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ENGINEERING CHANGE NOTICE

Page 1 of 2

1. ECN 166505

Proj. ECN

2. ECN Category (mark one) Supplemental [] Direct Revision [X] Change ECN [] Temporary [] Standby [] Supersedure [] Cancel/Void []	3. Originator's Name, Organization, MSIN, and Telephone No. J. N. Strode, Waste Tank Process Control, R2-11, 3-1280		4. Date 8/31/94
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12. Description of Change

This document updates revision 19 by incorporating changed facility schedule assumptions, as well as waste generation rates and volumes which have occurred since the publication of revision 19. All the values in this document will be updated several times per year.

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13a. Justification (mark one)							
	Criteria Change	[X]	Design Improvement	[]	Environmental	[]	
As-Found []	Facilitate Const.	[]	Const. Error/Omission	[]	Design Error/Omission	[]	

13b. Justification Details

See line 12 above.

14. Distribution (include name, MSIN, and no. of copies)

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1. ECN (use no. from pg. 1): 166505

15. Design Verification Required	16. Cost Impact				17. Schedule Impact (days)	
	ENGINEERING		CONSTRUCTION			
[] Yes	Additional	[] $	Additional	[] $	Improvement	[]
[X] No	Savings	[] $	Savings	[] $	Delay	[]

18. Change Impact Review: Indicate the related documents (other than the engineering documents identified on Side 1) that will be affected by the change described in Block 12. Enter the affected document number in Block 19.

SDD/DD	[]	Seismic/Stress Analysis	[]	Tank Calibration Manual	[]
Functional Design Criteria	[]	Stress/Design Report	[]	Health Physics Procedure	[]
Operating Specification	[]	Interface Control Drawing	[]	Spares Multiple Unit Listing	[]
Criticality Specification	[]	Calibration Procedure	[]	Test Procedures/Specification	[]
Conceptual Design Report	[]	Installation Procedure	[]	Component Index	[]
Equipment Spec.	[]	Maintenance Procedure	[]	ASME Coded Item	[]
Const. Spec.	[]	Engineering Procedure	[]	Human Factor Consideration	[]
Procurement Spec.	[]	Operating Instruction	[]	Computer Software	[]
Vendor Information	[]	Operating Procedure	[]	Electric Circuit Schedule	[]
OM Manual	[]	Operational Safety Requirement	[]	ICRS Procedure	[]
FSAR/SAR	[]	IEFD Drawing	[]	Process Control Manual/Plan	[]
Safety Equipment List	[]	Cell Arrangement Drawing	[]	Process Flow Chart	[]
Radiation Work Permit	[]	Essential Material Specification	[]	Purchase Requisition	[]
Environmental Impact Statement	[]	Fac. Proc. Samp. Schedule	[]	Tickler File	[]
Environmental Report	[]	Inspection Plan	[]		[]
Environmental Permit	[]	Inventory Adjustment Request	[]		[]

19. Other Affected Documents: (NOTE: Documents listed below will not be revised by this ECN.) Signatures below indicate that the signing organization has been notified of other affected documents listed below.

Document Number/Revision	Document Number/Revision	Document Number Revision

20. Approvals

Signature	Date	Signature	Date
OPERATIONS AND ENGINEERING		ARCHITECT-ENGINEER	
Cog. Eng. G. M. Koreski/J. N. Strode	8/31/94	PE	
Cog. Mgr. N. W. Kirch	9/2/94	QA	
QA		Safety	
Safety		Design	
Environ.		Environ.	
East Systems Engineering R. A. Dodd	9/6/94	Other	
Wst Tnk Upgrd Instalatn/Testng G. L. Dunford	9/9/94		
		DEPARTMENT OF ENERGY	
TWRS Program Office R. D. Wojtasek	9/9/94	Signature or a Control Number that tracks the Approval Signature	
TWRS Proc Eng R. C. Roal	9/9/94		
		ADDITIONAL	

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Document Number:	WHC-SD-WM-ER-029, REVISION 20
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Signature: G. M. Koreski / J. N. Strode

Organization/Charge Code 7E310/N1F6B

7. Abstract

Waste receipts to the double-shell tank system are analyzed and wastes through the year 2015 are projected based on generation trends of the past 12 months. A computer simulation of site operations is performed, which results in projections of tank fill schedules, tank transfers, evaporator operations, tank retrieval, and aging waste tank usage.

This projection incorporates current budget planning and the clean-up schedule of the Tri-Party Agreement. Assumptions were current as of July 1994.

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(3) Title

Operational Waste Volume Projection

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OPERATIONAL WASTE VOLUME PROJECTION

JULY 1994

Prepared by

GM Koreski
JN Strode

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TABLE OF CONTENTS

1.0 SUMMARY 1

2.0 INTRODUCTION 5
- 2.1 Purpose 5
- 2.2 Methodology 5

3.0 GENERAL FACILITY DESCRIPTIONS 7
- 3.1 B Plant 7
- 3.2 242-A Evaporator, LERF, LETF 7
- 3.3 Grout 9
- 3.4 PFP 9
- 3.5 PUREX 10
- 3.6 S Plant 10
- 3.7 Solid Waste Trench 31 Leachate 10
- 3.8 T Plant 11
- 3.9 Tank Farms 11
- 3.10 UO_3 Facility 13
- 3.11 Waste Sampling and Characterization Facility (WSCF) 13
- 3.12 100 Area 13
- 3.13 300 Area 13
- 3.14 400 Area 14
- 3.15 Salt Well Liquid Pumping 14

4.0 PROJECTION CASE ASSUMPTIONS 15
- 4.1 Lower Planning Case Assumptions 20
- 4.2 Baseline Case Assumptions 29
- 4.3 Upper Planning Case Assumptions 32

5.0 RESULTS AND CONCLUSIONS 34
- 5.1 Lower Planning Case Results and Conclusions 34
- 5.2 Baseline Case Results and Conclusions 37
- 5.3 Upper Planning Case Results and Conclusions 54
- 5.4 Actual Waste Generation Compared to Management Limits 56

6.0 SPACE SAVING ALTERNATIVES 58

7.0 BIBLIOGRAPHY 60

APPENDICES

A. Miscellaneous One Time Waste Additions and Facility Holdups A-2
B. Possible Future Assumptions Changes and Impacts B-2
C. Acronyms C-2

TABLE OF CONTENTS (CONTINUED)

FIGURES

1. Comparison of the Tank Requirements for the 7/94 Projection Cases . 2
2. Methodology of the OWVP 5
3. Double-Shell Tank Requirements for the Lower Planning Case 36
4. Double-Shell Tank Requirements for the Baseline Case 38
5. Facility Waste Generation Graphic 39
6. Tank Fill Graphic 40
7. Tank Levels During Four-Year Projection 41
8. Short Range Tank Space Summary 42
9. Simplified Schematic of Current and Planned Routings 43
10. Dilute Receiver Tanks and 242-A Evaporator Operations 45
11. PUREX Facility Waste Generation and Tank Levels 47
12. West Area Waste Generation and SY Tank Levels 48
13. B Plant and Hanford Facility Waste 49
14. AP Farm Tank Levels 50
15. AN Farm Tank Levels 51
16. Aging Tank Requirements 52
17. Aging Waste Tank Usage 53
18. Double-Shell Tank Requirements for the Upper Planning Case 55
19. Monthly Facility Generations 57

TABLES

1. Summary of Assumptions For the July 1994 Projection Cases 3
2. Assumption Matrix 16
3. Salt Well Pumping Schedule for 35% Porosity 22
4. Plutonium Finishing Plant Schedule 25
5. DST Solids Levels in Kgals 28
6. Salt Well Pumping Schedule for 45% Porosity 33
7. Specific Use Space 39
8. Comparison of Average Monthly Waste Generation Rates 56

1.0 SUMMARY

The Operational Waste Volume Projection (OWVP) presents a basis for evaluating future Double-Shell Tank (DST) space through the end of FY 2005. This report presents a projected range of tank needs which is used to generate recommendations regarding site activities, waste management activities, facility requirements, and the need to build additional double-shell tanks. This document presents the results of three projections cases (Lower Planning, Baseline, and Upper Planning Cases) which represent varying degrees of tank space needs and operational risks. Operating assumptions for the three cases were established in July 1994 to bracket future site operations and DST needs:

- The Lower Planning Case manages projected tank space needs within the available tank space (28 DSTs) by delaying a number of planned Tank Waste Remediation System (TWRS) program activities which could delay Tri-Party Agreement (TPA) milestones. The Lower Planning Case eliminates the need for construction of new DST space but introduces additional uncertainties and risks into the overall TWRS program beyond those of the Baseline Case.

- The Baseline Case is meant to project DST needs based on TPA milestones, TWRS program planning, and the most realistic operational assumptions. The Baseline Case requires building five additional DSTs through FY 2005 which decreases the uncertainties and risks while meeting all TPA milestones.

- The Upper Planning Case uses more pessimistic projection assumptions and requires the building of thirteen additional DSTs by the end of FY 2005 while minimizing uncertainties and risks.

A comparison of the projected tank space needs required for the three projection cases is depicted in Figure 1. Key assumptions for the three projection cases are summarized in Table 1. Differences in assumptions have been highlighted. Detailed assumptions, risks, and space saving alternatives are presented later in this document. At a minimum, this DST space forecast will be updated annually with the latest information available regarding the estimated volume of waste requiring storage in the DSTs.

Areas Requiring Management Consideration

Facility waste minimization requirements initiated by the Tank Space Management Board (TSMB) helped to guarantee tank space availability prior to the 242-A Evaporator restart. However, considering the possibility of future tank space shortages, the Terminal Clean-out (TCO) and monthly waste generations will continually need to be minimized.

Should a tank space shortage occur during the period FY 1998-2005 (Figure 1), the shortage could be solved using a combination of the following actions:

- delay Tank 101-SY and 103-SY dilution
- delay the Single-Shell Tank (SST) stabilization
- accelerate the construction of new DSTs
- delay the SST solids retrieval
- delay in-tank washing and/or pretreatment activities

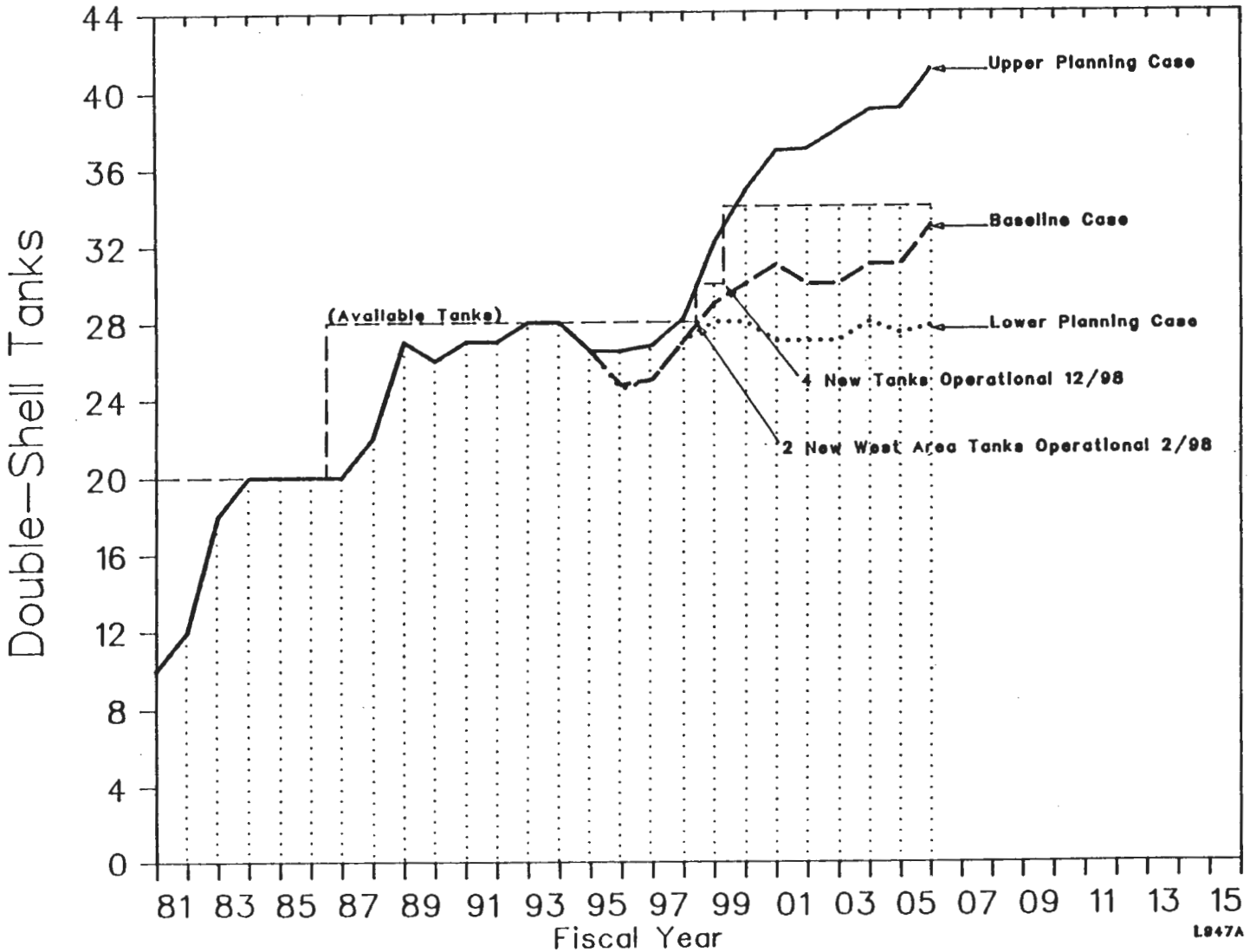

Figure 1. Comparison of the Tank Requirements for the 7/94 Projection Cases

Table 1. Summary of Assumptions For the July 1994 Projection Cases

Facility or Project	Lower Planning Case (L947LC) Assumptions	Baseline Case (L947BC) Assumptions	Upper Planning Case (L947UC) Assumptions
Total Monthly Facility Generations	64 Kgal/month	93 Kgal/month	108 Kgal/month
PUREX TCO	TCO FY94-97 (0.3 Mgal dDSSF)	TCO FY94-97 (0.4 Mgal dDSSF)	TCO FY94-97 (1.5 Mgal DN)
B Plant TCO	TCO FY97-01 (0.56 Mgal DN)	TCO FY97-01 (0.56 Mgal DN)	TCO FY97-01 (0.56 Mgal DN)
100 Area TCO	TCO FY95-99 (0.57 Mgal DSSF)	TCO FY95-99 (0.57 Mgal DSSF)	TCO FY95-99 (0.57 Mgal DSSF)
Evaporator Restart	04/1994; LERF 13 Mgal	04/1994; LERF 13 Mgal	04/1994; 13 Mgal LERF
Effluent Treatment Facility Startup Rate TOE	06/1995 150 gpm 70%	06/1995 150 gpm 70%	06/1996 150 gpm 70%
SST Stabilization Porosity Complexed SWL Volume Pumped	 35% 14% ~3.6 Mgal by end of FY 2000	 35% 14% ~3.6 Mgal by end of FY 2000	 45% 14% ~5.1 Mgal by end of FY 2000
PFP Stabilization Run Startup	FY 1998	FY 1998	FY 1998
Grout	No Restart--Use Grout Feed Tanks	No Restart--Use Grout Feed Tanks	No Restart--Use Grout Feed Tanks
Tank 101-SY Dilution (Date)	No Dilution	1:1 Dilution (FY 1998)	3:1 Dilution (FY 1998)
Tank 103-SY Dilution (Date)	No Dilution	1:1 Dilution (FY 2000)	3:1 Dilution (FY 2000)
SST Solids Retrieval 106-C solids (start; receiver tank) SST Solids Retrieval Start Rate SST Waste Retrieval Complete SST Site Closure Complete	 FY 1997; Tank 102-AY 09/2003 0.2 Mgal (0.8 Total) in FY 2004; 0.3 Mgal (1.2 Total) in FY 2005 FY 2018 FY 2024	 FY 1997; Tank 102-AY 09/2003 0.2 Mgal (0.8 Total) in FY 2004; 0.3 Mgal (1.2 Total) in FY 2005 FY 2018 FY 2024	 FY 1997; Tank 102-AY 09/2003 0.2 Mgal (0.8 Total) in FY 2004; 0.3 Mgal (1.2 Total) in FY 2005 FY 2018 FY 2024
LLW Pretreatment Facility startup	12/2004	12/2004	12/2004
LLW Operational Tanks	None; Pretreatment & Vitrification are Close Coupled	3 in FY 2005; 4 in FY 2006	3 in FY 2005; 4 in FY 2006
LLW Vitrification	06/2005; 2 Mgal in 2005	06/2005; 2 Mgal in 2005	06/2005; 2 Mgal in 2005
In-Tank Washing (FY 1995-2000)	Consolidate all NCAW & 106-C solids. Consolidate all NCAW supernates.	Consolidate Washed 101-AZ & 102-AZ solids. Consolidate all NCAW supernates.	Wash Tank 101-AZ solids only.
HLW Enhanced Sludge Washing	06/2008	06/2008	06/2007
HLW Vitrification startup	12/2009	12/2009	12/2009
Evaporation Limit for Wastes--SpG	1.5	1.5	1.4
New Tanks in West Area	None	2 in 02/1998	2 in 02/1998
New Tanks in East Area	None	4 in 12/1998	4 in 12/1998
Contingency Tank	None	One starting FY 1999	One starting FY 1999
Loss of DST Space	None	None	One DST starting FY 1998

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2.0 INTRODUCTION

2.1 Purpose

The purpose of the Operational Waste Volume Projection (OWVP) is to present a basis for evaluating future Double-Shell Tank (DST) needs to meet Tri-Party Agreement Milestone (TPA) M-46-00. This report presents a projected range of tank needs which is used to generate recommendations regarding site activities, waste management activities, facility requirements, and the need to build additional DSTs. This document presents the results of three projections cases (Lower Planning, Baseline, and Upper Planning Cases) which represent varying degrees of tank space demands. Operating assumptions for the three cases were established in July 1994 to bracket future site operations and DST needs. Need dates for new DST construction, tank retrievals, facility schedules, waste generation reductions, conflicts in meeting TPA milestones (WDOE, 1994), and funding priorities can then be reviewed in relation to tank space availability.

2.2 Methodology

The process followed in preparing an OWVP is shown in Figure 2, below.

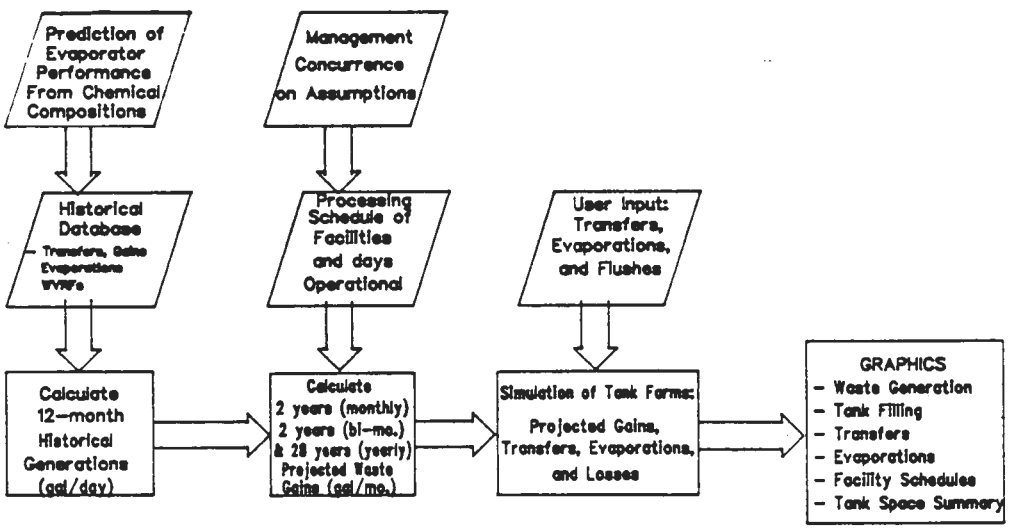

Figure 2. Methodology of the OWVP

The process of updating the OWVP begins with the request for updated facility or project "assumptions" from each of the operating facilities and projects that will contribute waste to DST inventory. The term "assumption" in this document refers to engineering inputs or bases supplied by the facilities based on their future operational plans (determined by budget, DOE directive, TPA milestones, etc.). Typical assumptions include operating schedules, waste generation rates, stream compositions, modes of operation, etc. The operating facilities and projects provide estimates of volume, composition, and radionuclide content data for each distinct waste stream exiting the facility.

In addition to the projected facility waste generation rates, the processing schedules of each of the plants are factored into the projection. For the Plutonium-Uranium Extraction (PUREX) facility, B Plant, and 100N Area, the volumes of waste generated from TCO are estimated and entered. For the Plutonium Finishing Plant (PFP), a schedule is used which shows the days per month or year the Plutonium Reclamation Facility (PRF) and the Remote Mechanical "C" (RMC) line will be operating. These projected waste generation rates and plant schedules are used to project waste volumes that each plant will be producing per month or year. The composition data is used to calculate Waste Volume Reduction Factors (WVRFs) and to determine waste segregation requirements (due to chemical, radionuclide, or heat content). The WVRF (Riley, 1988) is defined as the amount of water that can be removed from a waste stream. From the facility assumptions, a matrix of basic assumptions for the three cases to be incorporated into the OWVP projections were prepared and presented to WHC management and program office for approval.

Once the projection cases have been approved, the database of past waste gains, transfers, and evaporations is updated with data from the most recent months of Tank Farm operations. The early years of the projection are simulated in more detail than the later years. In the first period of the projection, monthly waste volumes are predicted. For the next period of the projection, bi-monthly waste volumes are predicted. For the last years of the projection, yearly waste volumes are predicted.

The processing sequence in the simulation is designed to model the actual activities in the tank farms. After a dilute receiver tank is filled with waste, the contents are transferred to an available holding tank. The dilute waste must remain in the holding tank for at least four months to allow for sampling and characterization before it can be transferred to the 242-A Evaporator feed tank (Tank 102-AW) for evaporation. After dilute waste is concentrated in the 242-A Evaporator, it is sent to a slurry receiver tank (Tank 106-AW) as Double-Shell Slurry Feed (DSSF) which will eventually be disposed of through the Low-Level Waste (LLW) pretreatment and vitrification process.

The processing sequence for the Neutralized Current Acid Waste (NCAW) solids is for the solids to be washed in-tank (Place, 1991) and then disposed of in the High-Level Waste (HLW) vitrification plant. The separated supernates and washes will be pretreated to form high-level and low-level streams. The HLW vitrification facility will incorporate high-level and transuranic (TRU) wastes into a glass matrix for disposal. The low-level stream will be sent to LLW vitrification for final disposal.

3.0 GENERAL FACILITY DESCRIPTIONS

A brief description of the facilities and projects pertinent to this projection are listed in the following sections. Waste generation volumes and assumptions pertinent to each of the three projection cases are listed in Section 4.

3.1 B Plant

B Plant was constructed in 1945 to recover plutonium by the bismuth phosphate process. The facility was refurbished in 1967 to recover ^{90}Sr and ^{137}Cs byproducts. The byproduct recovery mission was completed in FY 1985 and B Plant was once considered for waste pretreatment. B Plant is no longer considered a viable option for pretreatment of Hanford tank waste.

B Plant discharges a low-level miscellaneous waste stream (dilute non-complexed waste) resulting from cell drainage, vessel clean-out, condensate collection, etc. Future TCO activities will generate wastes that can be separated into three categories (Smith, 1994): 1) aqueous phase waste generated during organic solvent removal (may be complexed waste); 2) dilute non-complexed (DN) waste; and 3) uncharacterized waste resulting from vessel flushing. Uncharacterized wastes will be characterized when they are produced.

Miscellaneous waste generation rates and the volume and schedule for terminal cleanout activities (Smith, 1994) are presented in Section 4.

3.2 242-A Evaporator, LERF, LETF

The 242-A Evaporator was restarted on April 15, 1994 and evaporated the wastes stored in Tanks 102-AW, 106-AW, and 103-AP during Campaign #1. To understand the projection model for the 242-A Evaporator, it is necessary to understand the waste flow during evaporator operation and the simulation model. Waste from the dilute holding tanks are transferred into the evaporator feed tank (Tank 102-AW). Waste in the feed tank is then transferred to the 242-A Evaporator for boil-down. In the evaporator operation, four to six months is required for wastes to be RCRA (Resource Conservation and Recovery Act) characterized (Halgren, 1990) before they can be evaporated.

- This projection model assumed that the 242-A Evaporator would operate in a "Linked Run" process mode (Guthrie, 1993). A "Linked Run" is a continuous operation of the 242-A Evaporator, made possible by simultaneously transferring from the DST's to the Evaporator feed tank (Tank 102-AW).

- The second evaporator campaign is scheduled to concentrate waste from Tanks 101-AP, 107-AP, and 108-AP starting in October 1994 (Guthrie, 1994 and Ross, 1994).

- The third evaporator campaign is scheduled to start in June 1995. The dilute non-complexed waste to be used for the third campaign had not been designated at the time of this projection. (Likely candidates include DN wastes in Tank 106-AP, 104-AW, 105-AW, 102-AY, 103-AW, and 101-AN).

- A period of four to six months is required from the time a tank is filled with dilute wastes before the waste can be evaporated. This period allows time for RCRA characterization, documentation, and facility preparation (Guthrie, 1993). To minimize projected tank space needs, this computer simulation allowed four months.

- In the computer simulation, dilute waste is transferred to the evaporator feed tank (Tank 102-AW) for evaporation. Provided the waste has not reached its concentration limit, the monthly evaporation is continued until the maximum Waste Volume Reduction (WVR) for the month is achieved.

- The desired WVR for each 242-A Evaporator campaign is determined by boil-down studies, computer simulation, and/or process control sampling. The concentration of waste increases after each pass through the Evaporator until it reaches a concentration level consistent with engineering studies. The waste volume projection model of the 242-A Evaporator operation used in these projections cases produced DSSF with a specific gravity of 1.4-1.5 g/ml. Upon reaching the desired concentration level, the concentrated waste is transferred to the evaporator receiver tank (Tank 106-AW). At the end of a campaign or when Tank 106-AW has been filled, DSSF is transferred to a holding tank.

- A 13 million gallon storage facility will be used to store evaporator condensate (Williams, 1994). This facility is called the Liquid Effluent Retention Facility (LERF).

- Based on performance during the first evaporator campaign, approximately 1.3 gallon of condensate will be sent to LERF for every gallon of Waste Volume Reduction (WVR). Based on a factor of 1.3 gallon of condensate/gallon of WVR, the Evaporator should be able to achieve about 10 million gallons of WVR before the LERF is full. Current evaporator campaign schedules would not fill the LERF to capacity before the Liquid Effluent Treatment Facility starts in June 1995.

- During each campaign the 242-A Evaporator will be able to process 1,000 - 2,000 Kgal per month (Guthrie, 1993). Two months of down time are allowed in the simulation between campaigns. The down time allows transfer of the concentrated waste from Tank 106-AW to a slurry holding tank, staging the dilute waste designated for the next campaign, and set-up of the 242-A Evaporator.

- An average evaporation rate of 500-750 Kgal/month (Guthrie, 1993) is used in this simulation taking in to consideration:
  - the 242-A Evaporator historical processing rates
  - downtime between campaigns
  - waste characterization
  - staging and tank transfers

- The simulation used in this projection evaporates all dilute wastes to a concentrated interim storage form in the same year that a tank has been filled. This assumption is valid if the evaporator is operating and the yearly waste generation rate has not exceeded the annual WVR limit of the evaporator. Historically, dilute wastes were concentrated to near

the aluminate boundary which would produce concentrated wastes with a specific gravity which could range from 1.3 to 1.67 g/ml. However, it has been noted that all of the DSTs currently on the Flammable Gas Watch List (i.e., tanks with safety concerns related to hydrogen build-up) have specific gravities greater than 1.4 g/ml (Reynolds, 1994). To avoid production of future Flammable Gas Watch List tanks, it has been proposed that all future waste concentrations should be limited to a specific gravity of 1.4 g/ml unless additional technical evaluation shows flammable gas will not build-up. The adoption of the 1.4 g/ml specific gravity limit on concentrated wastes had not been finalized at the time this projection was completed (Dodd, 1994).

The waste volume projection model of the 242-A Evaporator operation used in previous projections, typically produced DSSF with a specific gravity of 1.50-1.55 g/ml. Reducing these wastes to a specific gravity of 1.4 g/ml could increase waste storage volumes by approximately 25-37.5 percent, depending on the chemical composition of the waste. The evaporation limit used for each of the projection cases is presented in Section 4. The Upper Planning case used a 1.4 g/ml limit for evaporation.

- A new facility called the Liquid Effluent Treatment Facility (LETF) will be operational in June 1995 to process the stored evaporator condensate from the LERF basins and newly generated evaporator condensate concurrently (Williams, 1994).

3.3 Grout

- No additional Grout Vaults are scheduled to be poured at the Hanford site. TWRS program planning requires that all LLW will be pretreated through a LLW pretreatment facility and eventually vitrified in a LLW vitrification plant. Tanks that were originally designated and set aside as grout feed tanks will be used for other purposes.

3.4 PFP

The Plutonium Finishing Plant (PFP) is a facility in the 200 West Area which houses the processes and supporting operations for:

1) converting plutonium nitrate and oxide to other forms or compounds,
2) dissolution of solid forms of plutonium;
3) purification of plutonium-bearing solution;
4) shipping, receiving and storage of special nuclear materials;
5) treatment and handling of PFP liquid wastes destined for tank farms.

Current planning for PFP is for a stabilization run to be completed to clean up the process lines that were involved in the above activities.

An Environmental Impact Statement (EIS) will have to be completed before PFP stabilization can occur. PFP is currently in an operations standby condition with maintenance and laboratory work on-going, but with the major process lines (Plutonium Reclamation Facility (PRF) and Remote Mechanical C Line (RMC)) in standby pending the outcome of the EIS (Backlund, 1994). The schedule for PFP stabilization is dependent on the outcome of the EIS. Volumes for the PFP stabilization runs for each of the projection cases are listed in Section 4.

3.5 PUREX

The Plutonium Uranium Extraction (PUREX) Facility was used to separate irradiated N Reactor fuel into plutonium nitrate, uranyl nitrate hexahydrate (UNH), neptunium nitrate, and waste products. The main processing operations involved dissolution of cladding and irradiated fuel, solvent extraction and conversion of plutonium nitrate to plutonium oxide. Acid recovery, solvent treatment systems, and off-gas treatment supported the major processes.

Westinghouse Hanford Company has been directed by the Department of Energy (DOE) to proceed with deactivation of PUREX. A detailed plan for the deactivation of the PUREX facility was completed in the fourth quarter of FY 1993. The PUREX facility will continue to generate miscellaneous waste until deactivation activities commence. Once deactivation activities begin there will be an increase of PUREX facility generated waste. Deactivation of PUREX started in April 1994 and will continue through July 1998 (Hamrick, 1994). It is assumed that all waste transfers from PUREX to the DST system will cease once deactivation has been completed. PUREX miscellaneous waste generation and deactivation volumes for each of the projection cases are listed in Section 4.

3.6 S Plant

S Plant (or 222-S Labs) is a dedicated laboratory facility. The Laboratory currently provides analytical chemistry services in support of Westinghouse Hanford Company's processing plants. Emphasis is on waste management processing plants, environmental monitoring programs, B Plant, Tank Farms, 242-A Evaporator, Waste Encapsulation Storage Facility (WESF), PUREX Facility, Plutonium Finishing Plant (PFP), research support activities, and essential materials. Radioactive liquid waste at 222-S is generated by disposal of process and environmental samples and decontamination operations. The primary program being supported is tank characterization. Dilute, non-complexed wastes resulting from 222-S operations are transported to 204-AR vault via tanker truck. S Plant monthly waste generation volumes for the projection cases are presented in Section 4.

3.7 Solid Waste Trench 31 Leachate

A leachate collected from the mixed waste landfill (Trench 31). The maximum daily leachate volume is estimated to be 110,000 gallons from the 24 hour/25 year precipitation event (McKenney, 1994). Only the Upper Planning Case assumed a 10 Kgal/month waste generation from Trench 31.

3.8 T Plant

T Plant's primary mission is decontamination and treatment of radiologically and chemically contaminated waste and equipment (Jenkins, 1994). T Plant also provides inspection and repackaging services to various Hanford facilities as well as the certification (hydrostatic leak testing) of the railcars used to transport liquid wastes to Tank Farms. The 2706-T Low-Level Decontamination Facility (where low-level equipment decontamination is performed) has recently been approved for restart. The 2706-T Decontamination activities will be initiated in FY 1994 and should accelerate to full level by FY 1995. Limited 221-T canyon decontamination activities may also be initiated in 1994. Full scale canyon decontamination activities (primarily Tank Farms long-length contaminated equipment) should be initiated in 1996 (Crane, 1994).

T Plant is currently testing new decontamination techniques (ice blasting and CO_2 decontamination systems) to reduce liquid waste generations. Dilute, non-complexed wastes collected at T Plant during decontamination, repackaging, condensate collection, or railcar certification are currently being transported to 204-AR vault via railcar. These wastes contain approximately 5 % solids (Jenkins, 1994). T Plant monthly waste generations for the projection cases are presented in Section 4.

3.9 Tank Farms

There are currently 28 double-shell tanks (DSTs) used to receive, store, and evaporate the liquid wastes generated at the Hanford facilities to an interim waste form. The interim waste form (e.g., DSSF) is currently stored in tank farms awaiting pretreatment and vitrification for final disposal. Tank farm waste generation sources and operational considerations are listed below for the aging and non-aging waste tanks.

Aging Double-Shell Tanks

Four of the DSTs (AY and AZ farms) are designated as aging waste tanks that were designed to store high-heat wastes (e.g., NCAW wastes or wastes containing high-heat loads due to the presence of ^{90}Sr or ^{137}Cs). The aging waste tanks are equipped with condensers and air-lift circulators. The purpose of the condensers is to handle the vapors from primary tank vent systems when hot liquid is present. Condensates are collected in catch tanks (e.g., 151-AZ, 152-AX, or TK-417) and returned either to an aging waste tank or to a dilute receiver tank. The air-lift circulators aid in suspending NCAW solids and in heat removal. Air-lift circulators require periodic flushing to prevent clogging.

Aging waste tank operation assumptions are as follows:

- Aging waste tanks can be used for storage of dilute non-aging waste. However, non-aging waste tanks cannot be used for storage of aging wastes.

- It is assumed that there will be no additional aging waste produced by the Hanford facilities. However, certain wastes containing high ^{90}Sr or

^{137}Cs contents may require storage in aging waste tanks due to their radioactivity.

- Single-shell tank (SST) solids retrieved from Tank 106-C will be stored in an aging DST (Tank 102-AY) due to the high heat contents of the solids.

- It is assumed that the in-tank washing activities will commence in FY 1995 to supply the initial feed for the High Level Waste (HLW) vitrification facility. The first step in all the in-tank washing scenarios involves the decanting and transfer of the supernate from Tank 101-AZ to Tank 101-AY (contents previously transferred to AP Farm). The decanted aging waste supernate from Tank 101-AZ will require storage in an aging waste tank due to its heat content. Additional in-tank washing activities vary for the projection cases and are listed in Section 4.

- One million gallons of aging tank space is kept available for receiving the contents of an aging waste tank, in the unlikely event of a tank leak (Department of Energy order 5820.2A).

- Tank 102-AY is designated as a 200 East Area dilute receiver for non-complexed wastes. This tank is currently receiving direct transfers of wastes from B Plant and rail or truck shipments via 204-AR vault from S Plant, T Plant, 100 Area, 300 Area, and 400 Area.

Non-Aging Double-Shell Tanks

The remaining 24 DSTs are called non-aging waste tanks and are used to store wastes that do not contain high-heat loads in accordance with applicable operational and waste segregation policies. Non-aging waste tank operation assumptions are as follows:

- Waste segregation and compatibility are requirements of DOE Order 5820.2A (DOE, 1990) and WAC 173-303-395 (Dangerous Waste Regulations). The overriding purpose of waste segregation and compatibility are to ensure the safety of waste storage and tank farms operations as well as to minimize future pretreatment costs. Wastes that are typically segregated include:

  - Phosphate Wastes--dilute phosphate (DP) or concentrated phosphate (CP).
  - Wastes Containing High Organic Concentrations--dilute complexed (DC) or complexant concentrate (CC).
  - TRU containing wastes--Neutralized Cladding Removal Wastes (NCRW solids) or PFP solids (PT).
  - Watch list tank wastes to prevent inadvertent commingling with other wastes.
  - Pretreated waste streams.
    Washed NCAW solids, etc.
  - Concentrated interim waste types--e.g., double-shell slurry feed (DSSF) or double-shell slurry (DSS) need to be separated from dilute wastes to prevent the need to reconcentrate.
  - Wastes exhibiting exothermic reactions.

- Operational tank usage for this projection include the following:

Operation	Designated Tank
Evaporator Feed Tank	Tank 102-AW (modeled as a full tank)
Evaporator Receiver Tank	Tank 106-AW (tank level varies)
Dilute Receiver Tank	Tank 105-AW (PUREX direct transfers)
Dilute Receiver Tank	Tank 102-AY
200 East SWL Receiver (DN)	Tank 101-AN
200 West SWL Receiver (DN)	Tank 102-SY
Spare Tank Space	Tank 104-AP

Flushes are generated during the receipt of waste transfers either from railroad tank cars, tanker trucks, or after tank to tank transfers. The amount of flush and monthly waste generation rates for Tank Farms are presented in Section 4.

3.10 UO_3 Facility

The UO_3 Facility concentrated and calcined uranyl nitrate hexahydrate (UNH) recovered by the PUREX plant to produce uranium oxide (UO_3) and nitric acid (HNO_3). Until now, the UO_3 Facility has not produced any DST wastes. Rainwater collected at the facility will be sent to cribs.

3.11 Waste Sampling and Characterization Facility (WSCF)

It is assumed that the Waste Sampling and Characterization Facility (WSCF) will become operational in FY 1994 (Francik, 1993). This facility will generate aqueous low level wastes which will be sent to 200 East Area DSTs. Waste generation volumes for the WSCF (Warwick, 1993) for all projection cases will be approximately 0.7 Kgal/month (including flush).

3.12 100 Area

All projection cases assumed that N Reactor decommissioning activities would generate 571 Kgals of concentrated wastes (Watson, 1992). This waste will be concentrated at the source. Decommissioning of the N Reactor is estimated to take 6 years beginning in 1995 as shown in Section 4. Based on information received from 100 Area representatives, waste generation from decommissioning and basin cleanout activities is being reviewed and will be updated in the near future.

3.13 300 Area

Facilities in the 300 Area are used primarily for research and development activities or for analytical support. Liquid wastes from the various 300 Area Facilities are transferred to the 340 Facility. Liquid wastes collected at the 340 Facility are transferred to 204-AR vault in 20,000 gallon railroad tank cars. Monthly waste generation rates for the three projection cases are listed in Section 4.

3.14 400 Area

There are three major facilities in the 400 Area (Miller, 1991). These include the Fast Flux Test Facility (FFTF), the Maintenance and Storage Facility (MASF), and the Fuel and Material Examination Facility (FMEF). Radioactive liquid waste is primarily generated in conjunction with the removal of residual sodium from reactor components or with decontamination activities. Shutdown of the FFTF has increased the amount of liquid waste generated by the plant's Sodium Removal System (Miller, 1993). The monthly waste generation rate used for all projection cases is 1 Kgal/month (Miller, 1993) as shown in Section 4.

3.15 Salt Well Liquid Pumping

Salt Well Liquid (SWL) pumping will occur for single-shell tanks (SSTs) which have 50,000 gallons or more of drainable interstitial liquid. Pumping is scheduled to stop when the output rate decreases to 0.05 gallons per minute. Tank 101-AN was designated as the East Area dilute non-complexed SWL receiver tank. Tank 102-SY was designated as the West Area dilute non-complexed SWL receiver tank. These projection cases assumed that complexed SWL in 200 East Area would be transferred to Tank 101-AY while complexed SWL from 200 West Area could be added to Tank 103-SY (a Watch List Tank). Approximately 14% of the SWL waste is assumed to be complexed.

Schedules for SWL pumping are presented in Section 4.

4.0 PROJECTION CASE ASSUMPTIONS

The Operational Waste Volume Projection presents a basis for evaluating future DST space needs through the end of FY 2005. This report presents a projected range of tank needs which is used to generate recommendations regarding site activities, waste management activities, facility requirements, and the need to build additional double-shell tanks. This document presents the results of three projections cases (Lower Planning, Baseline, and Upper Planning Cases) which represent varying degrees of tank space needs and operational risks. Operating assumptions for the three cases were established in July 1994 which were assumed to bracket future site operations and DST needs:

- The Lower Planning Case manages projected tank space needs within the available tank space (28 DSTs) by delaying a number of planned TWRS program activities which could delay TPA milestones. The Lower Planning Case eliminates the need for construction of new DST space but introduces additional uncertainties and risks into the overall TWRS program beyond those of the Baseline Case.

- The Baseline Case is meant to project DST needs based on TPA milestones, TWRS program planning, and the most realistic operational assumptions. The Baseline Case requires building six additional DSTs through the end of FY 2005 which decreases the uncertainties and risks while meeting all TPA milestones.

- The Upper Planning Case uses more pessimistic projection assumptions and requires the building of thirteen additional DSTs through the end of FY 2005 while minimizing the uncertainties and risks.

Assumptions used for all cases are presented in Table 2. The assumptions for each case are listed in greater detail in the following sections.

Table 2. Assumption Matrix
For the July 1994 Operational Waste Volume Projection
(All Years are Fiscal Years)

	Lower Planning Case	Baseline Case	Upper Planning Case
Facility Generations			
Total Limit, Kgal/mo	64	93	108
PUREX			
Monthly Rate, Kgal/mo	0	0	0
TCO Scheduled	1994-1997	1994-1997	1994-1997
TCO Volume, Kgal DN	300	400	1500
UO_3 Facility			
Monthly Rate, Kgal/mo	0	0	0
B Plant			
Monthly Rate, Kgal/mo	23	23	23
TCO Scheduled	1997-2001	1997-2001	1997-2001
TCO Volume, Kgal DN	562	562	562
S Plant			
Monthly Rate, Kgal/mo	12	18	18
T Plant			
Monthly Rate, Kgal/mo	12	15	20
100 Area			
Monthly Rate, Kgal/mo	0	0	0
Basin Cleanouts			
TCO Scheduled	1995-1999	1995-1999	1995-1999
TCO Volume, Kgal DSSF	571	571	571
300 Area			
Monthly Rate, Kgal/mo	5	5	5
400 Area			
Monthly Rate, Kgal/mo	1	1	1
WSCF			
Monthly Rate, Kgal/mo	0.7	0.7	0.7
Tank Farms			
Monthly Rate, Kgal/mo	10	30	30
Solid Waste Mixed Waste Trench 31 Leachate			
Monthly Rate, Kgal/mo	0	0	10

Table 2. Assumption Matrix
For the July, 1994 Operational Waste Volume Projection
(continued)

	Lower Planning Case	Baseline Case	Upper Planning Case
One Time Waste Additions:			
105-F & 105-H Basins			
Total in 1995-96, Kgal	225	225	225
Tank 107-AN Caustic Addition			
Total in 1995, Kgal	50	50	50
Salt Well Liquid Pumping			
Total Volume remaining	3.6 Mgal	3.6 Mgal	5.1 Mgal
Volume 1994 thru 1999	3.58 Mgal	3.58 Mgal	5.08 Mgal
Volume 1994 thru 2005	3.6 Mgal	3.6 Mgal	5.1 Mgal
Completion, FY	2000	2000	2000
Meets TPA Milestones	Yes	Yes	Yes
Dilute Complexed SWL	0.5 Mgal	0.5 Mgal	0.7 Mgal
Porosity	35%	35%	45%
Single-Shell Tank (SST) Solids			
Tank 106-C Retrieval	1997	1997	1997
SST Waste Retrieval Demo	2003	2003	2003
Tank Farm Closure start	2018	2018	2018
Retrieval Dilution Ratio	3:1	3:1	3:1
Vol. retrieved in 2004(Mgal)	0.2	0.2	0.2
Vol. retrieved in 2005(Mgal)	0.3	0.3	0.3
Meets TPA Milestones	Yes	Yes	Yes
No. SSTs Retrieved	149	149	149
Sludge Retrieved (Mgal)	12.2	12.2	12.2
Saltcake Retrieved (Mgal)	23.4	23.4	23.4
Low Level Waste (LLW) Pretreatment Facility			
Includes New Evaporator	Yes	Yes	Yes
Start Construction(mo/yr)	11/1998	11/1998	11/1998
Constr. complete(mo/yr)	12/2003	12/2003	12/2003
Hot Start	12/2004	12/2004	12/2004
Complete processing(mo/yr)	12/2028	12/2028	12/2028
TWRS completion date	2020	2020	2020
Starting Feed	DSSF/SST Saltcake	DSSF/SST Saltcake	DSSF/SST Saltcake
Rate(12/2004-6/2007),Mgal/yr	6	6	6
LLW Feed Tank (filled)	1	1	1
LLW Receipt Tanks; 2005	0	1	1
LLW Receipt Tanks; 2006 on	0	2	2
HLW Receipt Tanks; 2005 on	1	1	1

Table 2. Assumption Matrix
For the July, 1994 Operational Waste Volume Projection
(continued)

	Lower Planning Case	Baseline Case	Upper Planning Case
LLW Vitrification Facility			
Start Construction(mo/yr)	12/1997	12/1997	12/1997
Constr. complete(mo/yr)	12/2003	12/2003	12/2003
Hot Start	06/2005	06/2005	06/2005
Complete vitrification	12/2028	12/2028	12/2028
Characterization time per tank	1 week	0.5 year	0.5 year
Rate (6/2005-6/2007),Mgal/yr	6	6	6
Vol. vitrified 2005, Mgal	2	2	2
In-Tank Washing			
Start	1995	1995	1995
Scenario #	Case 4	Case 2	Case 1
Basic description of solids combination.	Combine washed 101-AZ, 102-AZ & 106-C solids.	Combine washed 101-AZ & 102-AZ solids;use 102-AZ as dil. receiver.	Wash 101-AZ only; no solids combination; use 101-AZ as dil. receiver.
High Level Waste (HLW) Pretreatment (Enhanced Sludge Washing)			
Start Construction(mo/yr)	06/2001	06/2001	06/2001
Hot Start(enh. sludge wash)	06/2008	06/2008	06/2007
Complete processing	12/2028	12/2028	12/2028
HLW Vitrification Facility			
Start Construction(mo/yr)	06/2002	06/2002	06/2002
Constr. complete(mo/yr)	12/2007	12/2007	12/2007
Hot Start	12/2009	12/2009	12/2009
Complete vitrification	12/2028	12/2028	12/2028
Characterization time per tank	2 weeks	1.5 years	1.5 years
Production rate (metric ton/day)	20	20	20
PFP			
Stabilization Run	1998	1998	1998
Evaporator			
Next Outage Date	>2005	>2005	>2005
Evaporation Product	DSSF	DSSF	dilute DSSF
Evaporation Limit (g/ml)	1.52	1.52	1.4
LERF capacity (Mgal)	13	13	13
Gal. condensate/gal. WVR	1.3	1.3	1.3
Yearly evaporation of DN (i.e., maintain currency)	Yes	Yes	Yes

Table 2. Assumption Matrix
For the July, 1994 Operational Waste Volume Projection
(continued)

	Lower Planning Case	Baseline Case	Upper Planning Case
Liquid Effluent Treatment Facility			
Start date (mo/yr)	06/1995	06/1995	06/1996
Rate	150 gpm	150 gpm	150 gpm
TOE	70 %	70 %	70 %
Watch List/Safety			
101-SY Dilution & date	None	1:1 (1998)	3:1 (1998)
103-SY Dilution & date	None	1:1 (2000)	3:1 (2000)
Spare/Contingency Space			
Spare Space, Mgal	2.28	2.28	2.28
Contingency space, Mgal	None	1.14	1.14
-date	N/A	(1999 on)	(1999 on)
Waste Segregation			
Loss of Waste Segregation	No	No	No
Store DSSF on NCRW solids	No	No	No
Segregate Complexed wastes	Yes	Yes	Yes
Loss of DST Space			
Number Tanks Removed from Service	None	None	1
Date Tank Removed	N/A	N/A	1998
New DST Construction			
New West Area Tanks	None	2	2
Date Constructed	N/A	2/98	2/98
New East Area Tanks	None	4	4
Date Constructed	N/A	12/98	12/98

4.1 Lower Planning Case Assumptions

Assumptions for the Lower Planning Case have been selected to manage the projected tank space needs within the available tank space (28 double-shell tanks) and yet with a minimum impact to Tri-Party Agreement milestones. Some of the required assumption changes include a loss of contingency space; a reduced facility waste generation limit; combination of NCAW and Tank 106-C solids, a delay in the dilution of Tanks 101-SY and 103-SY; and close-coupling of the low level waste pretreatment and vitrification facilities. Detailed assumptions are described below:

Plutonium and Uranium Extraction (PUREX)

- Westinghouse Hanford has been directed by the Department of Energy (DOE) to proceed with deactivation of PUREX. Deactivation of PUREX started in April 1994 and will continue through July 1998 (Hamrick, 1994). It is assumed that all waste transfers from PUREX to the DST system will cease once deactivation has been completed. This projection case assumes that the PUREX Facility will generate a total of 0.3 Mgal of waste (Wollam, 1994) from miscellaneous waste additions and terminal cleanout operations. This volume assumes that waste generations will be concentrated in the PUREX concentrator prior to transfer to DSTs.

UO_3 Facility

- No wastes are expected to be sent to the DST system. Rainwater collected at the facility will be sent to cribs.

B Plant

- B Plant is no longer considered a viable option for pretreatment of Hanford tank wastes. B Plant will continue to generate 23 Kgal/month of miscellaneous waste until plant stabilization has been completed. Cleanout and stabilization of B Plant is estimated to take 5 years beginning in FY 1997 and generate 0.562 Mgal of dilute non-complexed TCO wastes (Smith, 1994) for all projection cases.

S Plant

- The 222-S Analytical Lab conducts DST characterization, process support, and research and development activities. Liquid wastes are generated by disposal of process, DST, and environmental samples. This projection case used a 12 Kgal/month generation limit for these activities.

T Plant

- T Plant's primary activities include the decontamination and treatment of radiologically and chemically contaminated waste and equipment located on the Hanford site. Liquid wastes are generated during these activities and during the certification and hydrostatic leak testing of rail cars. This projection case used an average monthly waste generation rate of 12 Kgal/month for T Plant operations (Jenkins, 1994).

100 Area

- Decommissioning of 100 Area facilities will generate 0.571 Kgal of concentrated liquid wastes (double-shell slurry feed or DSSF) (Watson, 1992). It is assumed that this waste will be concentrated at the source. Decommissioning of N Reactor is estimated to take 6 years starting in FY 1995.

300 Area

- Facilities in the 300 Area are used primarily for analytical support and research and development activities. It is assumed that activities in the 300 Area will generate 5 Kgal/month (Frater, 1992) for all projection cases.

400 Area

- Liquid wastes are generated in 400 Area as a result of FFTF shutdown activities and from research and development. It is assumed that activities in 400 Area will generate 1 Kgal/month (Miller, 1993) for all projection cases.

Waste Sampling and Characterization Facility

- The Waste Sampling and Characterization Facility (WSCF) will generate 0.7 Kgal/month (Warwick, 1993) for all projection cases.

Tank Farms

- The Lower Planning Case used a 10 Kgal/month waste generation rate for Tank Farms due to line, cross-site, and air-lift circulator flushes.

105-F & 105-H Basin Cleanout

- Cleanout of 105-F and 105-H Basins will generate 225 Kgal of waste (plus flush) from 1995-1996 (Griffin, 1993) for all projection cases.

107-AN Caustic Addition

- Approximately 50 Kgal of caustic will be added to Tank 107-AN to mitigate the low caustic condition in the tank for all projection cases (Carothers, 1993).

Salt Well Liquid Pumping

- Salt Well Liquid (SWL) pumping will occur for single-shell tanks (SSTs) which have 50,000 gallons or more of drainable interstitial liquid. Pumping is scheduled to stop when the output rate decreases to 0.05 gallons per minute. Tank 101-AN was designated as the East Area dilute non-complexed SWL receiver tank. Tank 102-SY was designated as the West Area dilute non-complexed SWL receiver tank. These projection cases assumed that complexed SWL in East Area would be transferred to Tank 101-AY while complexed SWL from West Area could be added to Tank 103-SY (a Watch List Tank).

- This case used a 35 percent saltcake porosity resulting in a remaining volume of 3.6 million gallons of SWL (Forney, 1990) to be pumped from FY 1994 through the end of FY 2000 to meet TPA milestone M-41-00.

- Approximately 14% of the SWL waste is assumed to be complexed.

- The pumping schedule presented in Table 3 is based on the interim stabilization change package presented to DOE-RL (Lee, 1993). Total volumes were taken from Forney (1990) at 35% porosity. It is assumed that two-thirds of the pumpable volume in a SST will be pumped in the first half of the pumping schedule with the remaining one-third pumped in the second half (Boyles, 1994). It is also assumed that there will be no Complexed SWL pumped to DSTs in FY 1994.

Table 3. Salt Well Pumping Schedule for 35% Porosity (14% Complexed)

FISCAL YEAR	EAST AREA		WEST AREA		TOTALS
	DN	DC	DN	DC	
1989	55 KGAL	0 KGAL	0 KGAL	17 KGAL	72 KGAL
1990	44 KGAL	0 KGAL	0 KGAL	0 KGAL	44 KGAL
1991	227 KGAL	0 KGAL	0 KGAL	0 KGAL	227 KGAL
1992	121 KGAL	0 KGAL	0 KGAL	0 KGAL	121 KGAL
1993	0 KGAL	0 KGAL	37 KGAL	0 KGAL	37 KGAL
1994	184 KGAL	0 KGAL	0 KGAL	0 KGAL	184 KGAL
1995	22 KGAL	3 KGAL	95 KGAL	16 KGAL	136 KGAL
1996	119 KGAL	19 KGAL	633 KGAL	103 KGAL	874 KGAL
1997	356 KGAL	58 KGAL	459 KGAL	75 KGAL	948 KGAL
1998	267 KGAL	44 KGAL	696 KGAL	113 KGAL	1120 KGAL
1999	45 KGAL	7 KGAL	222 KGAL	36 KGAL	310 KGAL
2000	0 KGAL	0 KGAL	22 KGAL	4 KGAL	26 KGAL
TOTALS	1440 KGAL	131 KGAL	2164 KGAL	364 KGAL	4099 KGAL

Single-Shell Tank Solids Retrieval

- The TPA start date for retrieval of Tank 106-C (M-45-03A) is October 1997 but this projection assumed that the start date for retrieval of Tank 106-C would be October 1996 to satisfy Safety Initiative 6e (Wang, 1994 and Grumbly, 1993). Retrieval of Tank 106-C solids will require approximately a 3:1 ratio of dilution water to solids (Estey, 1994). Dilute complexed (DC) waste from Tank 101-AY will be used to sluice Tank 106-C solids. Solids retrieved from Tank 106-C will be stored in Tank 102-AY.

- Retrieval of the remaining solids from all 149 SSTs will begin in September 2003 (M-45-03-T1) and be completed by the end of FY 2018. A 3:1 ratio of dilution water to solids will be required for the retrieval of the remaining SST solids. It is further assumed that all solids will be removed from the SSTs and that SST site closure will be complete by FY 2024 (M-45-06).

- All projection cases assumed that SST solids retrieval rates would be at a relatively slow rate in FY 2004-2005 to allow LLW pretreatment time to free up DST space by pretreating and vitrifying DSSF wastes. Approximately 0.2 Mgal of solids (0.8 Mgal retrieved volume) would be retrieved from TX farm in FY 2004 and 0.3 Mgal of solids (1.2 Mgal retrieved volume) would be retrieved in FY 2005.

- Approximately 12.2 Mgal of sludge and 23.4 Mgal of saltcake will be retrieved from SSTs.

Low-Level Waste Pretreatment

- Construction of a new Low-Level Waste (LLW) Pretreatment Facility will begin in November 1998 and be completed in December 2003 to meet milestone M-50-02-T01. This facility will include additional evaporator capabilities to reduce the volume streams generated by the LLW pretreatment facility.

- Hot start-up of the LLW Pretreatment Facility to remove Cs and Sr from LLW will begin in FY 2005 and be completed by December 2028. The TWRS goal for completing LLW pretreatment is FY 2020. The initial LLW pretreatment feed will be double-shell slurry feed (DSSF) and SST saltcake which will be processed at an average rate of 6 Mgal/yr. The TWRS strategy for treatment and disposal of DST LLW mandates that all DSSF, DSS, and CP waste be retrieved for pretreatment by December 2007 (Honeyman, 1994).

- Retrieval of the sludge from each of the DSSF, DSS, and CP tanks will require a 3:1 dilution. The diluent can be dilute waste already in the DST, existing dilute waste from another DST, recycled water, or fresh water (Honeyman, 1994).

- This case assumed that the LLW pretreatment and vitrification facilities will be close coupled so that no LLW receipt tanks will be required between the pretreatment and vitrification facilities. One LLW

pretreatment feed tank (filled) and one HLW receipt tank (add to washed NCAW solids) will be required for facility operations.

LLW Vitrification

- Construction of a LLW Vitrification Facility will begin in December 1997 and be completed in December 2003 (M-60-00-T1).

- Hot start-up of the LLW Vitrification Facility will begin in June 2005 (M-60-05) and vitrification of all LLWs will be completed by December 2028. Operation of the LLW Vitrification Facility will begin with pretreated DSSF and SST saltcake feeds.

- This projection case allowed only one week for feed characterization and determining glass formulation prior to processing in the LLW Vitrification Facility.

- Vitrification rate will be 6 Mgal/yr.

In-Tank Washing

- In-tank washing (Place, 1991) will be used to prepare the initial feed for the HLW vitrification facility. In-tank washing Case 4 (MacLean, 1994) will be used to consolidate the washed NCAW solids from Tanks 101-AZ and 102-AZ and the washed solids retrieved from Tank 106-C into one aging waste tank. The supernates from Tanks 101-AZ, 102-AZ, and from the retrieval of Tank 106-C solids will be concentrated and combined into one aging waste tank. These operations decrease tank needs by one tank. These operations will also require acceptable heat calculations for the combined solids and will require higher than 5 M Na in the combined, concentrated supernates.

- In-tank washing operations will begin in FY 1995 and will be completed in FY 1999.

- Washed solids from these operations would be used as the initial feed for the high level waste vitrification facility.

High-Level Waste Pretreatment (Enhanced Sludge Washing)

- Construction of facilities for High-Level Waste (HLW) Pretreatment will begin in June 2001 (WDOE, 1994).

- Hot start-up of HLW Pretreatment will begin in June 2008 (M-50-04) and be completed by December 2028.

HLW Vitrification

- Construction of a new HLW Vitrification Facility will begin in June 2002 and be completed in December 2007 (M-51-03-T04).

- Hot start-up of the HLW Vitrification Facility will begin in December 2009 (M-51-03) and be completed by December 2028.

- This projection case allowed only one week for feed characterization and determining glass formulation prior to processing in the HLW Vitrification Facility.

- Rated production of the HLW vitrification process will be 20 metric tons/day.

Plutonium Finishing Plant (PFP)

- An Environmental Impact Statement (EIS) will have to be completed before PFP stabilization can occur. PFP is currently in an operations standby condition with maintenance and laboratory work on-going, but with the major process lines (Plutonium Reclamation Facility (PRF) and Remote Mechanical C Line (RMC)) in standby pending the outcome of the EIS (Backlund, 1994).

- PFP stabilization will begin in FY 1998 and will generate approximately 400 Kgal of dilute wastes using the schedule shown below.

  Note: The following schedule for PFP stabilization is dependent on the outcome of the EIS.

Table 4. Plutonium Finishing Plant Schedule

Fiscal Year	PRF Schedule	RMC Schedule
	Hours	Hours
FY 1994	(No Operations)	(No Operations)
FY 1995	(No Operations)	(No Operations)
FY 1996	(No Operations)	(No Operations)
FY 1997	450 hrs. Training	(No Operations)
FY 1998	450 hrs. Training, 3579 hrs. Operation	(No Operations)
FY 1999	1789 hrs Operations, 1192 hrs Cleanout	480 hrs Operations
FY 2000	(No Operations)	4320 hrs Operations

- If clean-out of gloveboxes and bays in the PRF is identified as an interim action, then some liquid waste generation (volume undetermined but likely less than 100 Kgal) could occur before the PFP stabilization campaign is started (Backlund, 1994).

- This projection assumed that there would be approximately 50 Kgals/month of waste generated while PRF was operating and there would be approximately 6 Kgals/month generated while the RMC was operating. It is assumed that the PFP labs will produce approximately 2.5 Kgals/month. Waste generations from the PFP stabilization campaign were considered a high priority waste generations (safety) and were assigned to "priority

space." (The approximate Kgal/month waste generations in this paragraph include all flushes of waste transfer lines from PFP to 244-TX and from 244-TX to Tank 102-SY).

- Additional volumes for PFP TCO have not been determined and are not included in this projection. TCO volumes need to be supplied by PFP engineers when results of the EIS are known.

- PFP waste generations and approximate percent solids are listed below (Barrington, 1991):

% Solids in PRF waste	3.5%
% Solids in RMC waste	4.4%
% Solids in lab waste	4.5%
gal/hr of PRF operation	69.0
gal/hr of RMC operation	9.7
gal/hr of lab operation	4.1

<u>242-A Evaporator</u>

- The 242-A Evaporator was restarted in April 1994. Campaign 1 (Tanks 102-AW, 106-AW, and 103-AP) was completed in June 1994.

- The second campaign will concentrate waste from Tanks 101-AP, 107-AP, and 108-AP starting in October 1994.

- The third campaign will begin in June 1995. Wastes to be concentrated in the third campaign have not been identified.

- Four to six months is required from the time a tank is filled with dilute waste until it can be evaporated. This time allows for RCRA characterization of the waste, documentation, and facility preparation.

- Non-complexed wastes will be evaporated to DSSF with a specific gravity of up to 1.5 g/l. Dilute complexed wastes will be evaporated to CC waste.

- Based on operating experience obtained during the first evaporator campaign in 1994, approximately 1.3 gallons of condensate will be sent to the Liquid Effluent Retention Facility (LERF) for each gallon of Waste Volume Reduction (WVR). A total of 13 million gallons of LERF storage will be available for evaporator process condensate and 6.5 million gallons for spare space. Using the factor of 1.3 gallon of condensate/gallon of WVR, the Evaporator should be able to achieve about 10 million gallons of WVR before the LERF is full. Based on current evaporator campaign schedules, the LERF would not be filled to capacity before the LETF starts in June 1995.

- The Evaporator will become current in 1996 and will remain current. To remain current, the Evaporator will be operated annually to evaporate all dilute wastes.

- Previous projections assumed that the 242-A Evaporator would require a 1 year outage for maintenance and or upgrades every 10 years based on a 10

year design life of the 242-A Evaporator (WHC-EP-0342). This projection assumed there would not be on outage before FY 2005.

Liquid Effluent Treatment Facility

- The Liquid Effluent Treatment Facility (LETF) is scheduled to start in June 1995. This facility will be designed with 40 to 150 gallon/minute variable flow rate. It is assumed that this facility will ramp up from a 24 percent Total Operating Efficiency (TOE) to 72 percent TOE over a four month period. The maximum anticipated processing rate of 72 percent TOE will be reached in October 1995. It is assumed that the LETF should be able to process condensate from the LERF basins and newly generated evaporator condensate simultaneously (Williams, 1994).

Watch List/Safety

- Previous projections have assumed that the dilution required to retrieve Tank 101-SY would be between 1:1 and 3:1 (Rieck, 1994). To minimize tank space needs the dilution of Tanks 101-SY and 103-SY was eliminated or postponed until after FY 2005 to allow LLW Pretreatment/Vitrification to work off some DSSF thus reducing the amount of stored wastes. It is assumed that agitation using a mixer pump will continue to be used for mitigation of flammable gas buildup. Other than the retrieval of Tank 106-C solids, no additional DST volume increase has been allowed for mitigation or remediation of Watch List Tanks for this projection case. However, these projection cases did assume that complexed SWL from West Area could be added to Tank 103-SY (a Watch List Tank).

Spare/Contingency Space

- A total of 2.28 million gallons (one aging and one non-aging tank) of spare space is reserved in case of a leak in an aging waste tank (DOE Order 5820.2A).

- At the request of WHC and DOE management, one tank of contingency space has usually been set aside in the long range projection (1999 on) to account for possible inaccuracies in the WVP software when projecting waste generations and/or waste volume reduction factors. To minimize tank space needs, no contingency space is set aside in this projection case.

Waste Segregation

- Wastes are segregated for safety of operations and storage; reduction in pretreatment costs; more efficient use of waste storage resources; and to comply with DOE Order 5820.2A and WAC 173-303-395.

- All current waste segregation practices are observed (complexed waste, NCAW, NCRW solids, PFP solids, and watch list tanks).

Loss of DST Space

- This projection case assumed that none of the DSTs would be removed from service by 2005.

New DST Construction

- o TPA Milestone M-42-01 called for the construction of two new tanks in 200 West Area by February 1998 with up to four additional tanks being constructed in 200 East Area (M-42-01) by December 1998. However, this projection case assumed that no new DSTs would be constructed by 2005.

Double-Shell Tank Solids Levels

- o The following solids levels have been used in this projection. Solids levels have been estimated for the tanks marked with an asterisk (*) based on the previous solids level measurement and the percent solids in facility generations that have been added to the tank since the last solids level measurement. Tanks with little or no solids are not listed.

Table 5. DST Solids Levels in Kgals (Hanlon, 1994 / Koreski, 1994)

TANK	SOLIDS	TANK	SOLIDS	TANK	SOLIDS
102-AN	89	101-AW	84	101-AY	83
104-AN	274	102-AW	3	102-AY	32
106-AN	17	103-AW*	487	101-SY	560
107-AN	134	104-AW*	267	102-SY*	133
101-AZ	35	105-AW*	388	103-SY	4
102-AZ	95	106-AW*	211		

- o Flush volumes are listed below:

  - B Plant 0% - PUREX 0%
  - NCAW 14% - PFP 6%
  - T Plant 6% - S Plant 6%
  - HFW 44%
  - Cross-Sites 20 Kgal + 30 Kgal test
  - SWL Pumping 10%
  - Misc tank farm water additions: 10 Kgals per month
  - Evaporator flush after each campaign: 35 Kgals to 102-AW (Haigh, 1992)
  - Evaporator Staging: 10 Kgals after each transfer
  - 244TX to Tank 102-SY: 4.5 Kgals after each 20 Kgals of waste (White, 1992)

- o Tank Fill Limits (except for special tank fill considerations):

  - AY, AZ Tanks: 980 Kgals
  - All other DSTs: 1140 Kgals

- o The assumptions used to simulate tank transfers in this projection are listed below:

  - Tank 102-SY: 879 Kgal in the tank, and PRF not operating, pumped down to 50 Kgal above solids.
  - Tank 102-AY: Start transfer at 900 Kgal.
  - Tank 105-AW and other dilute receivers: Start transfer at 1000 Kgal, pump down to 50 Kgal above solids.

4.2 Baseline Case Assumptions

Assumptions pertaining to the Baseline Case represent current Hanford Facility and project plans needed to meet the Tri-Party Agreement milestones. This case includes contingency space, no loss of waste segregation, facility requested waste generation rates, a 1:1 dilution of Tanks 101-SY and 103-SY, and two additional LLW pretreatment receipt tanks. Detailed assumptions are described below.

The assumptions pertaining to the Baseline Case are the same as those pertaining to the Lower Planning Case, except the following:

PUREX

- This projection case assumed that the PUREX Facility would generate a total of 400 Kgal of waste (Wollam, 1994) from miscellaneous waste additions and terminal cleanout operations. This volume assumed that waste generations would be concentrated in the PUREX concentrator prior to transfer to DSTs.

S Plant

- The 222-S Analytical Labs will generate 18 Kgal/month of wastes. The additional waste would come from accepting the return of mixed waste samples sent from the Hanford site to commercial laboratories for analysis (Warwick, 1993).

T Plant

- This projection case used an average monthly waste generation rate of 15 Kgal/month for T Plant operations (Jenkins, 1994).

Tank Farms

- Tank Farms will generate 30 Kgal/month from transfer line, cross-site transfer line, and air-lift circulator flushes. Increased generations would result from the higher number of transfers resulting from increased generation levels for the other Hanford facilities.

Low Level Waste Pretreatment

- This case assumed that the LLW pretreatment and vitrification facilities would not be close coupled and lag storage would be required in the DST system to store pretreated streams. In addition to the pretreatment feed tank, one "clean" LLW receipt tank and one HLW receipt tank will be required to store pretreated waste streams during the first year of operation (FY 2005). By the second year (FY 2006) of operation, an additional "clean" LLW receipt tank will be added (total of 4 operational tanks). It is assumed that these tanks will store all wastes from the LLW pretreatment facility destined for vitrification and that no additional DST storage will be required.

LLW Vitrification

- Feed characterization and frit acquisition would require one-half year prior to processing in the LLW Vitrification Facility.

In-Tank Washing

- In-tank washing Case 2 (MacLean, 1994) will be used to combine the washed NCAW solids in Tank 102-AZ after the initial sludge wash (MacLean, 1994). Tank 102-AZ would be used as a dilute receiver after consolidation of the NCAW solids.

HLW Vitrification

- This projection case allowed one and one-half years for feed characterization and frit acquisition prior to processing in the HLW Vitrification Facility.

Watch List/Safety

Tank 101-SY

- It is estimated that the dilution required to retrieve Tank 101-SY will be between 1:1 to 3:1 (three parts diluent to one part waste) (Rieck, 1994). Quarter scale tests are planned at Pacific Northwest Labs (PNL) to determine the required dilution ratio.

- This projection case assumed that a 1:1 (one part diluent to one part waste) dilution of Tank 101-SY will begin in FY 1998 (Miller, 1994) to alleviate hydrogen build-up concerns. Diluted waste from Tank 101-SY would be transferred to one of the 200 West Area tanks scheduled to be completed in February 1998. It is assumed that other Tank 101-SY remediation activities will not further impact DST volumes by the end of this projection (FY 2005).

Tank 103-SY

- It is estimated that the dilution required to retrieve Tank 103-SY will be between 1:1 to 3:1 (three parts diluent to one part waste).

- This projection case assumed that a 1:1 (one part diluent to one part waste) dilution of Tank 103-SY will occur in FY 2000 (Miller, 1994). Diluted wastes from Tank 103-SY would be transferred to one of the 200 West Area tanks scheduled to be completed in February 1998.

Spare/Contingency Space

- At the request of WHC and DOE management, one tank of contingency space has usually been set aside in the long range projection (1999 on) to account for possible inaccuracies in the WVP software when projecting waste generations and/or waste volume reduction factors.

- One contingency tank is added from FY 1999.

New DST Construction

- This projection case assumed that two new DSTs would be constructed in 200 West Area February 1998 (M-42-01).
- This projection case assumed that four new DSTs would be constructed in 200 East Area December 1998 (M-42-00).

4.3 Upper Planning Case Assumptions

The assumptions pertaining to the Upper Planning Case are the same as those pertaining to the Baseline Case, except for the following assumption changes which will increase tank space needs. Some of the assumption changes include increased facility miscellaneous and Terminal Cleanout waste generations; a higher SWL pumping volume; a delay in the start of the Effluent Treatment Facility; additional in-tank washing impacts; an evaporation limit of 1.4 g/l for DSSF; and a 3:1 dilution ratio for Tanks 101-SY and 103-SY.

PUREX

- This projection case assumed that the PUREX Facility will generate a total of 1.5 Mgal of dilute waste (Wollam, 1994) from miscellaneous waste additions and terminal cleanout operations.

T Plant

- This projection case used an average monthly waste generation rate of 20 Kgal/month for T Plant operations (Jenkins, 1994).

Solid Waste Mixed Waste Trench 31 Leachate

- The leachate collected in the solid waste mixed waste Trench 31 would be sent to DSTs. Trench 31 would generate 10 Kgal/month of leachate (McKenney, 1994).

In-Tank Washing

- In-tank Washing Case 1 (MacLean, 1994) will be used to wash NCAW solids in Tank 101-AZ (no combination of solids) beginning in FY 1995. Tank 101-AZ would be used as a dilute receiver after the solids are washed.

Watch List/Safety

- Mitigation and retrieval of Tank 101-SY would require a 3:1 dilution in FY 1998.

- Mitigation and retrieval of Tank 103-SY would require a 3:1 dilution in FY 2000.

Loss of DST Space

- The earliest DST construction began in 1968 with the building of the AY tank farm. Efforts are being taken to extend the life of the DSTs but the tanks still have a finite lifetime. This projection case assumed that one of the DSTs would have to be removed from service by 1998.

Salt Well Liquid Pumping

- The Upper Planning Case used a 45 percent saltcake porosity resulting in a remaining volume of 5.1 million gallons of SWL to be pumped from FY 1994 through the end of FY 2000 to meet TPA milestones.

- The pumping schedule presented in Table 6 is based on the interim stabilization change package presented to DOE-RL (Lee, 1993) but with a 45% saltcake porosity (Hanlon, 1994). It is assumed that two-thirds of the pumpable volume in a SST will be pumped in the first half of the pumping schedule with the remaining one-third pumped in the second half (Boyles, 1994). It is also assumed that there will be no Complexed SWL pumped to DSTs in FY 1994.

Table 6. Salt Well Pumping Schedule for 45% Porosity (14% Complexed)

FISCAL YEAR	EAST AREA		WEST AREA		TOTALS
	DN	DC	DN	DC	
1989	55 KGAL	0 KGAL	0 KGAL	17 KGAL	72 KGAL
1990	44 KGAL	0 KGAL	0 KGAL	0 KGAL	44 KGAL
1991	227 KGAL	0 KGAL	0 KGAL	0 KGAL	227 KGAL
1992	121 KGAL	0 KGAL	0 KGAL	0 KGAL	121 KGAL
1993	0 KGAL	0 KGAL	37 KGAL	0 KGAL	37 KGAL
1994	152 KGAL	0 KGAL	32 KGAL	0 KGAL	184 KGAL
1995	22 KGAL	4 KGAL	119 KGAL	19 KGAL	164 KGAL
1996	155 KGAL	25 KGAL	1034 KGAL	168 KGAL	1382 KGAL
1997	497 KGAL	81 KGAL	692 KGAL	113 KGAL	1383 KGAL
1998	396 KGAL	64 KGAL	887 KGAL	144 KGAL	1491 KGAL
1999	118 KGAL	19 KGAL	316 KGAL	51 KGAL	504 KGAL
2000	0 KGAL	0 KGAL	37 KGAL	6 KGAL	43 KGAL
TOTALS	1787 KGAL	193 KGAL	3154 KGAL	518 KGAL	5652 KGAL

5.0 RESULTS AND CONCLUSIONS

The results of a waste volume projection can be used to forecast tank space needs versus time, forecast evaporator operation, LLW pretreatment and disposal, HLW pretreatment and disposal, analyze tank space issues for aging and non-aging waste tanks, tank usage, or to determine the need and schedule for retrievals or cross-site transfers. To predict tank space needs, a graphic is produced showing tank count versus time as compared to the available space. A short range waste volume projection predicts tank space needs over approximately a four year period in monthly intervals. A long range waste volume projection predicts tank space needs over a longer range (1994-2005) in yearly intervals.

Except for near term scheduled evaporator operations, both types of projections assume that dilute waste will be evaporated to DSSF in the year they are produced, provided an evaporator is operational and the WVR limit of the evaporator has not been exceeded. Long range projection graphics for the Lower Planning Case, Baseline Case, and Upper Planning Case are presented in Sections 5.1, 5.2, and 5.3, respectively. Short range graphics, tank usage graphics, and evaporator WVR data have been included for the Baseline Case only. Results of the projection cases are included in the following sections.

5.1 Lower Planning Case Results and Conclusions

Tank space needs for the Lower Planning Case are shown in Figure 3. The Lower Planning Case manages projected tank space needs within the available tank space (28 DSTs) by delaying some planned TWRS program activities which could delay TPA milestones. Compared to the Baseline Case, these assumption changes include a loss of contingency space, reduced facility waste generations, combination of NCAW and Tank 106-C solids, an elimination (or delay) in the dilution of Tanks 101-SY and 103-SY, and close-coupling of the low-level waste pretreatment and vitrification facilities to avoid the need for LLW and HLW receipt tanks.

The Lower Planning Case eliminates the need for construction of new DST space but introduces additional uncertainties and risks into the overall TWRS program beyond those of the Baseline Case. The Lower Planning Case manages projected tank space needs within the available tank space (28 DSTs) by delaying a number of planned TWRS program activities. If the actual waste accumulations exceed the minimum amounts used in this projection case, it is conceivable that this case could lead to delays in TPA milestones to reduce volumes. Risks and uncertainties for this projection include the following:

- Facilities may not be able to meet the more restrictive 64 Kgal/month waste generation. The average waste generation rate for facilities for the period July 1, 1991 to June 30, 1994 (3 years) was approximately 28 Kgal/month (see Section 5.4). This waste generation reduction was achieved by waste minimization actions, delaying routine facility cleanup and decon activities, storing waste in the facilities, and postponing activities that would result in wastes other than those classified as safety, emergency, regulatory, or TPA milestone related. It is entirely possible that waste generations for the facilities could exceed the 64 Kgal/month limit since this level does not allow any margin for emergency generations. The volume impact due to this risk is probably minimal as

long as the 242-A Evaporator is available to evaporate these very dilute wastes.

- SWL Pumping may exceed the 35% porosity volume estimates. Recent pumping for some tanks high in saltcake have been exceeding the 35% porosity volumes. Impact could approach 1.5 million gallons due to the high concentration of these wastes.

- No LLW pretreatment or processing receipt tanks are provided. Pretreated wastes would have to be stored in lag storage provided with the new facility or be routed directly to the LLW Vitrification Facility. The volume impact from this risk could be two tanks in 2005, increasing to three tanks in 2006. The final determination for these tanks will be addressed in the TWRS EIS as these tanks would be supplied by the TWRS Project.

- In-tank washing combination of all NCAW and 106-C solids in one tank may not be achievable if the combined solids level/heat load exceed OSRs or mixing and/or retrieval of the large amount solids becomes an issue. Likewise, combination of all NCAW supernates into one tank may not be achievable since the supernates would have to be concentrated to greater than 5 M Na (aging waste restriction). The volume impact from this risk is dependent on the magnitude of the changes in assumptions but could be up to one million gallons (one tank).

- Evaporation limit for this projection of approximately 1.5 g/ml for DSSF may not be allowed due to safety considerations (could create conditions similar to those in other watch list tanks, e.g., Tank 101-SY). The volume impact due to this risk could be up to two million gallons by the end of FY 2005 if evaporation is limited to 1.4 g/ml.

- This case eliminates the dilution of Tank 101-SY and 103-SY, eliminating a passive safety mitigation action proposed to solve hydrogen gas generation. Mixer pumps would be required to eliminate gas buildup. This risk could increase tank space requirements by approximately two million gallons if a 1:1 dilution of Tanks 101-SY and 103-SY is required.

- At the request of DOE and WHC upper management, one contingency tank has been included in outer year projections (1999 on) to allow for inaccuracies in waste generations or waste volume reduction factors. This projection eliminates contingency space.

- Some double-shell tanks are nearing there design life. This projection does not provide for the loss of any DST space through 2005. The volume of this impact would be one million gallons if one DST is lost.

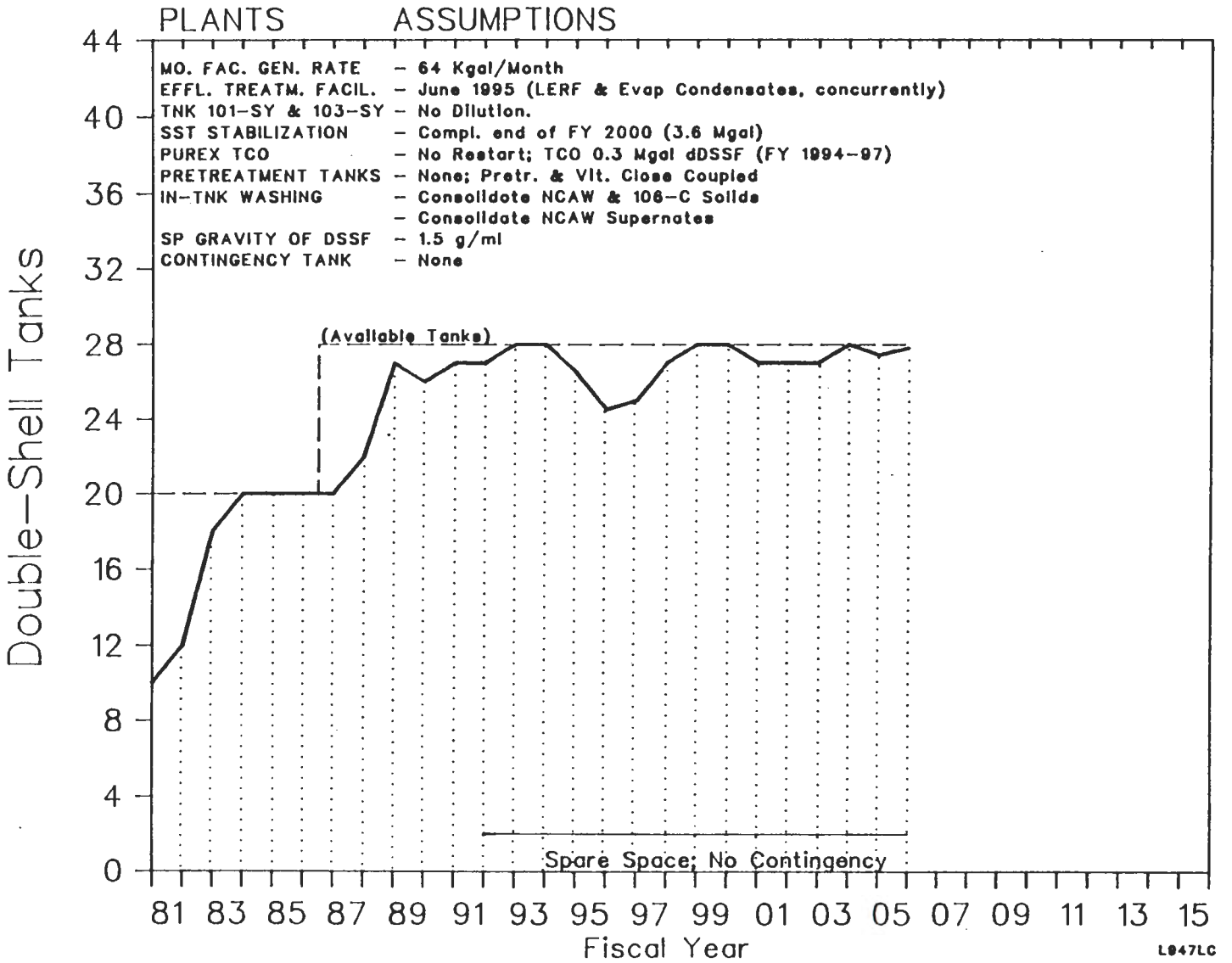

Figure 3. Double-Shell Tank Requirements for the Lower Planning Case

5.2 Baseline Case Results and Conclusions

Assumptions for the Baseline Case represent the current planning basis for TWRS programs to meet TPA milestones. Projected tank space needs for the Baseline Case are shown in Figure 4. Results from this projection require the construction of two new tanks in the 200 West Area in early FY 1998 to allow a 1:1 dilution of Tanks 101-SY and 103-SY. Construction of an additional three DSTs in the 200 East Area between FY 2000 and 2004 are required to meet projected DST space needs. This space is required to handle the higher expected facility waste generation and TCO volumes, contingency space, and pretreatment LLW and HLW receipt tanks.

The Baseline Case is meant to project DST needs based on TPA milestones and TWRS program planning. The Baseline Case requires building five additional DSTs through FY 2005 which decreases the uncertainties and risks while meeting all TPA milestones. Risks and uncertainties associated with this projection include the following:

- SWL Pumping may exceed the 35% porosity volume estimates. Recent pumping for some tanks high in saltcake have been exceeding the 35% porosity volumes. Impact could approach 1.5 million gallons due to the high concentration of these wastes.

- In-tank washing combination of all washed NCAW solids from Tanks 101-AZ and 102-AZ in one tank may not be achievable if the combined solids level/heat load exceed OSR limits. Likewise, combination of all NCAW supernates into one tank may not be achievable since the supernates would have to be concentrated to greater than 5 M Na. The volume impact from this risk is dependent on the magnitude of the changes in assumptions but could be up to one million gallons (one tank).

- Evaporation limit for this projection of approximately 1.5 g/ml for DSSF may not be allowed due to safety considerations (could create conditions similar to those in other watch list tanks, e.g., Tank 101-SY). The volume impact due to this risk could be up to two million gallons by the end of FY 2005 if evaporation is limited to 1.4 g/ml.

- The planning basis for dilution of Tank 101-SY and 103-SY includes a 1:1 dilution even though no experimental verification has been completed. Additional space (and/or the use of mixer pumps) may be required to eliminate gas buildup. This risk could increase tank space requirements by approximately 3.8 million gallons if a 3:1 dilution of Tanks 101-SY and 103-SY is required.

- Some double-shell tanks are nearing there design life. This projection does not provide for the loss of any DST space through 2005. The volume of this impact would be one million gallons if one DST is lost.

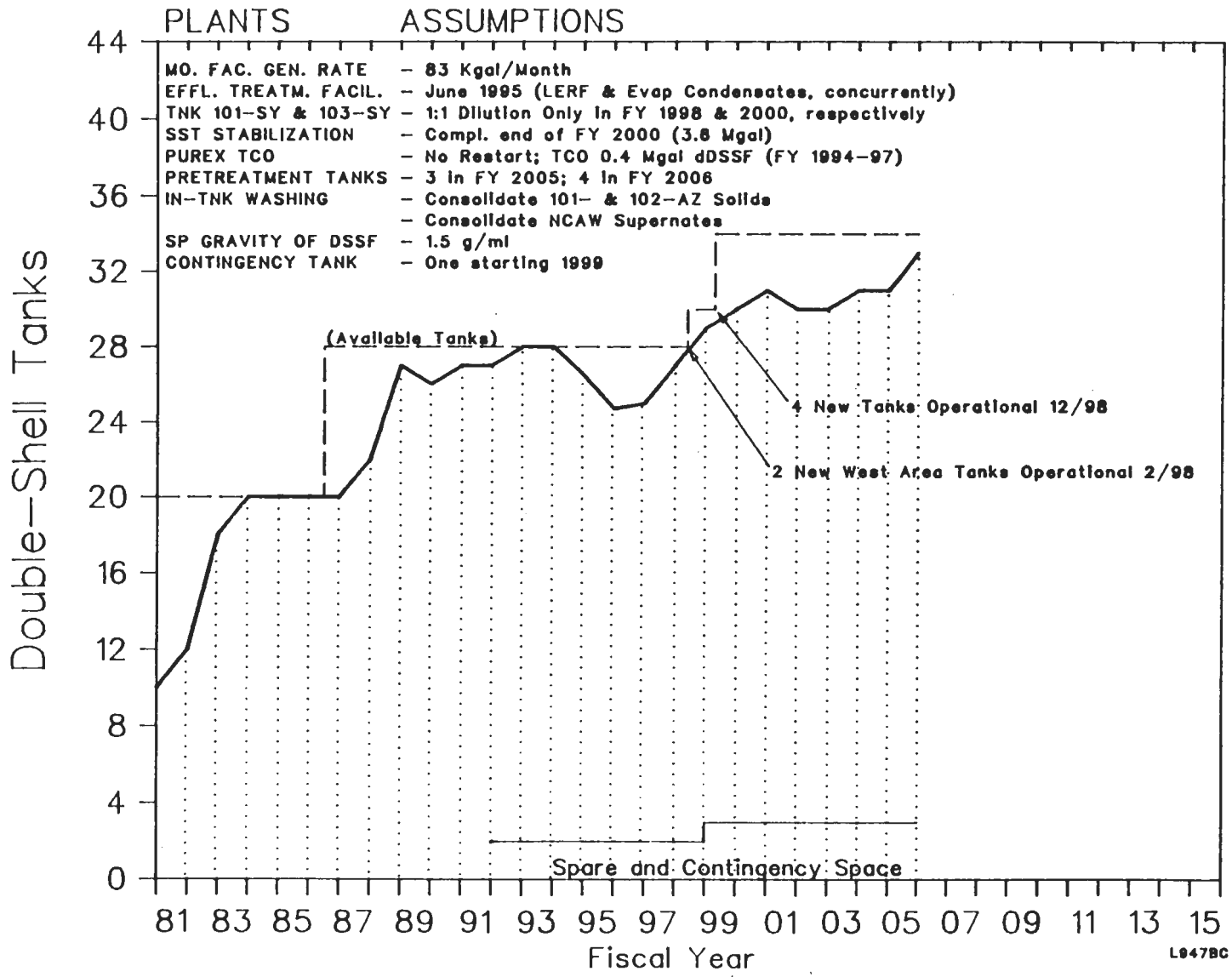

Figure 4. Double-Shell Tank Requirements for the Baseline Case

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Interpretation of Short Range Projection Results

This section provides an interpretation of detailed short range projection results. The "Specific Use Space" is tank space that is reserved for specific purposes such as spare tanks, segregated space, and other purposes in the short range projection. A break down of the "Specific Use Space" as of June 30, 1994 follows.

Table 7. Specific Use Space	
Spare Tank Space (1 Aging and 1 Non-aging Waste Tank)	2.28 Million Gallons
Segregated Tank Space (CC, CP, Sampled DSSF) (101-AY, 102-AN, 107-AN; 102-AP; and 105-AP)	0.63 Million Gallons
Miscellaneous Head Space (101-AP, 103-AP, 106-AP, 107-AP, 104-AW, 101-AZ, 102-AZ)	0.17 Million Gallons
Priority/Operational Tank Space (101-AN, 102-SY, 102-AW, 106-AW)	1.90 Million Gallons
Watch List Tank Space (101-SY, 103-SY, 103-AN, 104-AN, 105-AN, 101-AW)	0.70 Million Gallons
TOTAL===	5.68 Million Gallons

The OWVP presents certain information in the form of graphics. A number of these graphics show 12 months of historical operations and 24-48 months of projected operations. Most of the vertical axis represents thousands of gallons of waste generated. An example of this type of graphic is the facility waste generation graphic. The volume generated per month for each facility is depicted on a facility waste generation graph. An example of the facility waste generation graph for PUREX miscellaneous waste is shown below (Figure 5).

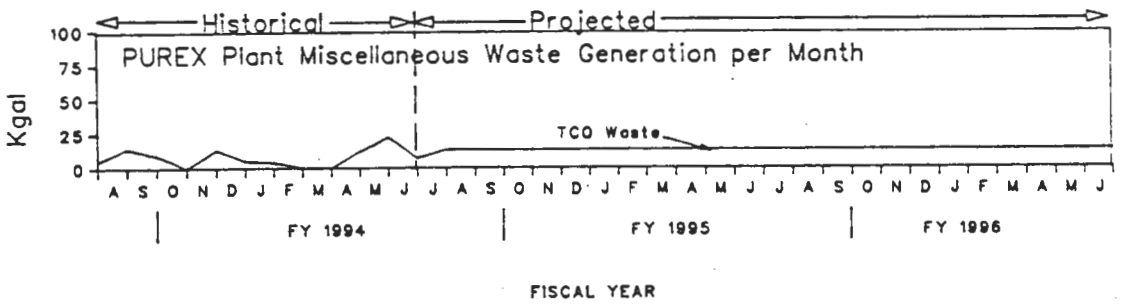

Figure 5. Facility Waste Generation Graphic

In the computer simulation, facility waste streams are routed to a receiver tank. A tank fill graphic shows the filling of the receiver tank and is on the same page as the facility waste generation graph of the waste stream it receives. The tank fill graphic shows the rate a specific tank is filled with waste. Usually when a receiver tank is full, waste is transferred to a

holding tank. This waste is either evaporated or stored for future disposal. For every transfer out of a tank, there is a corresponding receipt of the same volume into another tank or facility. For every evaporation out of a tank there is a corresponding receipt of the more concentrated waste in the receiving tank and an increase in the condensate from the 242-A Evaporator being sent to the LERF.

An example of this type of graph (a tank fill graphic) for Tank 105-AW is shown below (Figure 6).

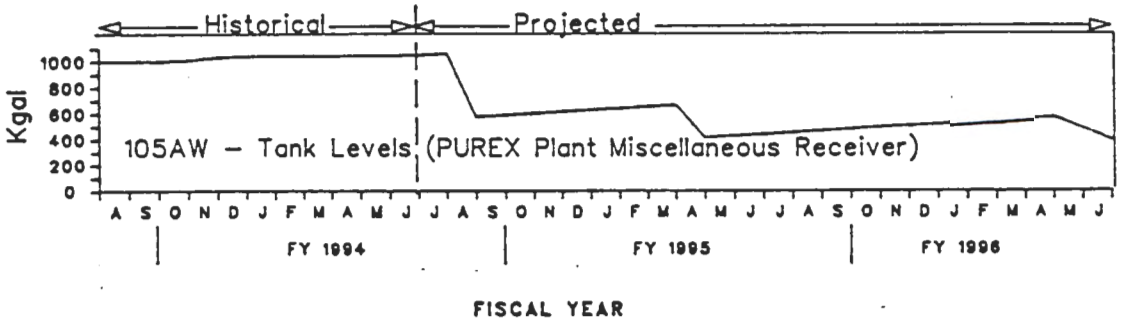

Figure 6. Tank Fill Graphic

The accuracy of this projection is directly related to the facility supplied assumptions. Some of the major assumptions are listed below:

- Process operating schedules define the planned dates of plant operations or deactivation activities. These assumptions are consistent with the TWRS program planning. Volumes and schedules for the various Hanford facilities are presented in Sections 3 and 4.

- Plant waste generation assumptions define the volume and type of waste that will be generated by the plants. These assumptions result from an analysis of recent waste generation history and future plans specified by the plants. Most waste streams volumes are projected based on historical data, TSMB generation rates, and facility supplied operating schedules. Section 5.4 includes a comparison of actual waste receipts to TSMB Limits for the period July 1, 1991 to June 30, 1994.

Tank roles and waste routings define the use of tanks in the system. For example, a tank will be designated to act as receiver of the PUREX facility miscellaneous waste (Tank 105-AW), while other tanks will store concentrated waste.

The graphics depicted on the next 3 pages summarize the short range projection results of the Baseline Case. Figure 7 shows the role of each tank during the first four years of the projection. It should be noted that if a tank has several transfers in or out of the tank in one month, no fluctuation in the tank level may appear. This is because the graphic program plots tank levels as of the last day of the month and any changes that occur during the month are not shown. Figures 8 shows the tank space needs for the short range projection completed for the Baseline Case. The simplified routing schematic shown in Figure 9 shows the assumptions that are made about the routing of waste from the plants to the tanks and from tanks to the facilities.

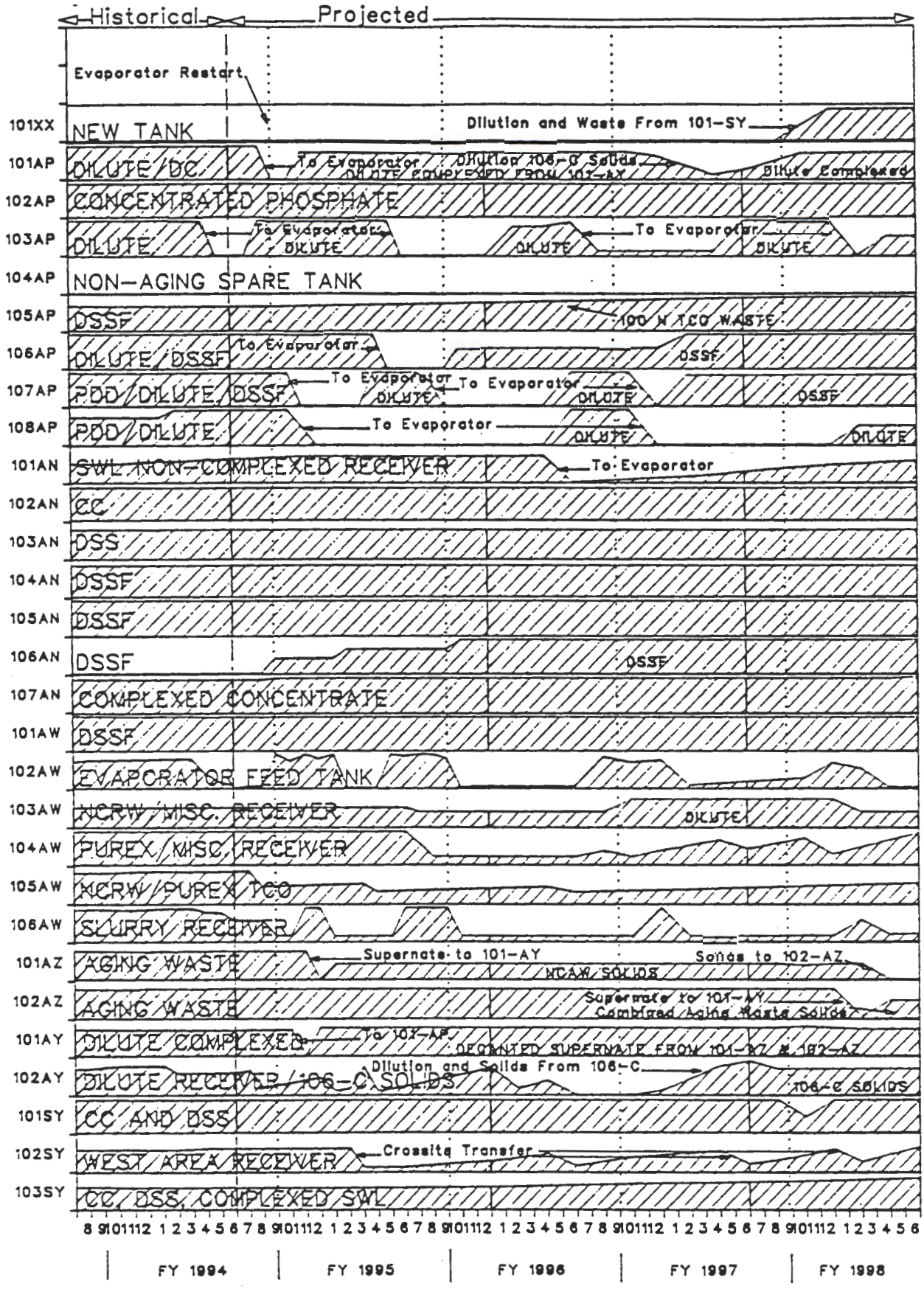

Figure 7. Tank Levels During Four Year Simulation

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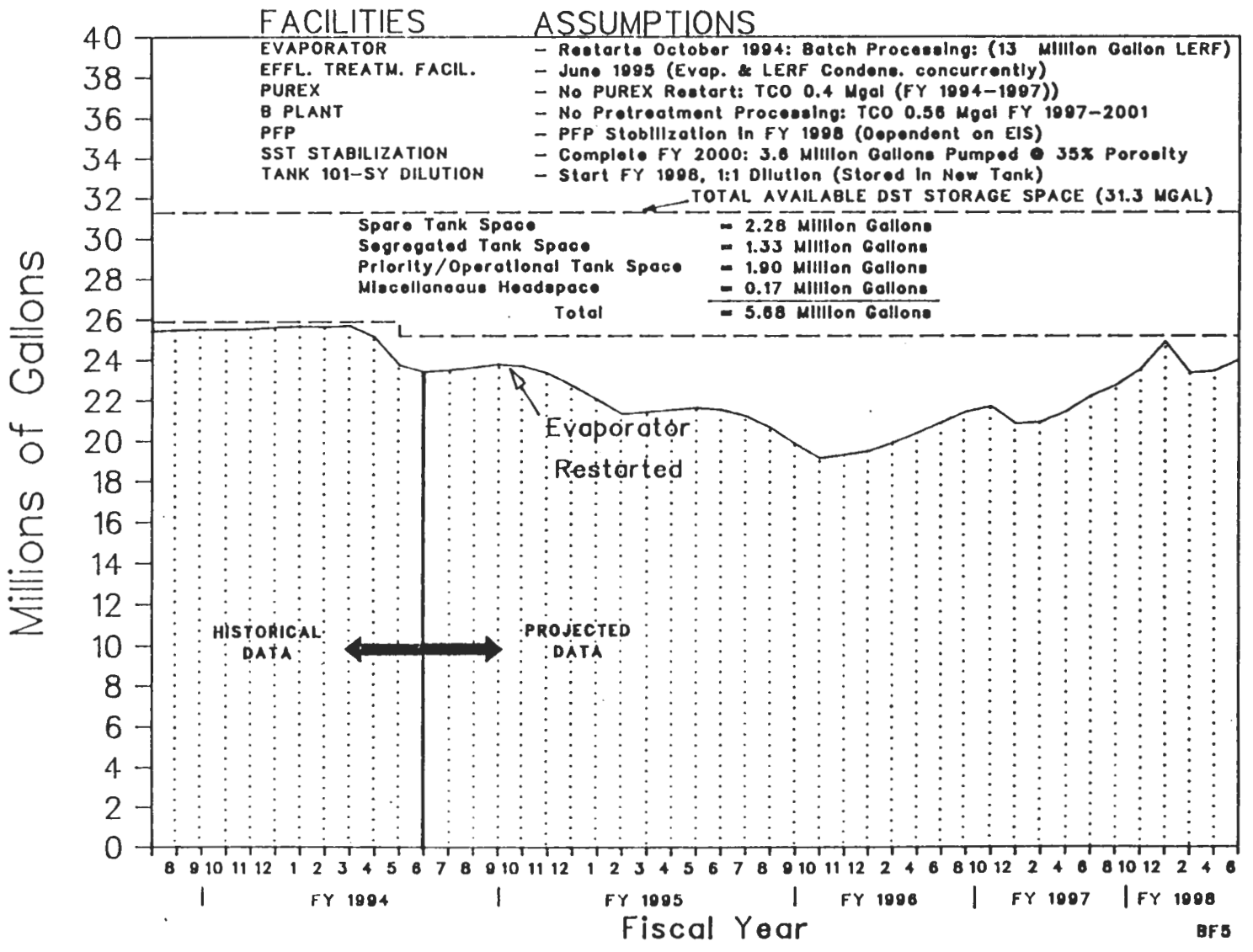


Figure 8. Short Range Tank Space Summary

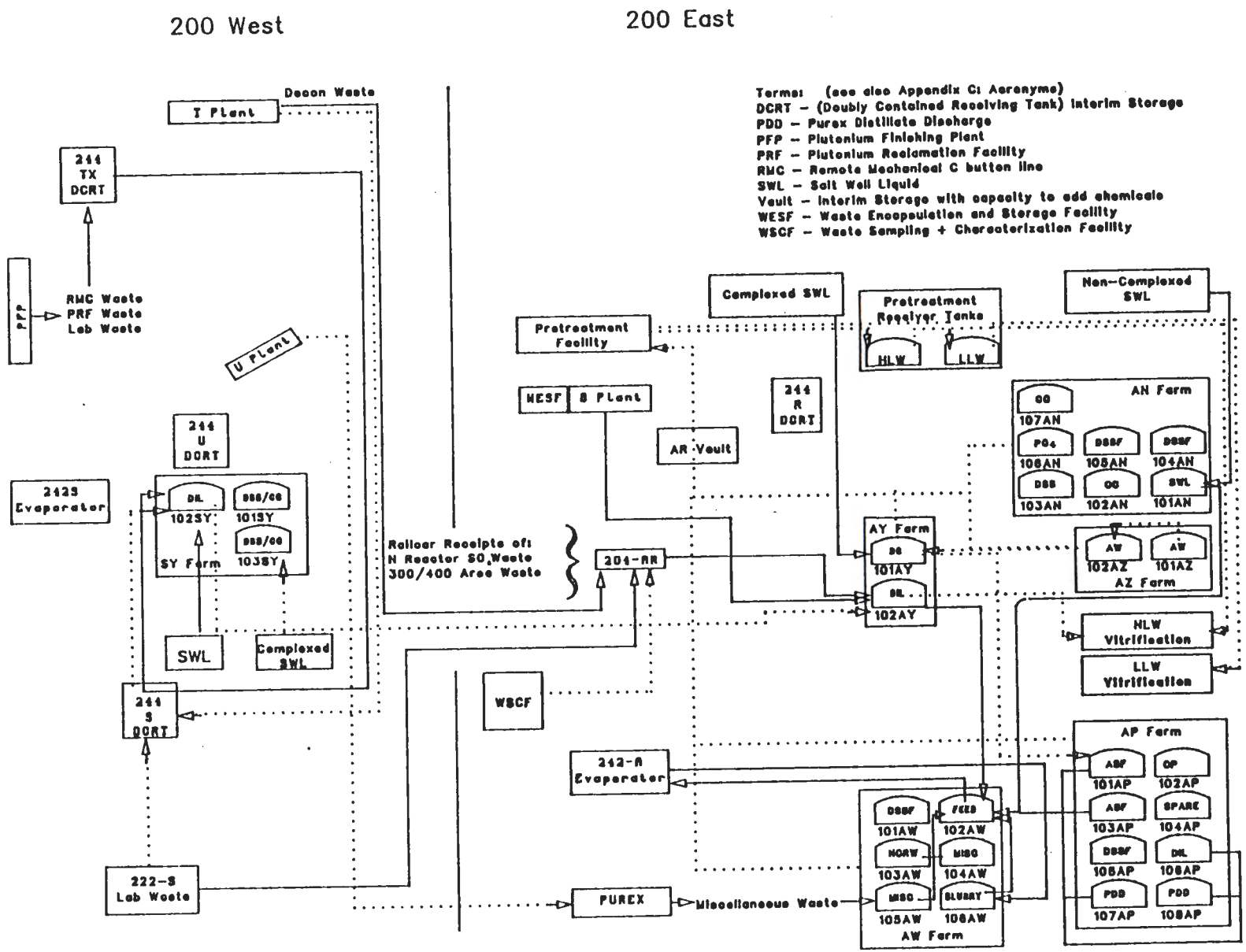


Figure 9. Simplified Schematic of Current and Planned Routings

The results of this projection are forecasts of evaporator operations, LLW pretreatment and disposal, HLW pretreatment and disposal, and an analysis of tank space issues for aging and non-aging waste tanks.

Evaporator WVR and LERF Condensate

Schedule and operational considerations presented in Section 4 result in the following Evaporator Waste Volume Reduction (WVR) and LERF Condensate production volumes for the Baseline Case. Operating experience obtained during the first evaporator campaign in 1994 indicate that approximately 1.3 gallons of condensate will be sent to the LERF for every one gallon of WVR. The projected volumes sent to LERF in the following table are calculated based on the 1.3 gallon condensate/gallon WVR factor. These volumes also assume that there that there will be no evaporator outages before 2005.

Fiscal Year	Evaporator WVR (Kgal)	Condensate to LERF (Kgal)
1994	2400	3120
1995	5640	7330
1996	4020	5230
1997	2190	2850
1998	1920	2500
1999	1960	2550
2000	1260	1640
2001	1220	1590
2002	1190	1550
2003	1100	1430
2004	1250	1630
2005	1480	1920

See Figure 10 for dilute receiver tanks, evaporator WVR, and the 242-A Evaporator operating schedules for the Baseline Case.

Based on the 1.3 gallon condensate/gallon WVR factor, scheduled evaporator operations would not fill the LERF before the Effluent Treatment Facility startup in June 1995. There should be sufficient LERF and DST space for storage of Hanford facilities generated waste between April 1994 and June 1995 when the LETF is available, provided:

- the 242-A Evaporator schedule is achieved
- the amount of condensate sent to LERF does not exceed the 1.3 gallon condensate/gallon WVR factor
- facilities stay within there respective generation limits
- no unexpected waste receipts are received in the DSTs

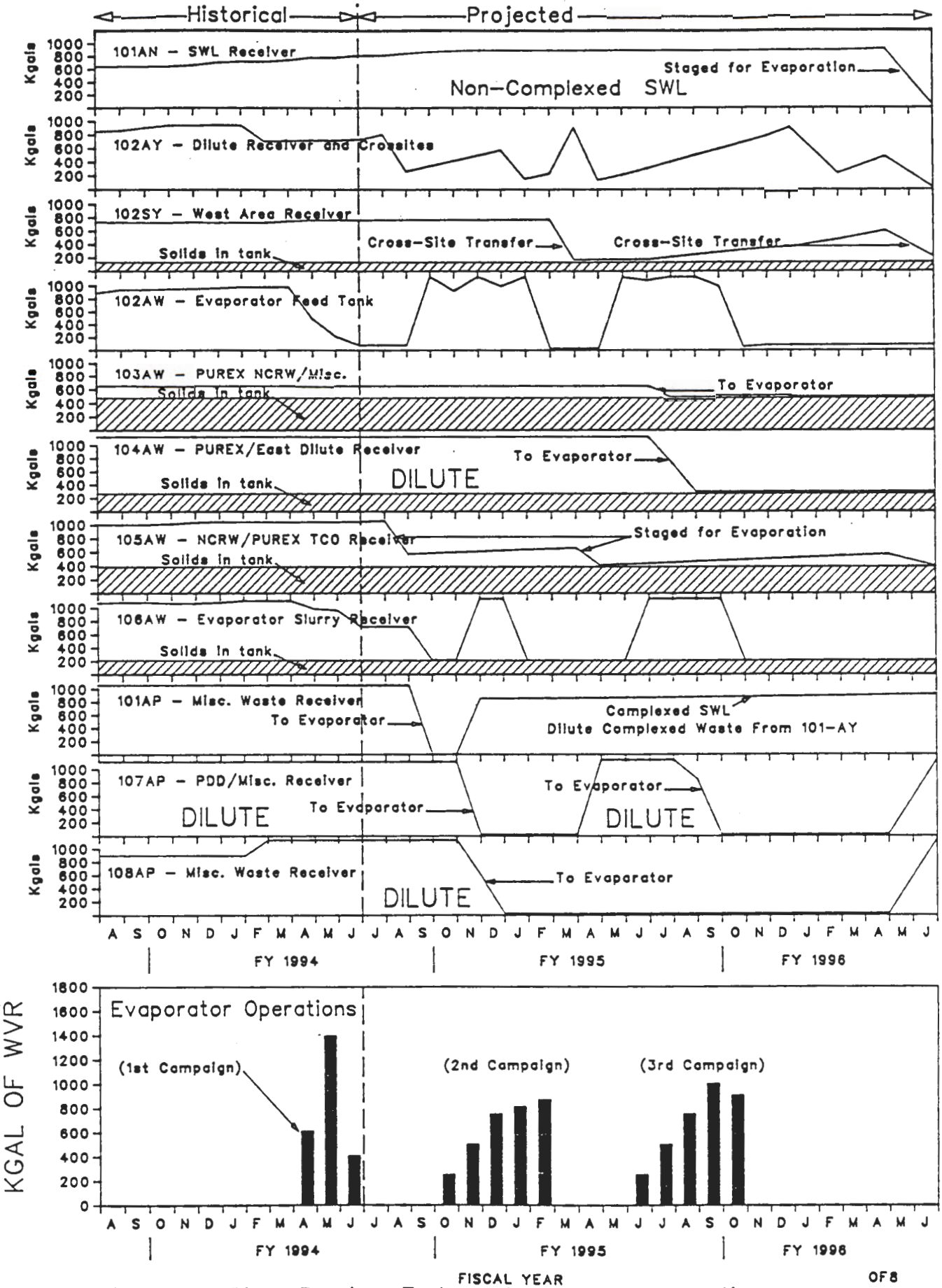


Figure 10. Dilute Receiver Tanks and Evaporator Operations

NON-AGING TANK SPACE

The tank space shortage in FY 1999 to FY 2005 (Figure 4) is caused by a combination of factors, including:

- SWL pumping (SST stabilization) volumes
- Tank 101-SY dilution and remediation
- Tank 103-SY dilution and remediation
- This projection case assumed that two "clean" pretreatment receipt tanks would be required in FY 2005
- Higher facility waste generation rates
- Decision not to operate the Grout Facility has eliminated an early means of freeing up DST space

RMC and PRF stabilization is assumed to start in FY 1998 (dependent on EIS). With the assumed PFP schedule, Tank 102-SY will not fill with solids during the operating life of PFP.

Figures 11 through 15 show the operation of most of the DST waste tanks for the Baseline Case projection.

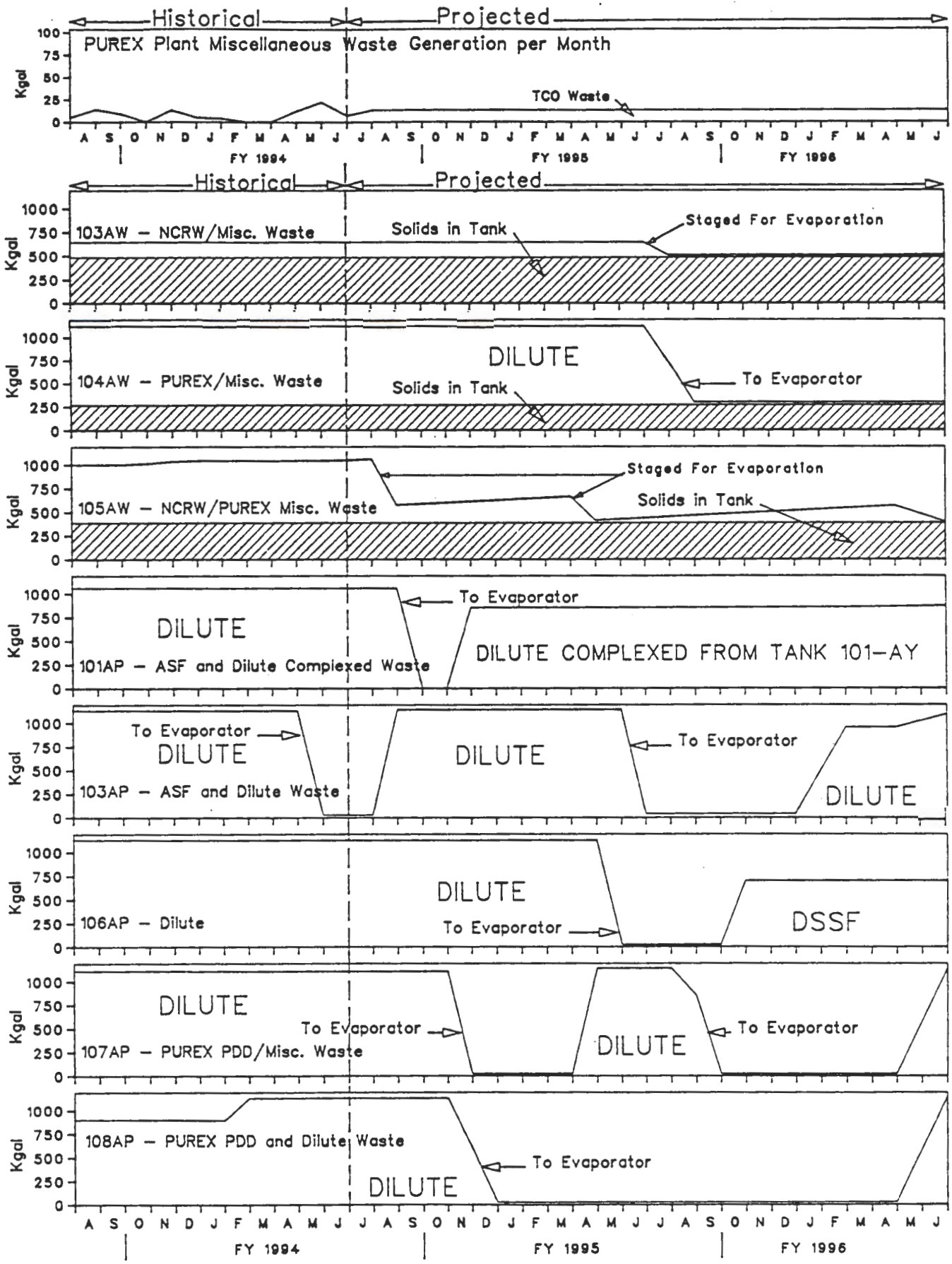
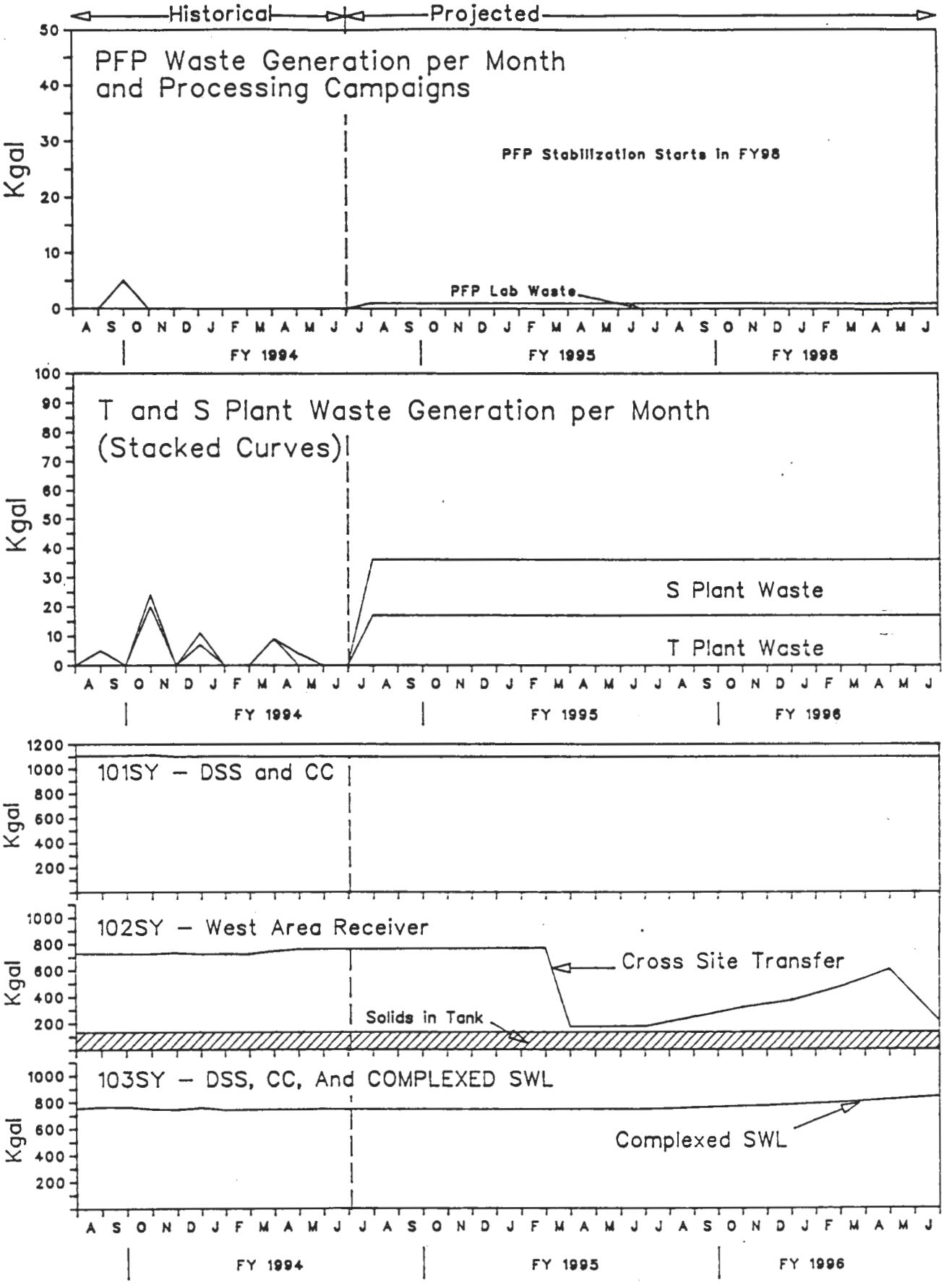


Figure 11. PUREX Facility Waste Generation and Tank Levels

OF10/10A



OF11OF11A

Figure 12. West Area Waste Generation and SY Tank Levels

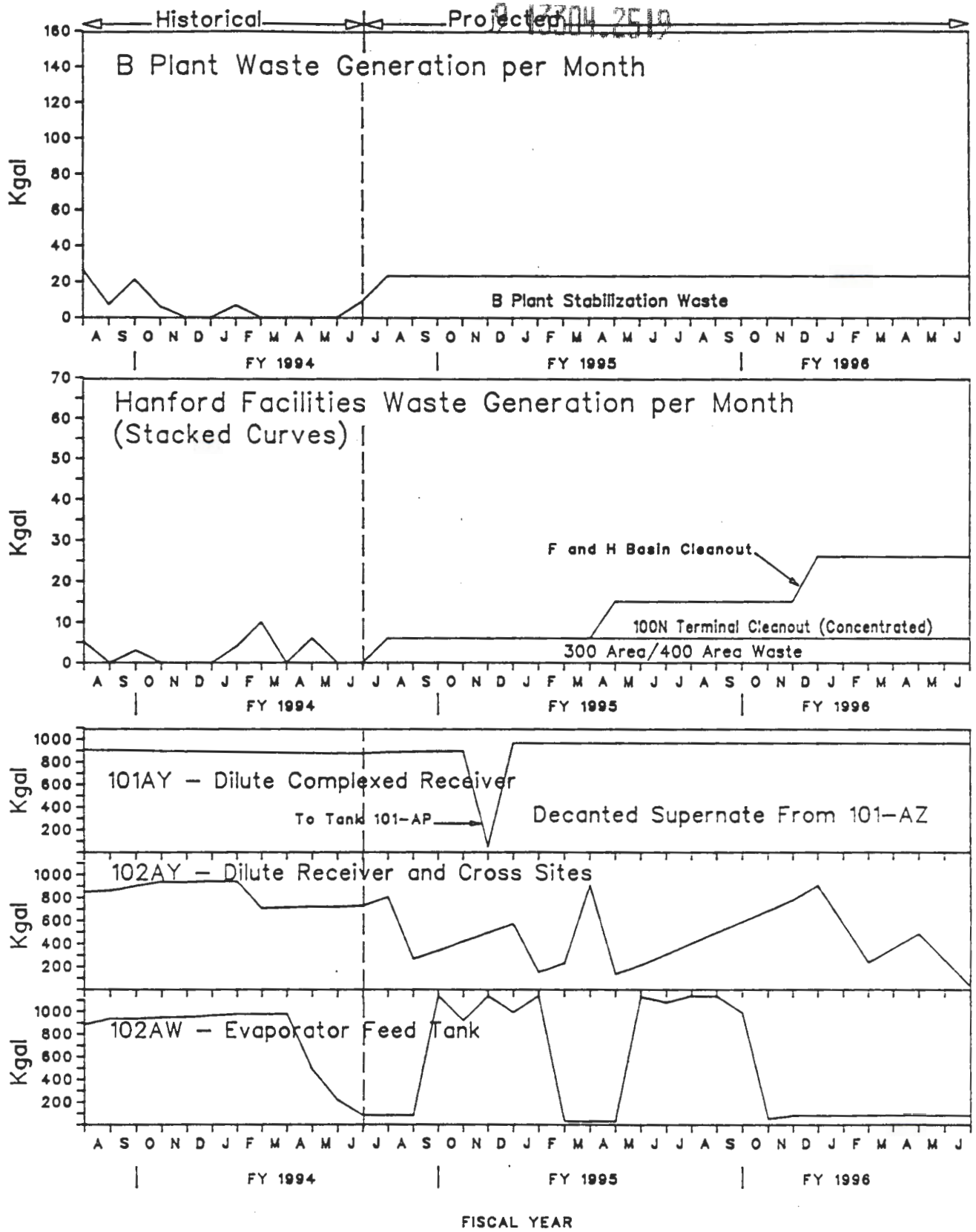


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Figure 13. B Plant and Hanford Facility Waste

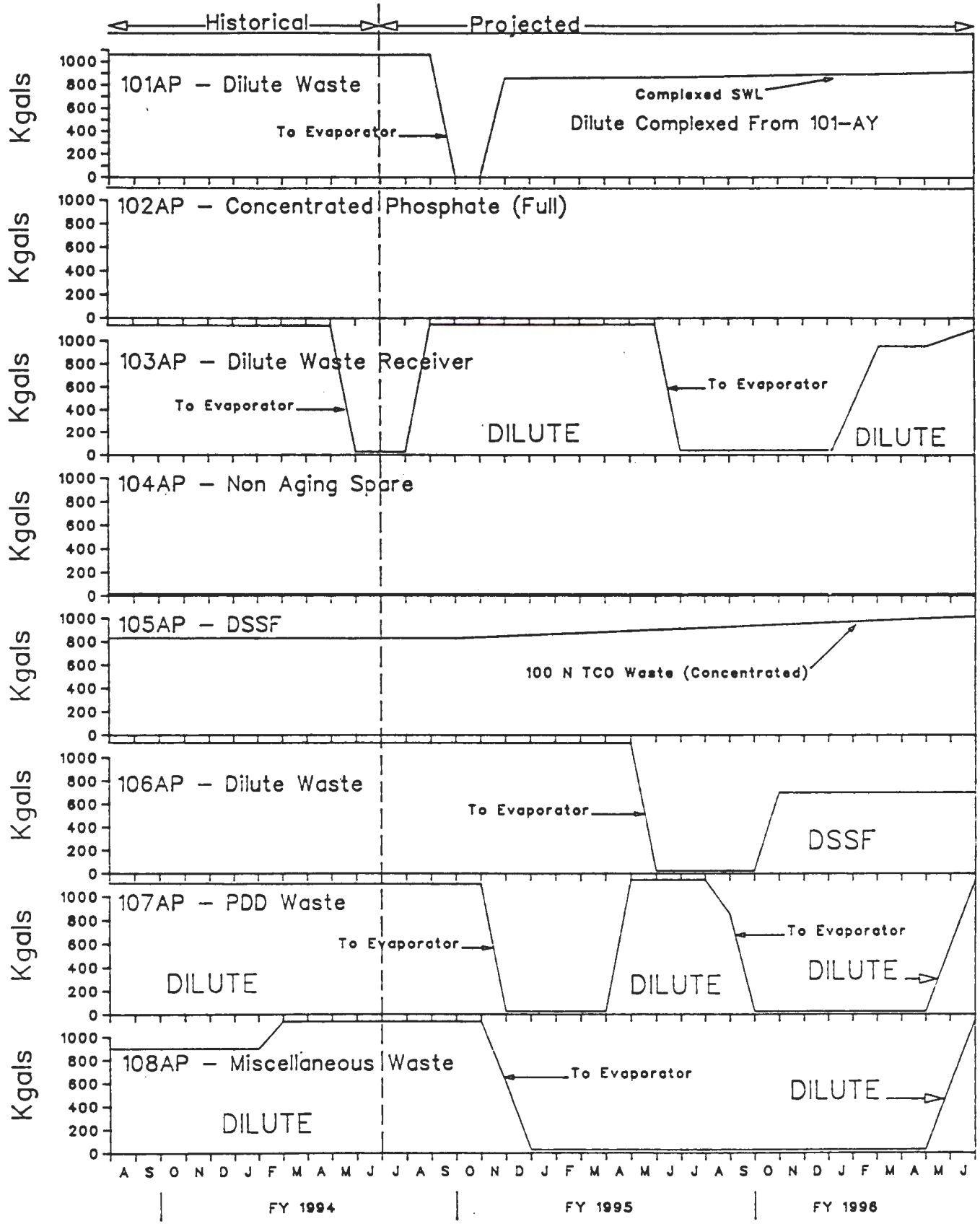

Figure 14. AP Farm Tank Levels

OF13

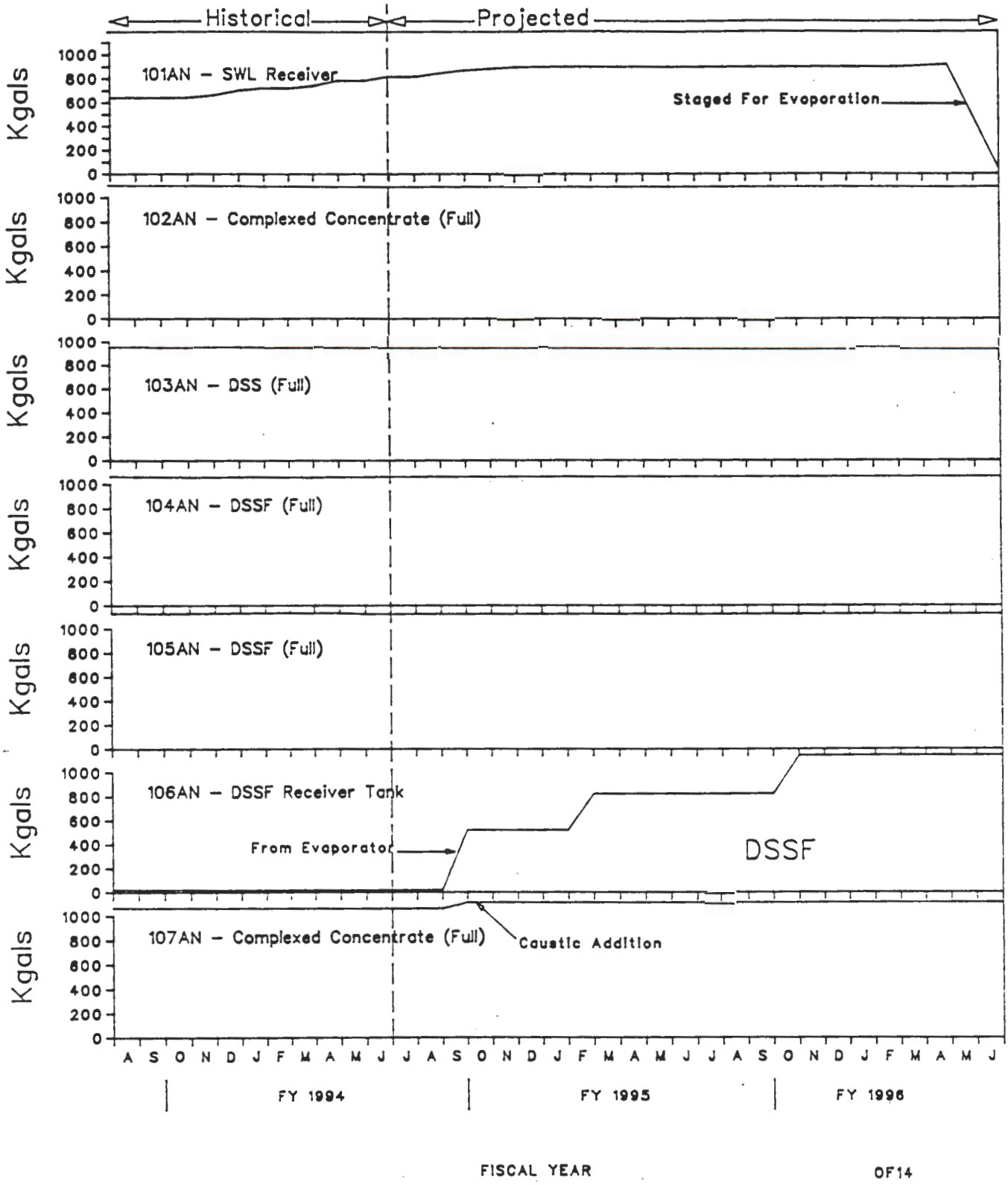

Figure 15. AN Farm Tank Levels

AGING WASTE TANK SPACE

It is assumed that the PUREX facility will not restart. With PUREX not restarting only two aging waste tanks (Tanks 101-AZ and 102-AZ) are required to store existing aging waste.

One additional aging waste tank will be required to retrieve and store the contents of Tank 106-C (a SST containing high heat waste). Waste from Tank 106-C is assumed to go to Tank 102-AY in FY 1997. This may cause a problem for final disposal of the contents of Tank 102-AY if the heel in Tank 102-AY is high in chlorides as indicated by initial characterization studies.

The In-Tank Washing Scenario adopted for the Baseline Case assumed that the washed solids for Tanks 101-AZ and 102-AZ could be combined in one aging waste tank (Tank 102-AZ). Likewise, aging waste supernates were concentrated and combined in one aging waste tank (Tank 101-AY). By 1999, these operations result in one aging tank being used to store washed solids for HLW vitrification; one aging tank used to store combined supernates; and one aging tank being used to store Tanks 106-C solids. A graph of aging waste tank space requirements as a function of time is presented in Figure 16. The uses of each individual aging waste tank for the Baseline Case are shown in Figure 17.

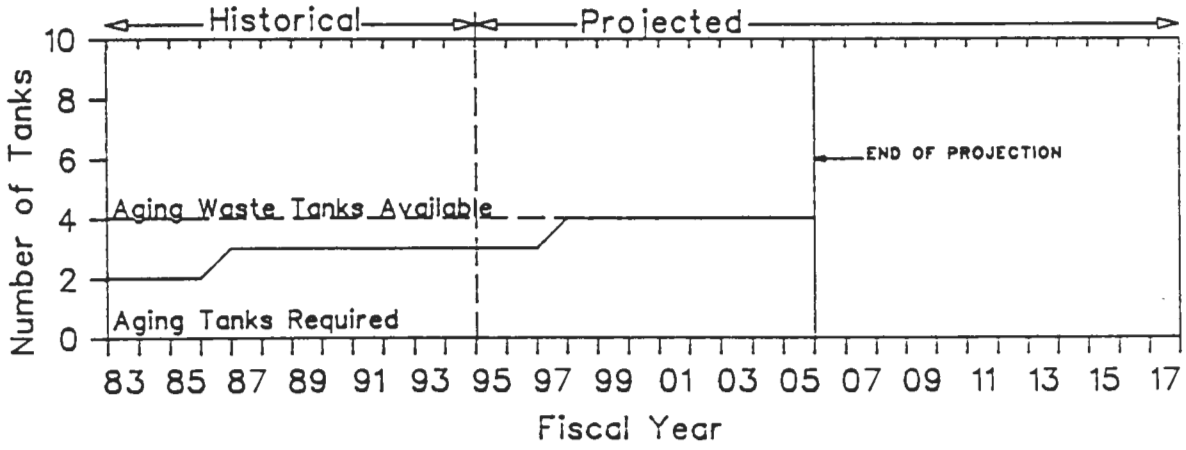

Figure 16. Aging Tank Requirements

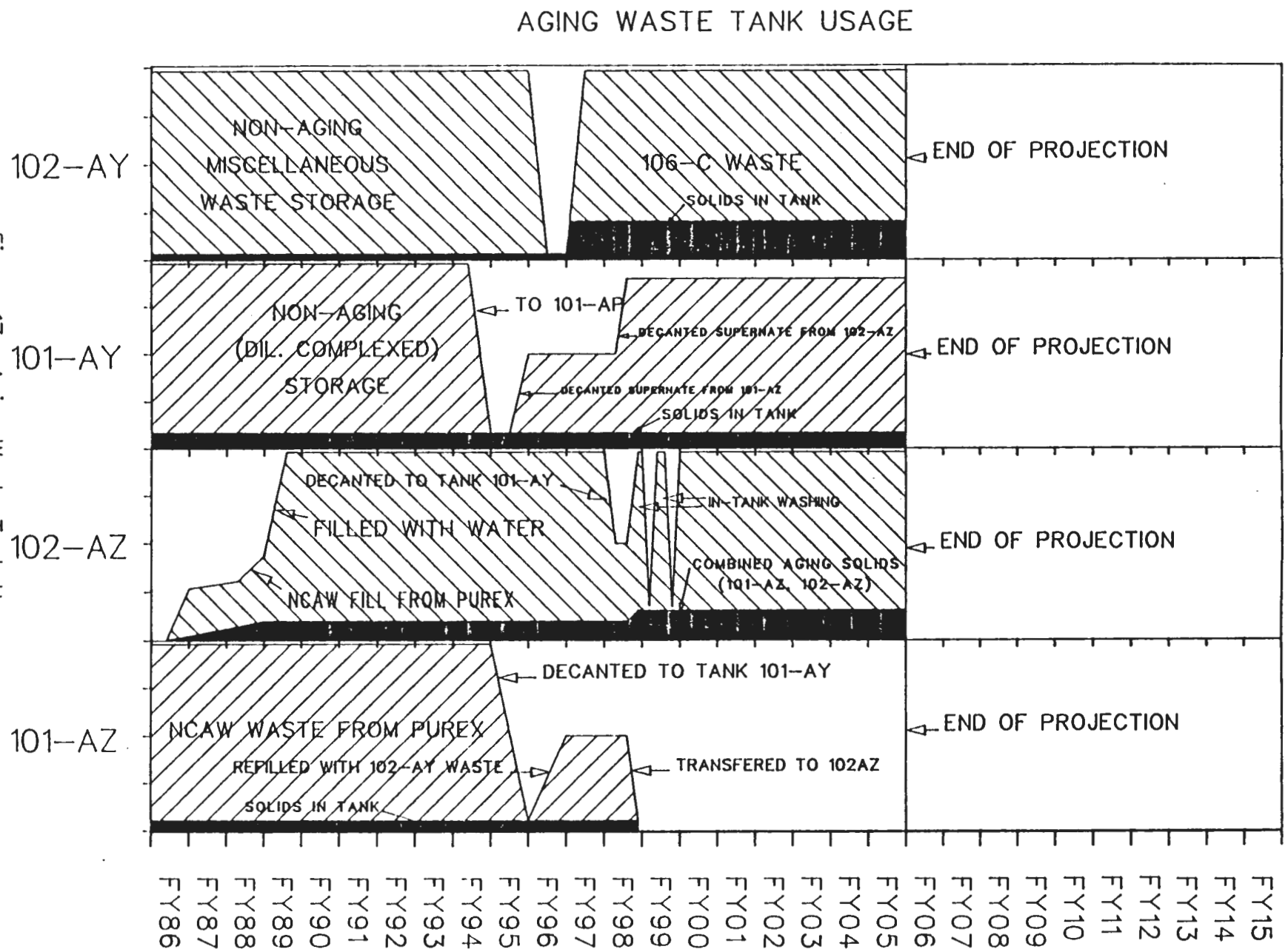

Figure 17. Aging Waste Tank Usage

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5.3 Upper Planning Case Results and Conclusions

Assumptions adopted for the Upper Planning Case were intended to provide an upper bound on tank space needs. These assumptions included higher facility waste generations and TCO volumes, a higher dilution ratio (3:1) for Tanks 101-SY and 103-SY, a higher SWL pumping volume (5.1 Mgal), a one year delay in the start of the Liquid Effluent Treatment Facility, a more pessimistic in-tank washing scenario, a reduction in the evaporation limit for DSSF (1.4 SpG), and the assumed loss of a DST in 1998.

Projected tank space needs for the Upper Planning Case are shown in Figure 18. Results from this projection require the construction of thirteen additional tanks by the end of 2005. A few of the new tanks would be needed in the 200 West Area to allow greater operational flexibility and spare space during the higher 3:1 dilution of Tanks 101-SY and 103-SY. Since the diluted wastes could be cross-sited to 200 East Area for storage, the majority of the new tanks would probably be constructed in the 200 East Area.

The additional DST space provided for the Upper Planning Case would lower risks, provide more DST operational flexibility, and provide more assurance that TPA milestones would be accomplished. The main drawback for this case would be the higher DST construction expenditure.

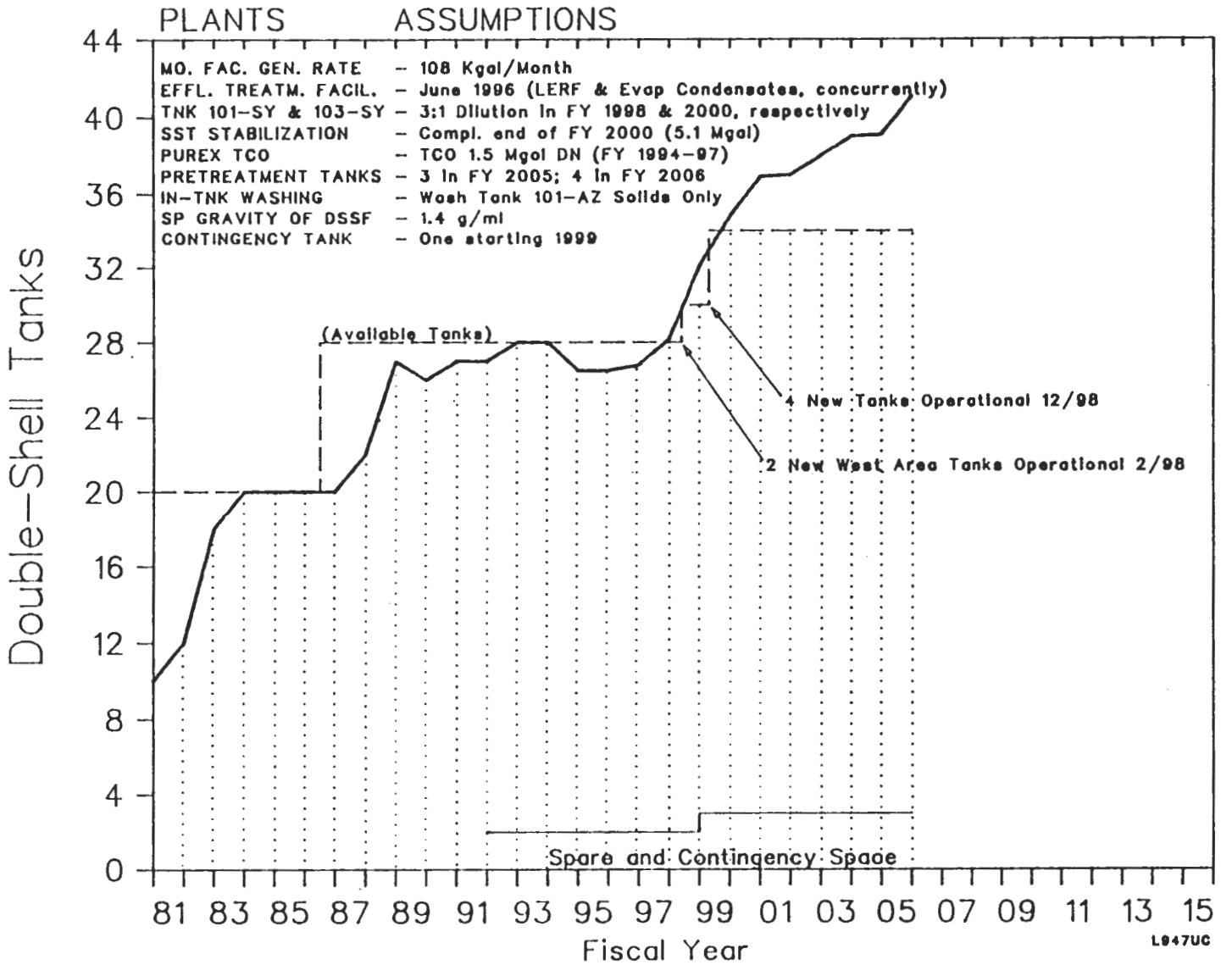


Figure 18. Double-Shell Tank Requirements for the Upper Planning Case

5.4 Actual Waste Generation Compared to Management Limits

During the Tank Space Management Board (TSMB) meeting on August 7, 1991, the need to establish new facility waste generation limits was discussed with the Hanford facility representatives based on additional delays in the 242-A Evaporator restart. A new total monthly waste generation rate of 64 Kgal/month was adopted based on: discussions with facility representatives, the average monthly waste generation rate for each facility during FY 1991, and the need to provide contingency space for potential delays in the 242-A Evaporator restart.

Facility generation limits were not established for high priority waste generations, which were assigned to "Priority Space". These generations included the PFP stabilization campaign (safety), SWL pumping (TPA milestone), and the 242-A Evaporator (space necessary for the mini-run and restart).

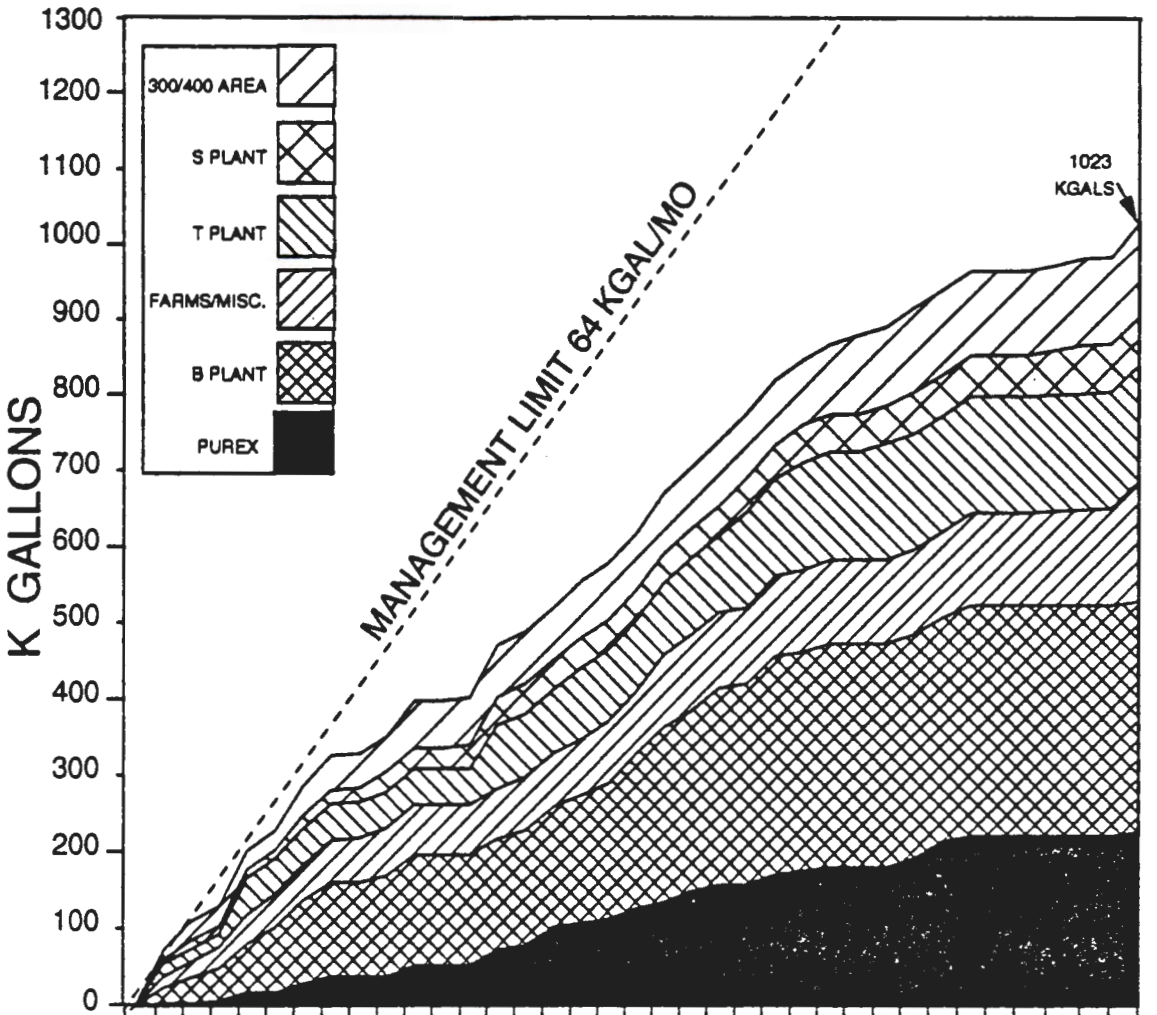
The new average monthly waste generation limits for each facility and the actual average monthly waste generation rate (Kgal/month) are compared below for the period July 1, 1991 through June 30, 1994.

Table 8. Comparison of Average Monthly Waste Generation Rates to the New Waste Generation Limits (kgal/month)

FACILITY	OLD MANAGEMENT LIMIT	64 KGAL/MONTH MANAGEMENT LIMIT	AVERAGE MONTHLY FACILITY GENERATIONS (7/91 - 1/94)
PUREX	28.6	15	7.13
UO_3	0	0	0
TANK FARMS	30.5	10	3.81
B PLANT	46.5	23	9.68
PFP	0.6	0	0
T PLANT	6.3	6	4.87
S PLANT	4	5	1.74
100N AREA	36#	0	0
300 AREA	3	5	2.94
400 AREA	1	0	0.65*
TOTAL	140.5	64	30.82

Monthly Totals do not Include 100 N Area one-time Waste
* One time transfer not included in monthly limits

Due to the commendable efforts by the Hanford facilities, all waste generators are below their average monthly waste generation limit for the period July 1, 1991 through June 30, 1994. A comparison of the volumes of waste entering the "Usable" DST tank space for that time frame is compared graphically in Figure 19, below.



MONTHLY LIMIT	7/91	8/91	9/91	10/91	11/91	12/91	1/92	2/92	3/92	4/92	5/92	6/92	7/92	8/92	9/92	10/92	11/92	12/92	1/93	2/93	3/93	4/93	5/93	6/93	7/93	8/93	9/93	10/93	11/93	12/93	1/94	2/94	3/94	4/94	5/94	6/94
300/400 AREA	5	13	12	0	0	0	12	8	0	0	16	0	0	7	0	0	8	0	0	5	0	5	0	0	0	7	12	0	8	0	0	0	0	0	4	0	11
S PLANT	5	5	6	0	0	0	7	0	0	9	0	0	4	5	3	0	0	0	0	0	0	0	5	0	5	0	0	0	5	0	0	0	0	5	4	0	0
T PLANT	6	17	0	0	30	0	0	0	0	0	0	0	0	36	0	0	10	0	0	0	7	0	26	0	14	0	0	11	0	0	0	0	0	0	0	0	0
TANK FARM	10	14	6	8	10	5	3	9	3	4	3	0	0	0	4	0	4	8	0	13	5	0	0	6	2	3	0	0	1	1	9	0	0	2	2	2	30
B PLANT	23	20	14	7	22	21	23	15	0	9	12	0	0	0	6	7	10	10	25	26	7	21	6	23	0	7	0	0	0	0	9	0	0	0	0	0	0
PUREX	15	3	0	4	10	0	12	9	0	0	15	0	0	21	5	24	5	5	13	9	14	9	0	13	5	4	0	0	12	22	7	0	0	0	0	0	5

O9407FACIL

NOTE: THIS GRAPHIC DEPICTS "USABLE SPACE" DEPLETION AND NOT TOTAL RECEIPTS TO DSTs

Figure 19. Monthly Facility Generations

6.0 SPACE SAVING ALTERNATIVES

The assumptions used for the Baseline Case result in a tank space shortage by 1998 if new DSTs are not constructed (see Figure 4). In the near term, space saving alternatives include waste minimization, continued availability of the 242-A Evaporator, LERF availability, and the LETF start-up. These alternatives must be considered because new inputs to the system may develop (e.g., unexpected new waste streams or a leaking SST or DST).

The response to the 1998 through 2005 tank space shortage for the Baseline Case must be in one of three areas. The inflows to the system must be reduced, the outflows to the system must be increased, or the available tank space increased. Inflows to the system include miscellaneous facility waste generations, TCO wastes, in-tank washing, dilution of Tanks 101 and 103-SY, pretreatment, SWL pumping, and SST solids retrieval. Outflows include the 242-A Evaporator and LLW vitrification. Increasing the tank space available could be done by building more tanks (a six to eight year task), mixing segregated waste types (which would gain about half a million gallons of space but increase interim storage and final disposal costs), or operating without reserved spare tank space. A cost/benefit analysis needs to be completed to determine the best alternative.

In addition to minimizing waste generations, other actions could be pursued. The list below includes many actions which can result in tank space savings or economization, and can serve as a starting point in a tank space optimization program.

<u>PUREX Facility</u>

- Continue to reduce waste being generated at the PUREX facility
- Evaporate dilute waste, from the PUREX facility and other facilities, in the PUREX facility concentrator
- Ion exchange of low level waste (outside vendor)
- Reroute non-hazardous streams to chemical sewer for land disposal
- Make the TCO of PUREX dependent upon tank space availability

<u>B Plant</u>

- Continue to reduce waste being generated at B Plant
- Route BCP waste to cribs
- Evaporate dilute waste, from B Plant and other facilities, in B Plant concentrators
- Replace steam heaters with electric heaters
- Make TCO at B Plant dependent on tank space availability

<u>Plutonium Finishing Plant</u>

- Continue to reduce waste being generated at PFP
- Delay the PFP Stabilization Campaign

6.0 SPACE SAVING ALTERNATIVES (CONTINUED)

Tank Farms

- Continue to reduce waste being added to DSTs
- Continue waste accountability and minimization controls
- Develop a total waste cutoff plan
- Increase the 5 M Na limitation on aging waste tanks
- Use dilute waste for retrieval, air lift circulator flushes, line flushes, etc.
- Increase the WVR of the 242-A Evaporator
- Move the solids from Tank 103-AW into Tank 105-AW
- Delay SWL pumping
- Build new tanks
- Accept loss of waste segregation (used in an extreme emergency)
- Store facility generated waste in designated "spare tank space" (used in an extreme emergency)
- Shorten 242-A Evaporator down times and improve efficiency
- Solidify treated waste and dispose of as low level waste in burial grounds
- Increase the heat limit on non-aging DSTs to allow either the Tank 106-C wastes or the supernate from Tank 101-AZ to be stored in a non-aging DSTs
- Concentrate DSSF to Double-Shell Slurry (DSS). Experience with Tank 101-SY makes this alternative highly unlikely
- Combine washed NCAW solids.
- Combine NCAW supernates.
- Store DN or DSSF wastes on NCRW solids.

Grout

- Reinstate the Grout Disposal Program
- Grout the existing waste in Tanks 102-AP and 101-AW

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APPENDIX A

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APPENDIX A. Miscellaneous One Time Waste Additions and Facility Holdups

The waste volume projection team does not establish waste generation limits for the facilities. Future new facility limits will be established by the Tank Space Management Board. Prior to the 242-A Evaporator restart, the monthly waste generation rates were maintained at or below waste management minimization guidelines, set forth by the Tank Space Management Board (Frater, 1992). Cell cleanout, basin cleanout, and plant processing for all facilities were delayed until after the Evaporator restarted in April 1994. The different waste generation limits and TCO volumes to be used for each of the three projection cases were presented previously in Section 3 and 4. The miscellaneous one time waste additions shown in Table A1 were used in all projection cases. Actual facility holdups or stored waste as of June 30, 1994 are presented in Table A2.

Table A1. Miscellaneous One Time Waste Additions

FACILITIES	VOLUMES & TYPE
100 Area: Sulfate Waste, Kgal	36 DN
300 Area: Fuel Supply Clean-out, Kgal (Feil, 1992)	12 DN
105-F, 105-H: Basin Clean-out Waste, Kgal (Griffin, 1991)	225 DN
Tank 107-AN: Caustic Addition, Kgal (Carothers, 1993)	50 DN
TOTAL=	323

Table A2. Facility Waste Storage and Capacity in Kgals as of JUNE 1994

FACILITY	ACTUAL HOLD-UP	WASTE STORAGE CAPACITY	PROCESS VESSELS CAPACITY
PUREX	250	100	215
B Plant	5	0	#225
S Plant	7	9	0
T Plant	5	50	0
100 Area	40	50	0
300 Area	7	60	0
400 Area	11	23	0
PFP	1	16	0
TOTAL=	326	308	440

25 Kgal capacity for storage of waste, the remaining space is not routed for storage (Killoy, 1992).

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APPENDIX B

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APPENDIX B. Possible Future Assumptions Changes and Impacts

Possible new waste streams, dilution ratios, and processing schedule changes that could impact DST space availability, but were not incorporated in this projection are discussed below.

K Basin:

Current plans are to dispose of K basin cleanup wastes either in the 100 Area or by sending these wastes to the LETF. Should the plans for facility modifications and/or permitting fail, these wastes could be sent to DSTs. Current plans are to remove 2 million gallons of basin water annually starting in September 1996 and continuing until basin water radiation concentrations are reduced from 3,000,000 pCi/L to 300,000 pCi/L (Lucas, 1994). In addition to the above wastes, an additional 2-3 million gallons of waste could be generated due to other basin cleanup activities from FY 1999 to FY 2002.

Caustic additions:

Depending on the outcome of present studies, an addition of ~50,000 gallons of caustic could be added to Tanks 102-AN and 102-AZ (Carothers, 1994). The intent of these additions would be to adjust the OH^- concentration in the waste to bring the tanks to within specifications.

SWL Pumping in West Area:

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APPENDIX C. Acronyms

ASD - ammonia scrubber distillate from
ASF - ammonia scrubber feed from
AW - aging waste, also called NCAW
BCP - B Plant process condensate
CC - complexant concentrate waste
CP - concentrated phosphate waste
DC - dilute complexed waste
DCRT - doubly contained receiver tank
DN - dilute non-complexed waste
DOE - U.S. Department of Energy
DP - dilute phosphate waste
DSS - double-shell slurry (most concentrated double-shell tank waste)
DSSF - double-shell slurry feed
DST - double-shell tank
EIS - Environmental Impact Study
FFTF - Fast Flux Test Facility
FSAR - Facility Safety Analysis Report
FY - fiscal year
GTF - Grout Treatment Facility
HFW - Hanford facility waste (waste produced at 100, 300, 400 areas)
HLW - High Level Waste
IPM - Initial Pretreatment Module
IX - ion-exchange
KGAL - kilogallon (1000 gallons)
LERF - Liquid Effluent Retention Facility
LETF - Liquid Effluent Treatment Facility
LLW - Low Level Waste
MTU - metric tons of uranium
NCAW - neutralized current acid waste
NCRW - neutralized coating (cladding) removal waste (synonym: cladding removal waste)
OWVP - Operational Waste Volume Projection
NEPA - National Environmental Policy Act
NPF - New Pretreatment Facility
NPV - New Pretreatment Vault
PDD - process distillate discharge from PUREX
PFP - Plutonium Finishing Plant
PRF - Plutonium Reclamation Facility
PSW - phosphate/sulfate waste
PUREX - Plutonium-Uranium Extraction
PWR II- pressurized water reactor, Shippingport Core II
RMC - Remote Mechanical C Line
SpG - Specific Gravity
SST - single-shell tank
SWL - salt well liquid
TCO - terminal clean-out
TOE - total operating efficiency
TPA - Tri-Party Agreement
TRU - transuranic
TRUEX - Transuranic Extraction Process
TSMB - Tank Space Management Board
UO_3 - Uranium Oxide Facility
WSCF - Waste Sampling and Characterization Facility
WVR - waste volume reduction

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