 Use the ½ Mgal Tank (empty) outside PUREX; a surge tank

5 - 3 Put liners in SSTs

5 - 4 Consolidate SST waste in SST system

4/5 - 5 Double-contained surface storage (e.g., tanker trucks, rail cars, LERF)

- 5.1 User LERF for interim storage
- 5.2 WNP-1 and 4
- 5.3 Build inexpensive kind
- 5.4 Compliant open air above ground bladders
- 5.5 Expand capacity of the WRFs (Waste Receiving Facilities)

5 - 6 Use Grout vaults

- 6.1 Restart Grout (for at least phosphate waste)

4 - 7 Build DST (new)

- Use old design, MWTF, AQ, AT

OPTIONS FOR FURTHER STUDY

C. TREATMENT ALTERNATIVES AT VIT

5 - 1 Optimize the waste treatment sequence (low aluminum first)
- 1.1 Pre-concentrate to the Vit plant
- 1.2 Blend feed to Vit plant
- 1.3 Blending retrieved SST material with Vit plant feed

4 - 2 Use Vit plant processing tank early

5 - 3 Accelerate Vit plant commissioning

5 - 4 Use guts, feathers, and all for Vit plant (i.e., blend and vitrify)
- 4.1 Vortec melter via above

D. CHG RETRIEVE AND STORE OR TREAT ELSEWHERE

4 - 1 Low volume capacity process unit
- 1.1 Separate nonhazardous non-rad fractions
- 1.2 Move Vit plant pre-treatment processes between DSTs and SSTs
- 1.3 Use low volume capacity unit (incoming waste)
- 1.3.1 Ceramics (being explored at Los Alamos on a bench scale)
- 1.4 Small mobile Vit plant
- 1.5 Portable evaporators

5 - 2 Use Grout vaults with better waste form than Grout

5 - 3 Stabilize (kitty litter), interim treat (encapsulate) to store in above-ground piles
- 3.1 Dry, pelletize waste form for interim storage

LEGEND

4 = IV – Options evaluated likely to alleviate 2007-2011 situation

5 = V – Options less likely to alleviate 2007-2011 situation

POTENTIAL NEW OPTIONS

B6 Restart Grout (for at least phosphate waste)
A4 Raising the limit >5 mo of sodium for aging waste tanks
A4 Remove liquid from aging waste tanks (liquid is the bottleneck for pretreatment Cs)
D1.3 Ceramics (being explored at Los Alamos on a bench scale)
A8.1 Defer caustic additions to DSTs
A8.2 Use something similar to the on board ship generators, with caustic addition
A10 Use evaporator as a chemical reactor specifically for organic tanks (Envelope C)
B5.5 Expand capacity of the WRFs (Waste Receiving Facilities)
D1.5 Portable evaporators
B2.3 Use the ½ Mgal tank (empty) outside PUREX; a surge tank

- Strategy
  - Do not use premium tank space for emergency space

Tank Space Options Report
Annotated Outline

Executive Summary

A few words and table that defines the options and results (schedule, cost, PROs, CONs, etc.). A brief summary of the process used and why (the problem the milestone was addressing).

I. Introduction
(Describe the layout of the report)

II. Background
a. Define Tank Space Problem statement
Addressing specifics of near term retrieval and objective to continue retrieval of high-priority SSTs during completion and start-up of the Waste Treatment Facility.
b. Describe Existing Tank Facilities (a simple line diagram); consider the schematic tank system provided to Ecology for M-32 Admin. Order submission

III. Methodology for Study
Time frame and focus of Options Study
Actions taken to define problem and identify options.
i. Workshops (what, when, why; introduce the four categories developed, evaluation criteria, and Perry's chart)
ii. Describe evaluation groups
1. Likely to alleviate 2007-2011 situation
2. Longer term solutions
3. Discounted

IV. Options evaluated likely to alleviate 2007-2011 situation (~4-6 pages for each option)
1. Description
- What is the concept
- Why will it increase available space
- Approximately how much space will be created
2. Background (source of reference list)
- Technical basis
- Prior studies
- Any implementation
3. Criteria for evaluation (briefly describe how this option matches)
- Technical feasibility
- Environmental risk reduction
- Worker health and safety
- Supports mission requirements
- Meet schedule
- Maintenance/operability
- Cost effective

- Ease of operations
- Regulatory impacts
- Other considerations and ancillary benefits

4. Cost estimate to implement and life-cycle cost considerations
   - Basis of cost
   - Uncertainty
5. Schedule
   - Basis of schedule
   - Uncertainty

V. Options evaluated less likely to alleviate 2007-2011 situation
(Brief outline of concept, potential benefits, rough estimate of timing separated into four categories: A. Saves/adds to existing space [within 31.3], B. Adds new space [beyond 31.3], C. Treatment alternatives at Vit Plant, and D. CHG retrieve and store or treat elsewhere)

VI. Options Also Considered
(A couple of sentences expanding description, reasons)

VII. Summary

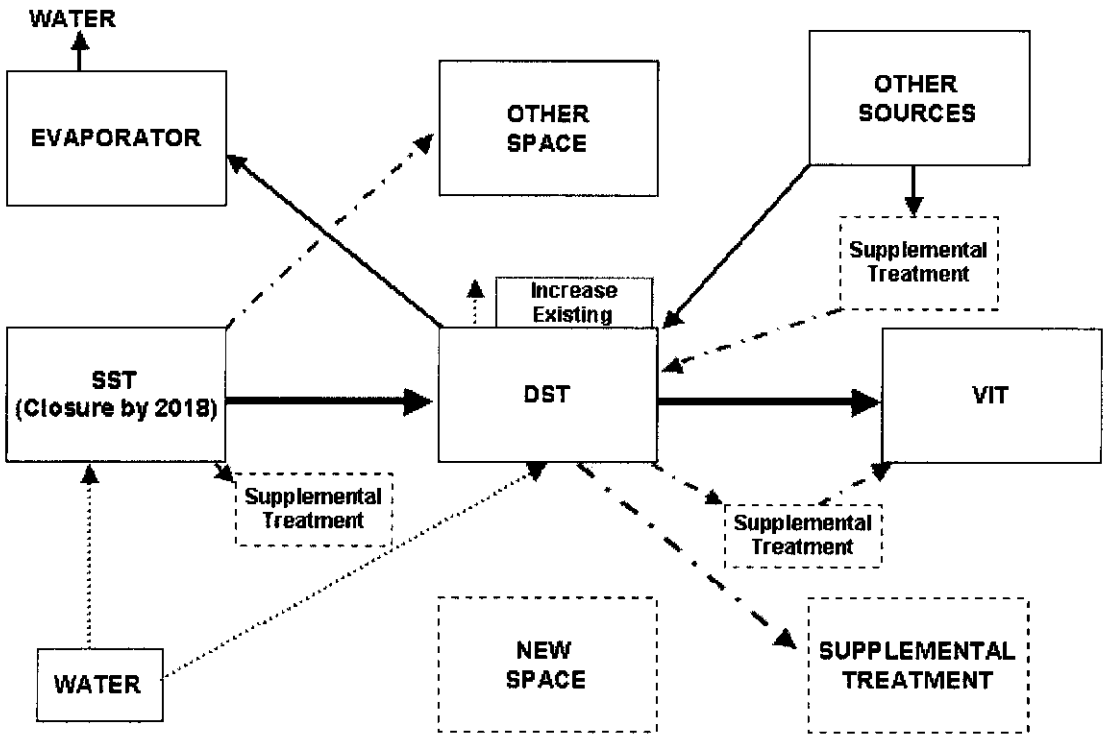
VIII. References

Appendices
A. November 29-30, 2000 Workshop Notes
B. January 12, 2001 Workshop Notes

MEMORIES

- ✓ Consider options to "optimize" retrieval
- ✓ HLW is constrained by RCRA requirements; approved treatment is only Vit. for land disposal
- ✓ Second cross-site transfer line (to be considered via analysis)
  - Joe Cruz to update/interface with Richard Heggen
- ✓ Use pictures/graphics to minimize words (Rex and Vick, good stuff)
- ✓ Ecology cannot give any approval due to internal Ecology procedures; therefore, they cannot represent without peer review

✓ = Validated memory; no action



NOTE: Include ancillary items such as DCRTs, etc.

ACTIONS

WHAT	WHO	WHEN
1. Communication between now and 3/31/01 • ORP – Open informational/ informal interface as sections are completed - Including advance draft • HAB – With Joe, conduct path forward presentation at the February waste management meeting (HS&WM) • WDOE – Via Joe Cruz/Bob Lober, etc. provide updates for the monthly TPA Project Managers meeting.	Cheri DeFigh-Price/ Rex Thompson	
2. Convey results/path forward to ORP management and convey outcome to Cherri DeFigh-Price	Joe Cruz	1/19/01
3. Provide WDOE advanced draft report informally	Joe Cruz	3/10/01
4. Convey results/path forward to WDOE management and convey outcome to Joe Cruz (Joe to Cherri DeFigh-Price)	Melinda Brown and Richard Heggen	1/23/01
5. Issue draft typed flipcharts and updated option pages to entire team via e-mail	Richard Harrington/ Robin Kummer	1/16/01